UNION TOOL

# Tungsten Carbide End Mills
# UNIMAX Series
# Vol.20

UNION TOOL CO.


Simplified Table
1 Flute
2 Flutes
3 Flutes
4 Flutes
5 Flutes
6 Flutes
UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball
Ball / Long Shank Ball
Long Neck Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data

# UNION TOOL is

- ☑ High quality
- ☑ Time - saving
- ☑ Variety - rich

UNION TOOL


●Simplified Table
●1 Flute
●2 Flutes
●3 Flutes
●4 Flutes
●5 Flutes
●6 Flutes
●UDC Series／78-113
●CBN Series／114-139
●Square／140-229
●Long Neck Square／230-289
●Radius／290-315
●Long Neck Radius／316-385
●Taper Neck Radius／386-395
●Ball / Long Shank Ball／396-433
●Long Neck Ball／434-507
●Taper Neck Ball／508-533
●Taper／534-541
●Spiral V Cutter／542-543
●Drill／544-562
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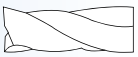
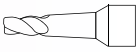
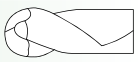
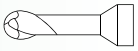
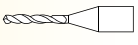
●Technical Data／572-592









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## Alphabetical Order


| Model Number | Page | Characteristic |
|---|---|---|
| **A** | | |
| AZS | 266 | 3 Flute Long Neck Square |
| **C** | | |
| CAS | 180 | 2 Flute Square |
| CBN-LBF | 120 | 2 Flute CBN Long Neck Ball |
| CBN-LBSF | 114 | 2 Flute CBN Long Neck Ball |
| CBN-LRF | 132 | 2 Flute CBN Long Neck Radius |
| CBN-RSF | 126 | 1 Flute CBN Long Neck Radius |
| CESUS | 216 | 4 Flute Square |
| CFB | 416 | 3 Flute Ball |
| CFLB | 502 | 3 Flute Long Neck Ball |
| CGB2000 | 414 | 2 Flute Ball |
| CGB4000 | 432 | 4 Flute Ball |
| CGE | 224 | 4 Flute Square |
| CNRS | 294 | 4 Flute Radius |
| CPR | 258 | 2 Flute Long Neck Square |
| CPRB | 498 | 2 Flute Long Neck Ball |
| CPRL | 262 | 2 Flute Long Neck Square (Long Shank) |
| CPRS25NSP | 564 | 2 Flute Radius / Long Neck Radius |
| CPRS30N | 566 | 2 Flute Long Neck Radius |
| CPS | 178 | 2 Flute Square |
| CRN-ES2000 | 174 | 2 Flute Square |
| CRN-ES4000 | 220 | 4 Flute Square |
| CRRS | 370 | 4 Flute Long Neck Radius |
| CRS20HSP | 570 | 4 Flute Long Neck Radius |
| CRS40HSP | 568 | 3 Flute Long Neck Radius (Short Length of Cut) |
| CSEB | 406 | 2 Flute Ball (R0.05/0.2 Length of Cut: Single Flute) |
| CSELB | 468 | 2 Flute Long Neck Ball for Deep Rib Milling |
| CSS | 140 | 2 Flute Square |
| CXERS | 298 | 4 Flute Radius |
| CXES | 196 | 4 Flute Square |
| CXLRS | 380 | 5 Flute Long Neck Radius |
| CXRS | 308 | 5 Flute Radius |
| CXS | 282 | 4 Flute Long Neck Square |
| CZS | 182 | 4 Flute Square |
| C-CER | 244 | 2 Flute Long Neck Square for Deep Rib Milling |
| C-CES2000 | 154 | 2 Flute Square |
| C-CES2000S | 168 | 2 Flute Square (Sharp Corner) |
| C-CES4000 | 208 | 4 Flute Square |
| C-CES4000S | 214 | 4 Flute Square (Sharp Corner) |
| C-CRS | 290 | 2 Flute Radius |
| C-CTE2000 | 534 | 2 Flute Taper |
| C-CTE4000 | 538 | 4 Flute Taper |
| C-UMD | 552 | 2 Flute UNIMAX Drill |

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## Alphabetical Order


| Model Number | Page | Characteristic |
|---|---|---|
| **D** | | |
| DCB | 412 | 2 Flute Ball |
| DCES2000 | 176 | 2 Flute Square |
| DCES4000 | 222 | 4 Flute Square |
| DCLB | 484 | 2 Flute Long Neck Ball |
| DCLRS | 376 | 4 Flute Long Neck Radius |
| DCLS | 254 | 2 Flute Long Neck Square |
| DCTNB | 526 | 2 Flute Taper Neck Ball |
| DLC-AZS | 270 | 3 Flute Long Neck Square |
| DLC-CFB | 422 | 3 Flute Ball |
| DLCLB | 488 | 2 Flute Long Neck Ball |
| **H** | | |
| HBL | 404 | 2 Flute Ball (Long Shank) |
| HFB | 426 | 4 Flute Ball |
| HFB-S | 427 | 4 Flute Ball (Short Shank) |
| HFTNB | 528 | 3 Flute Taper Neck Ball |
| HGB | 396 | 2 Flute Ball |
| HGLB | 436 | 2 Flute Long Neck Ball |
| HHRS | 384 | 6 Flute Long Neck Radius |
| HLRS2000 | 318 | 2 Flute Long Neck Radius |
| HLRS4000 | 338 | 4 Flute Long Neck Radius |
| HLRS2000E | 318 | 2 Flute Long Neck Radius (High Radius Accuracy) |
| HLS2000 | 230 | 2 Flute Long Neck Square |
| HLS4000 | 276 | 4 Flute Long Neck Square |
| HMERS | 312 | 4-6 Flute Radius |
| HMS | 226 | 3-6 Flute Square |
| HRRS | 362 | 4 Flute Long Neck Radius |
| HRRS-S | 368 | 4 Flute Long Neck Radius (Short Shank) |
| HSB | 398 | 2 Flute Ball (R0.05: Single Flute) |
| HSB-S | 402 | 2 Flute Ball (Short Shank) |
| HSLB | 446 | 2 Flute Long Neck Ball |
| HSLB-S | 464 | 2 Flute Long Neck Ball (Short Shank) |
| HTNB | 508 | 2 Flute Taper Neck Ball |
| HTNRS | 386 | 4 Flute Taper Neck Radius |
| **S** | | |
| SV | 542 | 2 Flute Spiral Chamfering Cutter |
| **U** | | |
| UDCB | 94 | 2 Flute Ball |
| UDCBF | 80 | 2 Flute Ball |
| UDCBH | 78 | 2 Flute Ball |
| UDCLB | 98 | 2 Flute Long Neck Ball |
| UDCLBF | 82 | 2 Flute Long Neck Ball |
| UDCLRS | 102 | 2 Flute Long Neck Radius |
| UDCLRSF | 86 | 2 Flute Long Neck Radius |
| UDCMX | 108 | 2 Flute Drill |
| UDCT | 112 | 2 Flute Thread Mill |
| UPDLB | 434 | 1 Flute Long Neck Ball |
| UPDLRS | 316 | 1 Flute Long Neck Radius |
| UTDF | 544 | 2 Flute UNIMAX Flat Drill |
| UTDLX | 558 | 2 Flute UNIMAX Drill (Long Flute) |
| UTDSX | 550 | 2 Flute UNIMAX Drill (Short Flute) |

# How to find your tool

Cover page

Search by diameter

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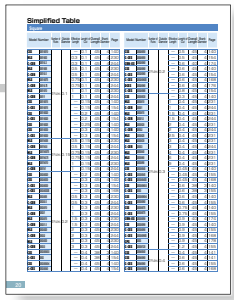


Search by number of flutes or shape from index

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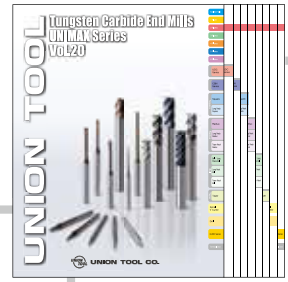


Search by end geometry

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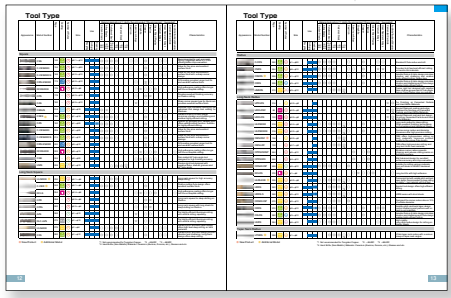


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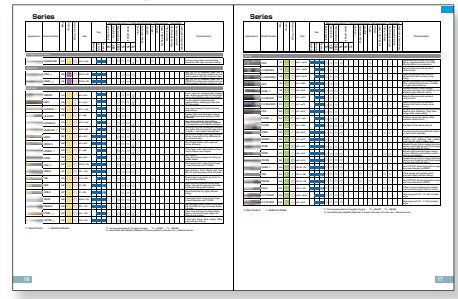
Search by series name




To the main description

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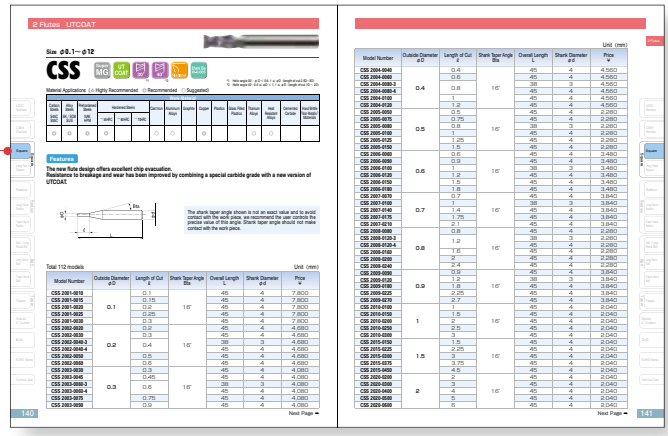



INDEX

# Icon Guide Lines

unit : mm

## Tool Material

- Super MG — Super Micro Grain
- CBN — CBN
- MG — Micro Grain
- Binderless PCD — Binderless PCD

## Coating

- HMG COAT — HMGCOAT
- HARD MAX — HARDMAX
- UT COAT — UTCOAT
- MICRO COAT — UT MICRO COAT
- UTS COAT — UTSCOAT
- TiAlN COAT — TiAlN COAT
- CrN COAT — CrN COAT
- UDC — UDC
- DIA — DIA
- DLC — DLC

## Geometry

- R — Corner Radius Design
- Back Taper Geometry — Back Taper Geometry
- Sharp Corner — Sharp Corner Design
- Variable Pitch — Variable Pitch
- Flatland — Flatland Design
- Variable Helix — Variable Helix
- X Thinning — X Thinning Design

## Shank Diameter Tolerance

- Shank Dia 0/-0.005 — Tolerance of Shank Diameter : 0/-0.005
- Shank Dia 0/-0.004 — Tolerance of Shank Diameter : 0/-0.004

## Ball Radius Tolerance

- R ±0.002 — Ball Radius Tolerance : ±0.002
- R ±0.003 — Ball Radius Tolerance : ±0.003
- R ±0.004 — Ball Radius Tolerance : ±0.004
- R ±0.005 — Ball Radius Tolerance : ±0.005
- R ±0.007 — Ball Radius Tolerance : ±0.007
- R ±0.01 — Ball Radius Tolerance : ±0.01

## Corner Radius Tolerance

- R ±0.002 — Corner Radius Tolerance : ±0.002
- R ±0.01 — Corner Radius Tolerance : ±0.01
- R ±0.003 — Corner Radius Tolerance : ±0.003
- R ±0.015 — Corner Radius Tolerance : ±0.015
- R ±0.005 — Corner Radius Tolerance : ±0.005
- R ±0.02 — Corner Radius Tolerance : ±0.02

## Half Included Angle Tolerance

- ±5′ — Half Included Angle Tolerance : ±5′

## Helix Angle

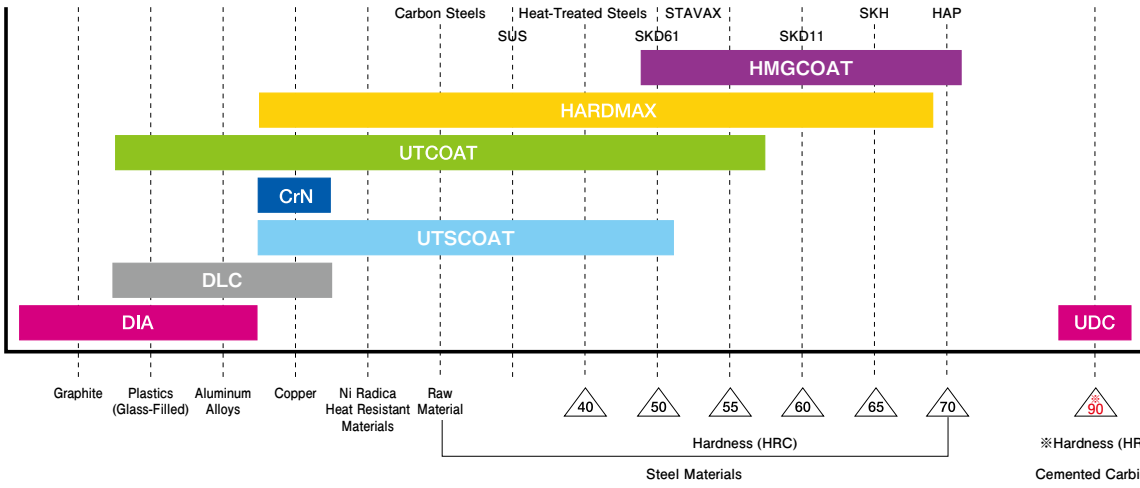
- 20° — Helix Angle 20°
- 42°~45° — Helix Angle 42°~45°
- 24° — Helix Angle 24°
- 45° — Helix Angle 45°
- 25° — Helix Angle 25°
- 0° — Helix Angle 0°
- 30° — Helix Angle 30°
- 20° — Helix Angle 20°
- 37°~40° — Helix Angle 37°~40°
- 30° — Helix Angle 30°
- 40° — Helix Angle 40°
- 35° — Helix Angle 35°
- 40°~42° — Helix Angle 40°~42°
- 40° — Helix Angle 40°

# Features of Coating

☆Highly Recommended ◎Recommended ○Suggested △Satisfactory

| Type | Color | Hardness (HV) | Heat Resistance | Toughness | Lubricant Efficiency | Recommended Use |
|---|---|---|---|---|---|---|
| HMG COAT | Purple-Black | 3700–4200 | ☆ | ○ | ◎ | for Steels |
| HARD MAX | Yellow-Gold | 3500–4000 | ☆ | ○ | ◎ | |
| UT COAT | Purple-Black | 3000–3500 | ◎ | ◎ | ☆ | |
| CrN COAT | Silver White | 2000–2200 | ○ | ◎ | ☆ | for Copper |
| UTS COAT | Silver White | 3000–3500 | ◎ | ◎ | ☆ | for Stainless Steels |
| DLC | Black | 4000–6000 | △ | △ | ☆ | for Aluminum / Copper / Plastics |
| DIA | Black | around 9000 | △ | △ | ◎ | for Graphite |
| UDC | Black | around 9000 | △ | ○ | ◎ | for Cemented Carbide |

## How to find best coating for your material applications



# Advisory for Safe Use of UNIMAX Tungsten Carbide 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.
- Do not use flammable cutting oils.

## Advisory for regrinding UNIMAX Tungsten Carbide End Mills

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

## UDCBH 78 Total 4 models

UDC Diamond coating
2 Flute High-speed Ball End Mills for Cemented Carbide and Hard Brittle Materials

High efficiency and long life Ball End Mills for milling Cemented Carbide.
High-level treatment to reduce cutting resistance and mill at a high feed rate.
Wear resistance improved drastically with optimized diamond coating.
Best for roughing and semi-finishing.

## CBN-RSF 126 Total 42 models

CBN 1 Flute Long Neck Radius End Mills for Super Finishing

Optimized CBN material for milling of ultra-hard materials along with excellent wear and chipping resistance ensures long tool life.
The unique cutting edge geometry allows for outstanding surface roughness.
High precision shank diameter tolerance of 0/-0.004 mm.
High precision diameter tolerance of 0/-0.005 mm and corner R accuracy offer super finishing.

## DLCLB 488 Total 71 models

DLCCOAT 2 Flute Long Neck Ball End Mills for Copper Electrode Milling

DLC coating offers excellent welding and wear resistance.
The flute geometry specially designed for Copper milling offers outstanding tool life.
High-precision outside diameter tolerances and radius accuracy measurements are printed on labels to improve machining accuracy.
High precision shank diameter tolerance of 0/-0.004 mm.

# ADDITIONAL MODELS

## CXES 196
Additional 12 models
Total 55 models

UTCOAT 4 Flutes Variable Pitch and Variable Helix
Highly Efficient Square End Mills

## HLS2000 230
Additional 5 models
Total 189 models

HARDMAX 2 Flutes
Long Neck Square End Mills

## C-CER 244
Additional 10 models
Total 148 models

UTCOAT 2 Flutes
Long Neck Square End Mills

## CXERS 298
Additional 10 models
Total 56 models

UTCOAT 4 Flutes Variable Pitch and Variable Helix
Highly Efficient Radius End Mills

## HLRS4000 338
Additional 42 models
Total 381 models

HARDMAX 4 Flutes
Long Neck Radius End Mills

## HTNRS 386
Additional 28 models
Total 111 models

HARDMAX 4 Flutes
Taper Neck Radius End Mills

## HGB 396
Additional 2 models
Total 20 models

HMGCOAT 2 Flutes for Hard Materials
Ball End Mills

## HSB 398
Additional 1 model
Total 71 models

HARDMAX 2 Flutes
Ball End Mills

## CSEB 406
Additional 1 model
Total 78 models

UTCOAT 2 Flutes
Ball End Mills

## HGLB 436
Additional 61 models
Total 155 models

HMGCOAT 2 Flutes for Hard Materials
Long Neck Ball End Mills

## HTNB 508
Additional 48 models
Total 245 models

HARDMAX 2 Flutes
Taper Neck Ball End Mills

## HFTNB 528
Additional 2 models
Total 75 models

HARDMAX 3 Flutes
Taper Neck Ball End Mills

# Tool Chart

## Square Series

Higher

Feed Rate

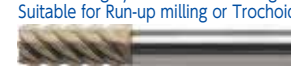
### 4 Flute High Efficiency Series

**CZS** 182

4 Flutes which enables even drilling. Patented

**HMS** 226

Achieves highly efficient side milling for ~65HRC !
Suitable for Run-up milling or Trochoid milling as well.



**CXES/CXS** 196 282

A wide variety of models Variable Pitch & Helix Series

**CESUS** 216

Outstandingly high Efficiency for Stainless milling
Variable Pitch & Helix Series

**CSS** 140

2 Flutes
Offers outstanding tool life by original grooved section.

**A wide variety of models**

**HLS2000** 230

2 Flutes

**HLS4000** 276

4 Flutes

Raw Materials ~ 55HRC — Prehardened Steels ~ 65HRC

Higher

Hardness

## Radius Series

Higher

Feed Rate

### High Efficiency Series

**CXRS** 308

Optimized for Side Milling. Dramatically high feed rate.
5 Flutes Variable Pitch & Helix

**CXLRS** 380

**CNRS** 294

Optimized flute design and coating for difficult-to-cut materials
4 Flutes Variable Pitch & High Helix

**CRRS** 370

**CXERS** 298

Enables deep cut slotting as well as side milling
4 Flutes Variable Pitch & Helix

### High Efficiency Milling

**HRRS** 362

4 Flutes Variable Pitch & High Helix

**HMERS** 312

4 Flutes / 6 Flutes

### High-precision Milling

**HLRS2000** 318

2 Flutes A wide variety of models

**HLRS4000** 338

4 Flutes Excellent surface quality even on the bottom

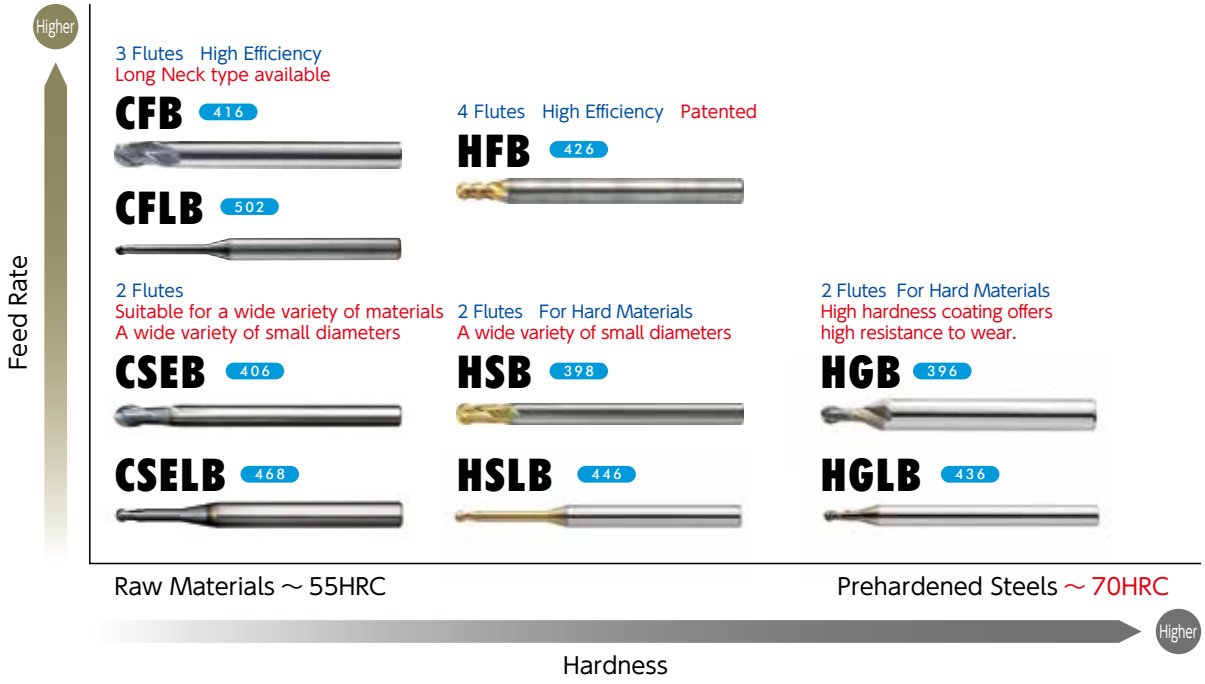
Raw Materials ~ 55HRC — Prehardened Steels ~ 65HRC

Higher

Hardness

# Tool Chart

## Ball Series




### For Cemented Carbide

| | | |
|---|---|---|
| Ball | UDCBH (All Flute/2 Flutes) | 78 |
| | UDCBF (All Flute/2 Flutes) | 80 |
| | UDCB (All Flute/2 Flutes) | 94 |
| | UDCLBF (Long Neck/2 Flutes) | 82 |
| | UDCLB (Long Neck/2 Flutes) | 98 |
| | UPDLB (Long Neck/1 Flute) | 434 |
| Radius | UDCLRSF (Long Neck/2 Flutes) | 86 |
| | UDCLRS (Long Neck/2 Flutes) | 102 |
| | UPDLRS (Long Neck/1 Flute) | 316 |

### For Graphite

| | | |
|---|---|---|
| Square | DCES2000 (All Flute/2 Flutes) | 176 |
| | DCES4000 (All Flute/4 Flutes) | 222 |
| | DCLS (Long Neck/2 Flutes) | 254 |
| Radius | DCLRS (Long Neck/4 Flutes) | 376 |
| Ball | DCB (All Flute/2 Flutes) | 412 |
| | DCLB (Long Neck/2 Flutes) | 484 |
| | DCTNB (Taper Neck/2 Flutes) | 526 |

### For Plastics

| | | |
|---|---|---|
| Square | CPS (All Flute/2 Flutes) | 178 |
| | CPR (Long Neck/2 Flutes) | 258 |
| | CPRL (Long Neck/2 Flutes) | 262 |
| Ball | CPRB (Long Neck/2 Flutes) | 498 |

### For Heat Resistant Alloys

| | | |
|---|---|---|
| Radius | CNRS (All Flute/4 Flutes) | 294 |
| | CRRS (Long Neck/4 Flutes) | 370 |
| Ball | CFB (All Flute/3 Flutes) | 416 |
| | CFLB (Long Neck/3 Flutes) | 502 |

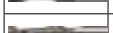
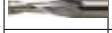
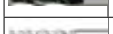
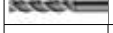
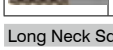
### For Aluminum Alloys

| | | |
|---|---|---|
| Square (Finishing) | CAS (All Flute/2 Flutes) | 180 |
| Square (Efficiency) | AZS/ DLC-AZS (Long Neck/3 Flutes) | 266 |
| Ball | DLC-CFB (All Flute/3 Flutes) | 422 |

### For Copper

| | | |
|---|---|---|
| Square | CRN-ES2000 (All Flute/2 Flutes) | 174 |
| | CRN-ES4000 (All Flute/4 Flutes) | 220 |
| Ball | DLCLB (Long Neck/2 Flutes) | 488 |

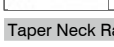
# Tool Type

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Square** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CSS | 140 | UT COAT | 2 | φ0.1~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Recommended for part and mold milling. Upgraded series of C-CES offering better chip evacuation. |
| | C-CES2000 | 154 | UT COAT | 2 | φ0.1~φ20 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish. |
|  | C-CES2000S | 168 | UT COAT | 2 | φ0.2~φ12 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish with a sharp corner design. |
| | CRN-ES2000 | 174 | CrN COAT | 2 | φ0.2~φ12 | | ■ | ■ | | | | | | | | ○ | | ☆ *1 | ○ | | | | | | CrN coating provides longer tool life and excellent surface finish. |
|  | DCES2000 | 176 | DIA | 2 | φ0.2~φ6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | High adherence coating offers longer tool life on Graphite milling. |
| | CPS | 178 | – | 2 | φ0.3~φ12 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Provides excellent finishing accuracy on Plastics milling. |
| | CAS | 180 | – | 2 | φ0.5~φ12 | | ■ | ■ | | | | | | | | ☆ | | ○ | | | | | | | Sharp corner square type for Aluminum provides excellent surface finish. |
| | CESUS | 216 | UTS COAT | 4 | φ6~φ12 | ■ | ■ | ■ | ◎ | ☆ | ○ | | | | ○ | | | ○ | | | ○ | ○ | | | Achieves high efficiency milling by the optimized tool design and coating for Stainless. |
|  | CXES ● | 196 | UT COAT | 4 | φ1~φ16 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and enables highly efficient milling. |
|  | CZS | 182 | UT COAT | 4 | φ1~φ20 | ■ | ■ | ▮ | ◎ | ◎ | ◎ | ○ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Special tip geometry with variable pitch offers vertical milling function. Suitable for highly efficient milling. |
| | C-CES4000 | 208 | UT COAT | 4 | φ1~φ20 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish. |
| | C-CES4000S | 214 | UT COAT | 4 | φ1~φ12 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish with a sharp corner desingn. |
| | CRN-ES4000 | 220 | CrN COAT | 4 | φ3~φ12 | | ■ | ■ | | | | | | | | ○ | | ☆ *1 | ○ | | | | | | CrN coating provides longer tool life and excellent surface finish. |
| | DCES4000 | 222 | DIA | 4 | φ3~φ10 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | High adherence coating offers longer tool life on Graphite milling. |
| | CGE | 224 | – | 4 | φ2~φ20 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | | Non-coated 45° helix angle tool designed for high finishing accuracy. |
| | HMS | 226 | HARD MAX | 3 4 6 | φ1~φ12 | | ■ | ■ | | | ○ | ◎ | ◎ | ◎ *2 | | | | | | | | | | | Precise rigid tool designed with negative flutes, shallow grooves and 45° helix angle. |
| **Long Neck Square** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HLS2000 ● | 230 | HARD MAX | 2 | φ0.1~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | | Long neck square for high accuracy deep milling. |
| | C-CER ● | 244 | UT COAT | 2 | φ0.1~φ6 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Positive cutting flute design offers excellent surface finish. |
|  | DCLS | 254 | DIA | 2 | φ0.4~φ6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | High adherence coating offers longer tool life on Graphite milling. |
|  | CPR | 258 | – | 2 | φ0.5~φ6 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Long neck square for deep slotting on Plastics. |
| | CPRL | 262 | – | 2 | φ0.5~φ4 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Long neck square with long shank for deep slotting on Plastics. |
| | AZS | 266 | – | 3 | φ1~φ12 | ■ | ■ | ■ | | | | | | | | ☆ | | ○ | ○ | | | | | | For Highly efficient Aluminum milling with vertical milling capability. |
| | DLC-AZS | 270 | DLC | 3 | φ1~φ12 | ■ | ■ | ■ | | | | | | | | ☆ | | ○ | ○ | | | | | | For Highly efficient Aluminum milling with vertical milling capability. |
| | HLS4000 | 276 | HARD MAX | 4 | φ1~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | | Variable pitch and back taper design offers high feed deep milling on hard materials. |
| | CXS | 282 | UT COAT | 4 | φ1~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Variable pitch and helix design controls vibration and chattering. Long Neck design offers deep milling. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

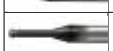
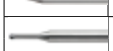
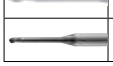
# Tool Type

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Radius** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C-CRS | 290 | UT COAT | 2 | φ1~φ20 | | ■ | | ◎ | ◎ | ◎ | ◎ | | | ○ | | | ◎ | | | ○ | ○ | | | Standard 2 flute radius end mill. |
| | CNRS | 294 | UT COAT | 4 | φ6~φ12 | | | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ☆ | ☆ | | | Provides high feed and efficient milling on hard-to-cut materials. |
| | CXERS ● | 298 | UT COAT | 4 | φ1~φ12 | | ■ | | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and enables highly efficient milling. Radius type. |
| | CXRS | 308 | UT COAT | 5 | φ3~φ12 | | ■ | | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and 5 flute design enables highly efficient milling. |
| | HMERS | 312 | HARD MAX | 4 6 | φ3~φ12 | | ■ | | | | ○ | ◎ | ◎ | ◎ *2 | | | | | | | | | | | Precise rigid tool designed with negative flutes, shallow grooves and 45° helix angle. Various Corner Radius sizes are available. |
| **Long Neck Radius** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UPDLRS | 316 | – | 1 | φ0.2~φ2 | | | ■ | | | | | | | | | | | | | | | ☆ | ◎ | For Finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCLRSF | 86 | UDC | 2 | φ0.3~φ2 | ■ | | | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and edge treatment for finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCLRS | 102 | UDC | 2 | φ0.3~φ2 | ■ | | | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coat and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | HLRS2000 | 318 | HARD MAX | 2 | φ0.4~φ6 | | ■ | | ○ | ○ | ◎ | ◎ | ◎ | ○ *2 | ○ | | | ◎ | | | ○ | ○ | | | Long neck radius for deep milling. Offers excellent finishing performance on Prehardened and Hardened Steels. |
| | HLRS2000E | 318 | HARD MAX | 2 | φ0.2~φ6 | | ■ | | ○ | ○ | ◎ | ◎ | ◎ | ○ *2 | ○ | | | ◎ | | | ○ | ○ | | | Precise corner radius and diameter tolerances offer high precision milling. |
| | CBN-RSF ● | 126 | – | 1 | φ0.2~φ2 | | | ■ | | | | | ◎ | ◎ *2 | | | | | | | | | | | CBN offers high-precision milling on hard materials. Improves product quality by the unique flute design. |
| | CBN-LRF | 132 | – | 2 | φ0.1~φ2 | | | ■ | | | ○ | ◎ | ◎ | ◎ *3 | | | | | | | | | | | CBN offers high-precision milling and long tool life for hard materials. |
| | CPRS25NSP | 564 | – | 2 | φ2~φ12 | | ■ | | | | | | | | | ◎ | | ○ | ◎ | | | | | | Miniature corner radius prevents chipping and reduces cutting marks on the milling surface. |
| | CPRS30N | 566 | – | 2 | φ4~φ10 | | ■ | | | | | | | | | ◎ | | ○ | ◎ | | | | | | Well balanced design for excellent surface accuracy and chip evacuation. |
| | CRS40HSP | 568 | HARD MAX | 3 | φ2~φ12 | | ■ | | ◎ | ◎ | ◎ | ○ | ○ | | ◎ | | ○ | | ○ | | | | | | Suitable for milling various materials from soft steels to 60HRC Hardened Steels. |
| | DCLRS | 376 | DIA | 4 | φ1~φ6 | | ■ | | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high adhesion. |
| | HLRS4000 ● | 338 | HARD MAX | 4 | φ0.2~φ6 | | ■ | | ○ | ○ | ◎ | ◎ | ◎ | ○ *2 | ○ | | | ○ | | | ○ | ○ | | | Precise rigid tool with variable pitch and back taper design. Recommended for deep milling on middle ~ hard materials with high feed. |
| | HRRS | 362 | HARD MAX | 4 | φ2~φ12 | | | ■ | | | ◎ | ◎ | ◎ | ○ *2 | ○ | | | | | | | | | | Special tool design offers high efficient milling. |
| | HRRS-S | 368 | HARD MAX | 4 | φ2~φ12 | | | ■ | | | ◎ | ◎ | ◎ | ○ *2 | ○ | | | | | | | | | | HRRS series with short shank. |
| | CRS20HSP | 570 | HARD MAX | 4 | φ2~φ12 | | ■ | | ○ | | ○ | ◎ | ◎ | | ◎ | | | | | | | | | | Designed the corner radius size as 10% of outside diameter. |
| | CRRS | 370 | UT COAT | 4 | φ2~φ12 | | | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ◎ | ◎ | | | Variable pitch and back taper design control chattering and perform well on hard-to-cut materials. |
| | CXLRS | 380 | UT COAT | 5 | φ3~φ12 | | ■ | | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and 5 flute design enables highly efficient milling. |
|  | HHRS | 384 | HARD MAX | 6 | φ6~φ12 | | ■ | | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | | High rigidity. Long neck radius design for milling on Harder Steels. |
| **Taper Neck Radius** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HTNRS ● | 386 | HARD MAX | 4 | φ1~φ6 | | | ■ | | | ◎ | ◎ | ◎ | ○ *2 | ○ | | | | | | | | | | 4 flute taper neck radius with a various lineup of taper neck angles. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

# Tool Type

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ball** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UDCBH ● | 78 | UDC | 2 | R0.4~R1 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | The improved Diamond coating and new edge treatment enable high feed rate milling. |
| | UDCBF | 80 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and edge treatment for finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCB | 94 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | HGB ● | 396 | HMG COAT | 2 | R0.05~R3 | ■ | ■ | ■ | | | ○ | ◎ | ◎ | ◎ | | | | | | | | | | | Long tool life on Hardened Steels due to HMGCOAT for milling hard materials and new carbide materials with high resistance to wear. |
| | HSB ● | 398 | HARD MAX | 2 | R0.03~R6 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | Broad application range from Copper to hard materials up to 70HRC. |
| | HSB-S | 402 | HARD MAX | 2 | R0.1~R2 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | High-accuracy Short Shank Ball End Mills for high-accuracy shrink-fit holder. |
| | HBL | 404 | HARD MAX | 2 | R1.5~R6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ◎ | | | ○ | ○ | | | Straight type long shank end mills for long overhang milling. |
| | CSEB ● | 406 | UT COAT | 2 | R0.05~R6 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | | | ○ | ○ | | | New UTCOAT. Broad application range from raw materials to 55HRC. |
| | DCB | 412 | DIA | 2 | R0.5~R6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating. |
| | CGB2000 | 414 | – | 2 | R0.2~R6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | | Non-coated sharp cutting edge design for excellent finish. |
| | CFB | 416 | UT COAT | 3 | R0.3~R6 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | ○ | | ◎ | ◎ | | | 3 flute design with variable pitch promotes high efficient milling. |
| | DLC-CFB | 422 | DLC | 3 | R0.3~R6 | ■ | ■ | ■ | | | | | | | | ☆ | | ○ | ○ | | | | | | DLC coating offers longer tool life for Aluminum milling. Highly efficient milling by 3 flute design. |
| | HFB | 426 | HARD MAX | 4 | R1~R6 | ■ | ■ | ■ | | | | ◎ | ◎ | ◎ | | | | | | | | | | | Rigid tool with negative cutting edge design. Special tip geometry provides enhanced cutting performance. |
| | HFB-S | 427 | HARD MAX | 4 | R1~R6 | ■ | ■ | ■ | | | | ◎ | ◎ | ◎ | | | | | | | | | | | Short Shank Ball for highly efficient milling. |
| | CGB4000 | 432 | – | 4 | R2~R10 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | | Non-coated sharp cutting edge design for excellent finish. 4 flute design offers high feed. |
| **Long Neck Ball** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UPDLB | 434 | – | 1 | R0.1~R1 | | | ■ | | | | | | | | | | | | | | | ☆ | ◎ | For finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCLBF | 82 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and edge treatment for finishing on Cemented Carbide and Hard Brittle Materials. |
|  | UDCLB | 98 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coat and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | HGLB ● | 436 | HMG COAT | 2 | R0.05~R3 | ■ | ■ | ■ | | | ○ | ◎ | ◎ | ◎ | | | | | | | | | | | Long tool life on Hardened Steels due to HMGCOAT for milling hard materials and new carbide materials with high resistance to wear. |
| | HSLB | 446 | HARD MAX | 2 | R0.05~R3 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | Broad application range from Copper to hard materials up to 70HRC. |
| | HSLB-S | 464 | HARD MAX | 2 | R0.1~R3 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | High-accuracy Short Shank Long Neck Ball End Mills for high-accuracy shrink-fit holder. |
| | CSELB | 468 | UT COAT | 2 | R0.05~R3 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | | | ○ | ○ | | | New UTCOAT. Broad application range from raw materials to 55HRC. |
| | DCLB | 484 | DIA | 2 | R0.2~R3 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating. |
| | DLCLB ● | 488 | DLC | 2 | R0.05~R3 | ■ | ■ | ■ | | | | | | | | | | ☆ | | | | | | | The optimized flute geometry and DLC coating offer long tool life and high-precision milling. |
| | CBN-LBSF | 114 | – | 2 | R0.05~R1 | | | ■ | | | ○ | ◎ | ◎ | ◎ *3 | | | | | | | | | | | CBN offers high-precision milling and long tool life for hard materials. Improves product quality by the unique flute design. |
|  | CBN-LBF | 120 | – | 2 | R0.05~R1 | | | ■ | | | ○ | ◎ | ◎ | ◎ *3 | | | | | | | | | | | CBN offers high-precision milling and long tool life for hard materials. |
| | CPRB | 498 | – | 2 | R0.2~R3 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Long neck ball for deep slotting on Plastics. |
|  | CFLB | 502 | UT COAT | 3 | R0.3~R3 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | ○ | | ◎ | ◎ | | | 3 flute long neck design with variable pitch promotes highly efficient milling. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

# Tool Type

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Taper Neck Ball** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HTNB ● | 508 | HARD MAX | 2 | R0.1~R2 | | ■ | | ○ | ○ | ◎ | ◎ | ◎ | ◎ *2 | ○ | | | ◎ | | | ○ | ○ | | | Taper neck ball type for deep milling. Various choices on taper angles for different wall angles. |
| | DCTNB | 526 | DIA | 2 | R0.5~R1 | | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Diamond coating offers longer tool life for Graphite milling. |
| | HFTNB ● | 528 | HARD MAX | 3 | R0.5~R2 | | ■ | | ○ | ○ | ◎ | ◎ | ◎ | ◎ *2 | ○ | | | | | | ○ | ○ | | | 3 flute and Taper Neck design offers highly efficient milling. |
| **Taper** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | C-CTE2000 | 534 | UT COAT | 2 | φ0.2~φ2.5 | | ■ | | ◎ | ◎ | ◎ | ◎ | | | ○ | | | ○ | | | | | | | Wide range with 30'~15° half included angle. |
| | C-CTE4000 | 538 | UT COAT | 4 | φ3~φ10 | | ■ | | ◎ | ◎ | ◎ | ◎ | | | ○ | | | ○ | | | | | | | Wide range with 30'~7° half included angle. |
| **Chamfering** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SV | 542 | – | 2 | φ3~φ12 | | ■ | | ◎ | ◎ | ◎ | | | | ○ | ○ | ○ | ○ | ○ | | | | | | Spiral peripheral cutting edge offers excellent chamfering. |
| **Drill and Thread Mill** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UDCMX | 108 | UDC | 2 | φ0.3~φ7 | | | | | | | | | | | | | | | ◎ | | | ☆ | ◎ *4 | Special Diamond coated tool for drilling Cemented Carbide and Hard Brittle materials. |
| | UDCT | 112 | UDC | 2 | M2~M8 | | | | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Thread Mills for Cemented Carbide and Hard Brittle materials. |
| | UTDF | 544 | UT COAT | 2 | φ2~φ12 | | | | ◎ | ◎ | ○ | | | | ◎ | ◎ | | | | | | | | | A point angle of 180° offers the unique possibility for pilot hole drilling. |
| | UTDSX | 550 | MICRO COAT | 2 | φ0.3~φ2 | | | | ◎ | ◎ | ○ | Contact sales when drilling over 45 HRC. | | | ○ | ◎ | | ○ | | | ○ | ○ | | | Coated carbide drills with short flute length. "X" thinning design provides excellent hole accuracy. |
| | C-UMD | 552 | MICRO COAT | 2 | φ0.1~φ6 | | | | ◎ | ◎ | ○ | | | | ○ | ◎ | | ○ | | | ○ | ○ | | | Carbide drills with wide range of sizes. |
| | UTDLX | 558 | MICRO COAT | 2 | φ0.3~φ3 | | | | ◎ | ◎ | ○ | | | | ○ | ◎ | | ○ | | | ○ | ○ | | | Coated carbide drills with long flute length. "X" thinning design provides excellent hole accuracy. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

# Series

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **For High Precision Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HLRS2000E | 318 | HARD MAX | 2 | φ0.2~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ○ *2 | ○ | | | ◎ | | | ○ | ○ | | | Precise corner radius and diameter tolerances offer high precision milling. |
| **HMGCOAT** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HGB ● | 396 | HMG COAT | 2 | R0.05~R3 | ■ | ■ | ■ | | | ○ | ◎ | ◎ | ◎ | | | | | | | | | | | Long tool life on Hardened Steels due to HMGCOAT for milling hard materials and new carbide materials with high resistance to wear. |
| | HGLB ● | 436 | HMG COAT | 2 | R0.05~R3 | ■ | ■ | ■ | | | ○ | ◎ | ◎ | ◎ | | | | | | | | | | | Long tool life on Hardened Steels due to HMGCOAT for milling hard materials and new carbide materials with high resistance to wear. |
| **HARDMAX** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | HMERS | 312 | HARD MAX | 4 6 | φ3~φ12 | | ■ | ■ | | | ○ | ◎ | ◎ | ◎ *2 | | | | | | | | | | | Precise rigid tool designed with negative flutes, shallow grooves and 45° helix angle. Various Corner Radius sizes are available. |
| | HMS | 226 | HARD MAX | 3 4 6 | φ1~φ12 | | ■ | ■ | | | ○ | ◎ | ◎ | ◎ *2 | | | | | | | | | | | Precise rigid tool designed with negative flutes, shallow grooves and 45° helix angle. |
| | HLS2000 ● | 230 | HARD MAX | 2 | φ0.1~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | | Long neck square for high accuracy deep milling. |
| | HLS4000 | 276 | HARD MAX | 4 | φ1~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | | Variable pitch and back taper design offers high feed deep milling on hard materials. |
| | HLRS2000 | 318 | HARD MAX | 2 | φ0.4~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ○ *2 | ○ | | | ◎ | | | ○ | ○ | | | Long neck radius for deep milling. Offers excellent finishing performance on Prehardened and Hardened Steels. |
| | HLRS4000 ● | 338 | HARD MAX | 4 | φ0.2~φ6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ○ *2 | ○ | | | ○ | | | ○ | ○ | | | Precise rigid tool with variable pitch and back taper design. Recommended for deep milling on middle ~ hard materials with high feed. |
| | HRRS | 362 | HARD MAX | 4 | φ2~φ12 | ■ | ■ | ▨ | | | ◎ | ◎ | ◎ | ○ *2 | ○ | | | | | | | | | | Special tool design offers high efficient milling. Improved milling efficiency by the unique design. |
| | HRRS-S | 368 | HARD MAX | 4 | φ2~φ12 | ■ | ■ | ▨ | | | ◎ | ◎ | ◎ | ○ *2 | ○ | | | | | | | | | | Short Shank Radius with improved milling efficiency. |
| | HTNRS ● | 386 | HARD MAX | 4 | φ1~φ6 | | ■ | ■ | | | ◎ | ◎ | ◎ | ○ *2 | ○ | | | | | | | | | | 4 flute taper neck radius with a various lineup of taper neck angles. |
| | HHRS | 384 | HARD MAX | 6 | φ6~φ12 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | | High rigidity. Long neck radius design for milling on Harder Steels. |
| | HSB ● | 398 | HARD MAX | 2 | R0.03~R6 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | Broad application range from Copper to hard materials up to 70HRC. |
| | HSB-S | 402 | HARD MAX | 2 | R0.1~R2 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | High-accuracy Short Shank Ball End Mills for high-accuracy shrink-fit holder. |
| | HBL | 404 | HARD MAX | 2 | R1.5~R6 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ◎ | | | ○ | ○ | | | Straight type long shank end mills for long overhang milling. |
| | HFB | 426 | HARD MAX | 4 | R1~R6 | ■ | ■ | ▨ | | | | ◎ | ◎ | ◎ | | | | | | | | | | | Rigid tool with negative cutting edge design. Special tip geometry provides enhanced cutting performance. |
| | HFB-S | 427 | HARD MAX | 4 | R1~R6 | ■ | ■ | ▨ | | | | ◎ | ◎ | ◎ | | | | | | | | | | | Short Shank Ball for highly efficient milling. |
| | HSLB | 446 | HARD MAX | 2 | R0.05~R3 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | Broad application range from Copper to hard materials up to 70HRC. |
| | HSLB-S | 464 | HARD MAX | 2 | R0.1~R3 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | | High-accuracy Short Shank Long Neck Ball End Mills for high-accuracy shrink-fit holder. |
| | HTNB ● | 508 | HARD MAX | 2 | R0.1~R2 | | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ *2 | ○ | | | ◎ | | | ○ | ○ | | | Taper neck ball type for deep milling. Various choices on taper angles for different wall angles. |
| | HFTNB ● | 528 | HARD MAX | 3 | R0.5~R2 | ■ | ■ | ■ | ○ | ○ | ◎ | ◎ | ◎ | ◎ *2 | ○ | | | | | | ○ | ○ | | | 3 flute and Taper Neck design offers highly efficient milling. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

# Series

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **UTCOAT** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CSS | 140 | UT COAT | 2 | φ0.1~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Recommended for part and mold milling. Upgraded series of C-CES offering better chip evacuation. |
| | C-CES2000 | 154 | UT COAT | 2 | φ0.1~φ20 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish. |
| | C-CES2000S | 168 | UT COAT | 2 | φ0.2~φ12 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish with a sharp corner design. |
| | CZS | 182 | UT COAT | 4 | φ1~φ20 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Special tip geometry with variable pitch offers vertical milling function. Suitable for highly efficient milling. |
| | CXES ● | 196 | UT COAT | 4 | φ1~φ16 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and enables highly efficient milling. |
| | C-CES4000 | 208 | UT COAT | 4 | φ1~φ20 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish. |
| | C-CES4000S | 214 | UT COAT | 4 | φ1~φ12 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Value for the price and excellent surface finish with a sharp corner design. |
| | CXS | 282 | UT COAT | 4 | φ1~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Variable pitch and helix design controls vibration and chattering. Long Neck design offers deep milling. |
| | C-CER ● | 244 | UT COAT | 2 | φ0.1~φ6 | | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Positive cutting flute design offers excellent surface finish. |
| | C-CRS | 290 | UT COAT | 2 | φ1~φ20 | | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | | | ◎ | | | ○ | ○ | | | Standard 2 flute radius end mill. |
| | CNRS | 294 | UT COAT | 4 | φ6~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ☆ | ☆ | | | Provides high feed and efficient milling on hard-to-cut materials. |
| | CXERS ● | 298 | UT COAT | 4 | φ1~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and enables highly efficient milling. Radius type. |
| | CXRS | 308 | UT COAT | 5 | φ3~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and 5 flute design enables highly efficient milling. |
| | CRRS | 370 | UT COAT | 4 | φ2~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ◎ | ◎ | | | Variable pitch and back taper design control chattering and perform well on hard-to-cut materials. |
| | CXLRS | 380 | UT COAT | 5 | φ3~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | | Variable Division & Helix design minimizes vibration and chattering and 5 flute design enables highly efficient milling. |
| | CSEB ● | 406 | UT COAT | 2 | R0.05~R6 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | | | ○ | ○ | | | New UTCOAT. Broad application range from raw materials to 55HRC. |
| | CFB | 416 | UT COAT | 3 | R0.3~R6 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | ○ | | ◎ | ◎ | | | 3 flute design with variable pitch promotes highly efficient milling. |
| | CSELB | 406 | UT COAT | 2 | R0.05~R3 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | | | ○ | ○ | | | New UTCOAT. Broad application range from raw materials to 55HRC. |
| | CFLB | 502 | UT COAT | 3 | R0.3~R3 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | ○ | | ◎ | ◎ | | | 3 flute long neck design with variable pitch promotes highly efficient milling. |
| | C-CTE2000 | 534 | UT COAT | 2 | φ0.2~φ2.5 | | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | | | ○ | | | | | | | Wide range with 30'~15° half included angle. |
|  | C-CTE4000 | 538 | UT COAT | 4 | φ3~φ10 | | ■ | ■ | ◎ | ◎ | ◎ | ◎ | | | ○ | | | ○ | | | | | | | Wide range with 30'~7° half included angle. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

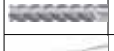
# Series

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **For Cemented Carbide and Hard Brittle Materials Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UDCBH ● | 78 | UDC | 2 | R0.4~R1 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | The improved Diamond coating and new edge treatment enable high feed rate milling. |
| | UDCBF | 80 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and edge treatment for finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCLBF | 82 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and edge treatment for finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCLRSF | 86 | UDC | 2 | φ0.3~φ2 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and edge treatment for finishing on Cemented Carbide and Hard Brittle Materials. |
| | UDCB | 94 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | UDCLB | 98 | UDC | 2 | R0.1~R3 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | UDCLRS | 102 | UDC | 2 | φ0.3~φ2 | ■ | ■ | ■ | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Special Diamond coating and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | UDCMX | 108 | UDC | 2 | φ0.3~φ7 | | | | | | | | | | | | | | | ◎ | | | ☆ | ◎ *4 | Special Diamond coating and tool design for milling Cemented Carbide and Hard Brittle Materials. |
| | UDCT | 112 | UDC | 2 | M2~M8 | | | | | | | | | | | | | | | ○ | | | ☆ | ◎ *4 | Thread Mills for Cemented Carbide and Hard Brittle materials. |
| **For finishing on Cemented Carbide and Hard Brittle Materials** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UPDLRS | 316 | – | 1 | φ0.2~φ2 | | | ■ | | | | | | | | | | | | | | | ☆ | ◎ | For finishing on Cemented Carbide and Hard Brittle Materials. |
| | UPDLB | 434 | – | 1 | R0.1~R1 | | | ■ | | | | | | | | | | | | | | | ☆ | ◎ | For finishing on Cemented Carbide and Hard Brittle Materials. |
| **CBN** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CBN-RSF ● | 126 | – | 1 | φ0.2~φ2 | | | ■ | | | | | ◎ | ◎ *2 | | | | | | | | | | | CBN offers high-precision milling on hard materials. Improves product quality by the unique flute design. |
| | CBN-LRF | 132 | – | 2 | φ0.1~φ2 | | | ■ | | | ○ | ◎ | ◎ | ◎ *3 | | | | | | | | | | | CBN offers high-precision milling and long tool life. |
| | CBN-LBSF | 114 | – | 2 | R0.05~R1 | | | ■ | | | ○ | ◎ | ◎ | ◎ *3 | | | | | | | | | | | CBN offers high-precision milling and long tool life for hard materials. Improves product quality by the unique flute design. |
| | CBN-LBF | 120 | – | 2 | R0.05~R1 | | | ■ | | | ○ | ◎ | ◎ | ◎ *3 | | | | | | | | | | | CBN offers high-precision milling and long tool life for hard materials. |
| **For Stainless Steel Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CESUS | 216 | UTS COAT | 4 | φ6~φ12 | ■ | ■ | ■ | ◎ | ☆ | ○ | | | | ○ | | | ○ | | | ○ | ○ | | | Achieves high efficiency milling by the optimized tool design and coating for Stainless. |
| **For Copper Electrode Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CRN-ES2000 | 174 | CrN COAT | 2 | φ0.2~φ12 | | ■ | ■ | | | | | | | | ○ | | ☆ *1 | ○ | | | | | | CrN coating provides longer tool life and excellent surface finish. |
| | CRN-ES4000 | 220 | CrN COAT | 4 | φ3~φ12 | | ■ | ■ | | | | | | | | ○ | | ☆ *1 | ○ | | | | | | CrN coating provides longer tool life and excellent surface finish. |
| | DLCLB ● | 488 | DLC | 2 | R0.05~R3 | ■ | ■ | ■ | | | | | | | | | | ☆ | | | | | | | The optimized flute geometry and DLC coating offer long tool life and high-precision milling. |
| **For Aluminum Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CAS | 180 | – | 2 | φ0.5~φ12 | | ■ | ■ | | | | | | | | ☆ | | ○ | | | | | | | Sharp corner square type for Aluminum provides excellent surface finish. |
| | AZS | 266 | – | 3 | φ1~φ12 | ■ | ■ | ■ | | | | | | | | ☆ | | ○ | ○ | | | | | | For Highly efficient Aluminum milling with vertical milling capability. |
| | DLC-AZS | 270 | DLC | 3 | φ1~φ12 | ■ | ■ | ■ | | | | | | | | ☆ | | ○ | ○ | | | | | | For Highly efficient Aluminum milling with vertical milling capability. |
| | DLC-CFB | 422 | DLC | 3 | R0.3~R6 | ■ | ■ | ■ | | | | | | | | ☆ | | ○ | ○ | | | | | | DLC coating offers longer tool life for Aluminum milling. Highly efficient milling by 3 flute design. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

# Series

| Appearance | Model Number | Page | Coating | Number of Flutes | Size | Use: Roughing | Use: Semi-Roughing | Use: Finishing | Material Applications (☆ Highly Recommended ◎Recommended ○Suggested): Carbon Steels S45C S55C | Alloy Steels SK SCM SUS | Prehardened Steels 30~45 HRC NAK HPM | Hardened Steels ~55 HRC | Hardened Steels ~60 HRC | Hardened Steels ~70 HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials | Characteristics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **For Plastic Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CPS | 178 | – | 2 | φ0.3~φ12 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Provides excellent finishing accuracy on Plastics milling. |
| | CPR | 258 | – | 2 | φ0.5~φ6 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Long neck square for deep slotting on Plastics. |
| | CPRL | 262 | – | 2 | φ0.5~φ4 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Long neck square with long shank for deep slotting. |
| | CPRB | 498 | – | 2 | R0.2~R3 | | ■ | ■ | | | | | | | | ○ | | ◎ | ☆ | | | | | | Long neck ball for deep slotting on Plastics. |
| **For Graphite Milling** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | DCES2000 | 176 | DIA | 2 | φ0.2~φ6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating |
| | DCES4000 | 222 | DIA | 4 | φ3~φ10 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating |
| | DCLS | 254 | DIA | 2 | φ0.4~φ6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating |
| | DCLRS | 376 | DIA | 4 | φ1~φ6 | ■ | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating |
| | DCB | 412 | DIA | 2 | R0.5~R6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating |
| | DCLB | 484 | DIA | 2 | R0.2~R3 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Long tool life with high-adhesion coating |
|  | CGE | 224 | – | 4 | φ2~φ20 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | | Non-coated 45° helix angle tool designed for high finishing accuracy. |
| | DCTNB | 526 | DIA | 2 | R0.5~R1 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ | Diamond coating offers longer tool life for Graphite milling. |
| | CGB2000 | 414 | – | 2 | R0.2~R6 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | | Non-coated sharp cutting edge design for excellent finish. |
| | CGB4000 | 432 | – | 4 | R2~R10 | | ■ | ■ | | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | | Non-coated sharp cutting edge design for excellent finish. |
| **Spiral Chamfering Cutter** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | SV | 542 | – | 2 | φ3~φ12 | | ■ | ■ | ◎ | ◎ | ◎ | | | | | ○ | ○ | ○ | ○ | ○ | | | | | Spiral peripheral cutting edge offers excellent chamfering. |
| **UNIMAX Drill** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | UTDF | 544 | UT COAT | 2 | φ2~φ12 | | | | ◎ | ◎ | ○ | | | | ◎ | ◎ | | | | | | | | | A point angle of 180° offers the unique possibility for pilot hole drilling. |
| | UTDSX | 550 | MICRO COAT | 2 | φ0.3~φ2 | | | | ◎ | ◎ | ○ | | | | ○ | ◎ | | ○ | | | ○ | ○ | | | Coated carbide drills with short flute length. "X" thinning design provides excellent hole accuracy. |
| | C-UMD | 552 | MICRO COAT | 2 | φ0.1~φ6 | | | | ◎ | ◎ | ○ | Contact sales when drilling over 45 HRC. | | | ○ | ◎ | | ○ | | | ○ | ○ | | | Carbide drills with wide range of sizes. |
| | UTDLX | 558 | MICRO COAT | 2 | φ0.3~φ3 | | | | ◎ | ◎ | ○ | | | | ○ | ◎ | | ○ | | | ○ | ○ | | | Coated carbide drills with long flute length. "X" thinning design provides excellent hole accuracy. |
| **EURO Series** | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CPRS25NSP | 564 | – | 2 | φ2~φ12 | | ■ | ■ | | | | | | | | ◎ | | ○ | ◎ | | | | | | Miniature corner radius prevents chipping and reduces cutting marks on the milling surface. |
| | CPRS30N | 566 | – | 2 | φ4~φ10 | | ■ | ■ | | | | | | | | ◎ | | ○ | ◎ | | | | | | Well balanced design for excellent surface accuracy and chip evacuation. |
| | CRS40HSP | 568 | HARD MAX | 3 | φ2~φ12 | ■ | ■ | ■ | ◎ | ◎ | ◎ | ○ | ○ | | ◎ | | ○ | | ○ | | | | | | Suitable for milling various materials from soft steels to 60HRC Hardened Steels. |
| | CRS20HSP | 570 | HARD MAX | 4 | φ2~φ12 | | ■ | ■ | ○ | | ○ | ◎ | ◎ | | ◎ | | | | | | | | | | Designed the corner radius size as 10% of outside diameter. |

● New Product ● Additional Model

*1 Not recommended for Tungsten Copper. *2 ~65HRC *3 ~68HRC
*4 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSS** | 2001-0010 | 2 Flutes | 0.1 | — | 0.1 | 45 | 4 | 140 |
| **HLS** | 2001-003 | | | 0.3 | 0.1 | 45 | 4 | 230 |
| **C-CER** | 2001-0.3 | | | 0.3 | 0.1 | 45 | 4 | 244 |
| **HLS** | 2001-005 | | | 0.5 | 0.1 | 45 | 4 | 230 |
| **C-CER** | 2001-0.5 | | | 0.5 | 0.1 | 45 | 4 | 244 |
| **HLS** | 2001-0075 | | | 0.75 | 0.1 | 45 | 4 | 230 |
| **C-CER** | 2001-0.75 | | | 0.75 | 0.1 | 45 | 4 | 244 |
| **HLS** | 2001-010 | | | 1 | 0.1 | 45 | 4 | 230 |
| **C-CER** | 2001-1 | | | 1 | 0.1 | 45 | 4 | 244 |
| **CSS** | 2001-0015 | | | — | 0.15 | 45 | 4 | 140 |
| **C-CES** | 2001-0015 | | | — | 0.15 | 45 | 4 | 154 |
| **CSS** | 2001-0020 | | | — | 0.2 | 45 | 4 | 140 |
| **C-CES** | 2001-0020 | | | — | 0.2 | 45 | 4 | 154 |
| **CSS** | 2001-0025 | | | — | 0.25 | 45 | 4 | 140 |
| **CSS** | 2001-0030 | | | — | 0.3 | 45 | 4 | 140 |
| **C-CES** | 2001-0030 | | | — | 0.3 | 45 | 4 | 154 |
| **HLS** | 2015-005 | 2 Flutes | 0.15 | 0.5 | 0.15 | 45 | 4 | 230 |
| **C-CER** | 2015-0.5 | | | 0.5 | 0.15 | 45 | 4 | 244 |
| **HLS** | 2015-0075 | | | 0.75 | 0.15 | 45 | 4 | 230 |
| **C-CER** | 2015-0.75 | | | 0.75 | 0.15 | 45 | 4 | 244 |
| **HLS** | 2015-010 | | | 1 | 0.15 | 45 | 4 | 230 |
| **C-CER** | 2015-1 | | | 1 | 0.15 | 45 | 4 | 244 |
| **CSS** | 2002-0020 | 2 Flutes | 0.2 | — | 0.2 | 45 | 4 | 140 |
| **CSS** | 2002-0030 | | | — | 0.3 | 45 | 4 | 140 |
| **C-CES** | 2002-0030 | | | — | 0.3 | 45 | 4 | 154 |
| **C-CES** | 2002-0030S | | | — | 0.3 | 45 | 4 | 168 |
| **HLS** | 2002-005 | | | 0.5 | 0.3 | 45 | 4 | 230 |
| **C-CER** | 2002-0.5 | | | 0.5 | 0.3 | 45 | 4 | 244 |
| **HLS** | 2002-010 | | | 1 | 0.3 | 45 | 4 | 230 |
| **C-CER** | 2002-1 | | | 1 | 0.3 | 45 | 4 | 244 |
| **HLS** | 2002-015 | | | 1.5 | 0.3 | 45 | 4 | 230 |
| **C-CER** | 2002-1.5 | | | 1.5 | 0.3 | 45 | 4 | 244 |
| **HLS** | 2002-020 | | | 2 | 0.3 | 45 | 4 | 230 |
| **C-CER** | 2002-2 | | | 2 | 0.3 | 45 | 4 | 244 |
| **HLS** | 2002-030 | | | 3 | 0.3 | 45 | 4 | 230 |
| **C-CER** | 2002-3 | | | 3 | 0.3 | 45 | 4 | 244 |
| **CSS** | 2002-0040-3 | | | — | 0.4 | 38 | 3 | 140 |
| **C-CES** | 2002 | | | — | 0.4 | 38 | 3 | 154 |
| **CSS** | 2002-0040-4 | | | — | 0.4 | 45 | 4 | 140 |
| **C-CES** | 2002-0040 | | | — | 0.4 | 45 | 4 | 154 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSS** | 2002-0050 | 2 Flutes | 0.2 | — | 0.5 | 45 | 4 | 140 |
| **C-CES** | 2002-0050 | | | — | 0.5 | 45 | 4 | 154 |
| **CRN-ES** | 2002-0060 | | | — | 0.6 | 40 | 4 | 174 |
| **CSS** | 2002-0060 | | | — | 0.6 | 45 | 4 | 140 |
| **C-CES** | 2002-0060 | | | — | 0.6 | 45 | 4 | 154 |
| **C-CES** | 2002-0060S | | | — | 0.6 | 45 | 4 | 168 |
| **DCES** | 2002-0060 | | | — | 0.6 | 45 | 4 | 176 |
| **C-CES** | 2002-0080 | | | — | 0.8 | 45 | 4 | 154 |
| **CSS** | 2003-0030 | 2 Flutes | 0.3 | — | 0.3 | 45 | 4 | 140 |
| **HLS** | 2003-010 | | | 1 | 0.4 | 45 | 4 | 231 |
| **C-CER** | 2003-1 | | | 1 | 0.4 | 45 | 4 | 244 |
| **HLS** | 2003-015 | | | 1.5 | 0.4 | 45 | 4 | 231 |
| **C-CER** | 2003-1.5 | | | 1.5 | 0.4 | 45 | 4 | 244 |
| **HLS** | 2003-020 | | | 2 | 0.4 | 45 | 4 | 231 |
| **C-CER** | 2003-2 | | | 2 | 0.4 | 45 | 4 | 244 |
| **HLS** | 2003-025 | | | 2.5 | 0.4 | 45 | 4 | 231 |
| **HLS** | 2003-030 | | | 3 | 0.4 | 45 | 4 | 231 |
| **C-CER** | 2003-3 | | | 3 | 0.4 | 45 | 4 | 244 |
| **HLS** | 2003-040 | | | 4 | 0.4 | 45 | 4 | 231 |
| **HLS** | 2003-060 | | | 6 | 0.4 | 45 | 4 | 231 |
| **HLS** | 2003-090 | | | 9 | 0.4 | 45 | 4 | 231 |
| **CSS** | 2003-0045 | | | — | 0.45 | 45 | 4 | 140 |
| **C-CES** | 2003-0045 | | | — | 0.45 | 45 | 4 | 155 |
| **C-CES** | 2003-0045S | | | — | 0.45 | 45 | 4 | 168 |
| **CSS** | 2003-0060-3 | | | — | 0.6 | 38 | 3 | 140 |
| **C-CES** | 2003 | | | — | 0.6 | 38 | 3 | 155 |
| **CSS** | 2003-0060-4 | | | — | 0.6 | 45 | 4 | 140 |
| **C-CES** | 2003-0060 | | | — | 0.6 | 45 | 4 | 155 |
| **CSS** | 2003-0075 | | | — | 0.75 | 45 | 4 | 140 |
| **C-CES** | 2003-0075 | | | — | 0.75 | 45 | 4 | 155 |
| **CRN-ES** | 2003-0090 | | | — | 0.9 | 40 | 4 | 174 |
| **CSS** | 2003-0090 | | | — | 0.9 | 45 | 4 | 140 |
| **C-CES** | 2003-0090 | | | — | 0.9 | 45 | 4 | 155 |
| **C-CES** | 2003-0090S | | | — | 0.9 | 45 | 4 | 168 |
| **CPS** | 2003 | | | — | 0.9 | 45 | 4 | 178 |
| **C-CES** | 2003-0120 | | | — | 1.2 | 45 | 4 | 155 |
| **CSS** | 2004-0040 | 2 Flutes | 0.4 | — | 0.4 | 45 | 4 | 141 |
| **CSS** | 2004-0060 | | | — | 0.6 | 45 | 4 | 141 |
| **C-CES** | 2004-0060 | | | — | 0.6 | 45 | 4 | 155 |
| **C-CES** | 2004-0060S | | | — | 0.6 | 45 | 4 | 168 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 2004-015 | 2 Flutes | 0.4 | 1.5 | 0.6 | 45 | 4 | 231 |
| **HLS** | 2004-020 | | | 2 | 0.6 | 45 | 4 | 231 |
| **C-CER** | 2004-2 | | | 2 | 0.6 | 45 | 4 | 245 |
| **HLS** | 2004-025 | | | 2.5 | 0.6 | 45 | 4 | 231 |
| **HLS** | 2004-030 | | | 3 | 0.6 | 45 | 4 | 231 |
| **C-CER** | 2004-3 | | | 3 | 0.6 | 45 | 4 | 245 |
| **HLS** | 2004-035 | | | 3.5 | 0.6 | 45 | 4 | 231 |
| **HLS** | 2004-040 | | | 4 | 0.6 | 45 | 4 | 231 |
| **C-CER** | 2004-4 | | | 4 | 0.6 | 45 | 4 | 245 |
| **HLS** | 2004-050 | | | 5 | 0.6 | 45 | 4 | 231 |
| **C-CER** | 2004-5 | | | 5 | 0.6 | 45 | 4 | 245 |
| **HLS** | 2004-080 | | | 8 | 0.6 | 45 | 4 | 231 |
| **HLS** | 2004-120 | | | 12 | 0.6 | 45 | 4 | 231 |
| **CSS** | 2004-0080-3 | | | — | 0.8 | 38 | 3 | 141 |
| **C-CES** | 2004 | | | — | 0.8 | 38 | 3 | 155 |
| **CSS** | 2004-0080-4 | | | — | 0.8 | 45 | 4 | 141 |
| **C-CES** | 2004-0080 | | | — | 0.8 | 45 | 4 | 155 |
| **DCLS** | 2004-020 | | | 2 | 0.8 | 45 | 4 | 254 |
| **DCLS** | 2004-040 | | | 4 | 0.8 | 45 | 4 | 254 |
| **DCLS** | 2004-060 | | | 6 | 0.8 | 45 | 4 | 254 |
| **CSS** | 2004-0100 | | | — | 1 | 45 | 4 | 141 |
| **C-CES** | 2004-0100 | | | — | 1 | 45 | 4 | 155 |
| **CRN-ES** | 2004-0120 | | | — | 1.2 | 40 | 4 | 174 |
| **CSS** | 2004-0120 | | | — | 1.2 | 45 | 4 | 141 |
| **C-CES** | 2004-0120 | | | — | 1.2 | 45 | 4 | 155 |
| **C-CES** | 2004-0120S | | | — | 1.2 | 45 | 4 | 168 |
| **CPS** | 2004 | | | — | 1.2 | 45 | 4 | 178 |
| **C-CES** | 2004-0160 | | | — | 1.6 | 45 | 4 | 155 |
| **CSS** | 2005-0050 | 2 Flutes | 0.5 | — | 0.5 | 45 | 4 | 141 |
| **HLS** | 2005-015 | | | 1.5 | 0.7 | 45 | 4 | 231 |
| **HLS** | 2005-020 | | | 2 | 0.7 | 45 | 4 | 231 |
| **C-CER** | 2005-2 | | | 2 | 0.7 | 45 | 4 | 245 |
| **HLS** | 2005-025 | | | 2.5 | 0.7 | 45 | 4 | 231 |
| **HLS** | 2005-030 | | | 3 | 0.7 | 45 | 4 | 231 |
| **HLS** | 2005-040 | | | 4 | 0.7 | 45 | 4 | 231 |
| **C-CER** | 2005-4 | | | 4 | 0.7 | 45 | 4 | 245 |
| **HLS** | 2005-050 | | | 5 | 0.7 | 45 | 4 | 231 |
| **HLS** | 2005-060 | | | 6 | 0.7 | 45 | 4 | 231 |
| **C-CER** | 2005-6 | | | 6 | 0.7 | 45 | 4 | 245 |
| **HLS** | 2005-080 | | | 1 | 0.7 | 45 | 4 | 231 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CER** | 2005-8 | 2 Flutes | 0.5 | 8 | 0.7 | 45 | 4 | 245 |
| **HLS** | 2005-100 | | | 10 | 0.7 | 50 | 4 | 231 |
| **HLS** | 2005-150 | | | 15 | 0.7 | 50 | 4 | 231 |
| **CSS** | 2005-0075 | | | — | 0.75 | 45 | 4 | 141 |
| **C-CES** | 2005-0075 | | | — | 0.75 | 45 | 4 | 155 |
| **C-CES** | 2005-0075S | | | — | 0.75 | 45 | 4 | 168 |
| **CAS** | 2005-0075 | | | — | 0.75 | 45 | 4 | 180 |
| **CSS** | 2005-0080 | | | — | 0.8 | 38 | 3 | 141 |
| **C-CES** | 2005 | | | — | 0.8 | 38 | 3 | 155 |
| **CSS** | 2005-0100 | | | — | 1 | 45 | 4 | 141 |
| **C-CES** | 2005-0100 | | | — | 1 | 45 | 4 | 155 |
| **CPR** | 2005-2 | | | 2 | 1 | 38 | 3 | 258 |
| **DCLS** | 2005-020 | | | 2 | 1 | 45 | 4 | 254 |
| **CPR** | 2005-4 | | | 4 | 1 | 38 | 3 | 258 |
| **DCLS** | 2005-040 | | | 4 | 1 | 45 | 4 | 254 |
| **CPRL** | 2005-4 | | | 4 | 1 | 80 | 4 | 262 |
| **CPR** | 2005-6 | | | 6 | 1 | 38 | 3 | 258 |
| **DCLS** | 2005-060 | | | 6 | 1 | 45 | 4 | 254 |
| **CPRL** | 2005-6 | | | 6 | 1 | 80 | 4 | 262 |
| **CPRL** | 2005-8 | | | 8 | 1 | 80 | 4 | 262 |
| **CPRL** | 2005-10 | | | 10 | 1 | 80 | 4 | 262 |
| **CSS** | 2005-0125 | | | — | 1.25 | 45 | 4 | 141 |
| **C-CES** | 2005-0125 | | | — | 1.25 | 45 | 4 | 155 |
| **CRN-ES** | 2005-0150 | | | — | 1.5 | 40 | 4 | 174 |
| **CSS** | 2005-0150 | | | — | 1.5 | 45 | 4 | 141 |
| **C-CES** | 2005-0150 | | | — | 1.5 | 45 | 4 | 155 |
| **C-CES** | 2005-0150S | | | — | 1.5 | 45 | 4 | 168 |
| **DCES** | 2005-0150 | | | — | 1.5 | 45 | 4 | 176 |
| **CPS** | 2005 | | | — | 1.5 | 45 | 4 | 178 |
| **C-CES** | 2005-0200 | | | — | 2 | 45 | 4 | 155 |
| **CRN-ES** | 2005-0200 | | | — | 2 | 45 | 4 | 174 |
| **CSS** | 2006-0060 | 2 Flutes | 0.6 | — | 0.6 | 45 | 4 | 141 |
| **CSS** | 2006-0090 | | | — | 0.9 | 45 | 4 | 141 |
| **C-CES** | 2006-0090 | | | — | 0.9 | 45 | 4 | 155 |
| **C-CES** | 2006-0090S | | | — | 0.9 | 45 | 4 | 168 |
| **HLS** | 2006-020 | | | 2 | 0.9 | 45 | 4 | 231 |
| **C-CER** | 2006-2 | | | 2 | 0.9 | 45 | 4 | 245 |
| **HLS** | 2006-030 | | | 3 | 0.9 | 45 | 4 | 231 |
| **HLS** | 2006-040 | | | 4 | 0.9 | 45 | 4 | 231 |
| **C-CER** | 2006-4 | | | 4 | 0.9 | 45 | 4 | 245 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 2006-050 | 2 Flutes | 0.6 | 5 | 0.9 | 45 | 4 | 231 |
| **HLS** | 2006-060 | | | 6 | 0.9 | 45 | 4 | 231 |
| **C-CER** | 2006-6 | | | 6 | 0.9 | 45 | 4 | 245 |
| **HLS** | 2006-070 | | | 7 | 0.9 | 45 | 4 | 231 |
| **HLS** | 2006-080 | | | 8 | 0.9 | 45 | 4 | 231 |
| **C-CER** | 2006-8 | | | 8 | 0.9 | 45 | 4 | 245 |
| **HLS** | 2006-100 | | | 10 | 0.9 | 45 | 4 | 231 |
| **C-CER** | 2006-10 | | | 10 | 0.9 | 45 | 4 | 245 |
| **HLS** | 2006-120 | | | 12 | 0.9 | 50 | 4 | 231 |
| **HLS** | 2006-180 | | | 18 | 0.9 | 50 | 4 | 231 |
| **CSS** | 2006-0100 | | | — | 1 | 38 | 3 | 141 |
| **C-CES** | 2006 | | | — | 1 | 38 | 3 | 155 |
| **CSS** | 2006-0120 | | | — | 1.2 | 45 | 4 | 141 |
| **C-CES** | 2006-0120 | | | — | 1.2 | 45 | 4 | 155 |
| **DCLS** | 2006-020 | | | 2 | 1.2 | 45 | 4 | 254 |
| **CPR** | 2006-4 | | | 4 | 1.2 | 38 | 3 | 258 |
| **DCLS** | 2006-040 | | | 4 | 1.2 | 45 | 4 | 254 |
| **CPR** | 2006-6 | | | 6 | 1.2 | 38 | 3 | 258 |
| **DCLS** | 2006-060 | | | 6 | 1.2 | 45 | 4 | 254 |
| **DCLS** | 2006-080 | | | 8 | 1.2 | 45 | 4 | 254 |
| **DCLS** | 2006-100 | | | 10 | 1.2 | 45 | 4 | 254 |
| **CSS** | 2006-0150 | | | — | 1.5 | 45 | 4 | 141 |
| **C-CES** | 2006-0150 | | | — | 1.5 | 45 | 4 | 155 |
| **CRN-ES** | 2006-0180 | | | — | 1.8 | 40 | 4 | 174 |
| **CSS** | 2006-0180 | | | — | 1.8 | 45 | 4 | 141 |
| **C-CES** | 2006-0180 | | | — | 1.8 | 45 | 4 | 155 |
| **CPS** | 2006 | | | — | 1.8 | 45 | 4 | 178 |
| **C-CES** | 2006-0240 | | | — | 2.4 | 45 | 4 | 155 |
| **CRN-ES** | 2006-0240 | | | — | 2.4 | 45 | 4 | 174 |
| **CSS** | 2007-0070 | 2 Flutes | 0.7 | — | 0.7 | 45 | 4 | 141 |
| **CSS** | 2007-0100 | | | — | 1 | 38 | 3 | 141 |
| **C-CES** | 2007 | | | — | 1 | 38 | 3 | 155 |
| **HLS** | 2007-020 | | | 2 | 1 | 45 | 4 | 232 |
| **C-CER** | 2007-2 | | | 2 | 1 | 45 | 4 | 245 |
| **C-CER** | 2007-3 | | | 3 | 1 | 45 | 4 | 245 |
| **HLS** | 2007-040 | | | 4 | 1 | 45 | 4 | 232 |
| **C-CER** | 2007-4 | | | 4 | 1 | 45 | 4 | 245 |
| **HLS** | 2007-060 | | | 6 | 1 | 45 | 4 | 232 |
| **C-CER** | 2007-6 | | | 6 | 1 | 45 | 4 | 245 |
| **HLS** | 2007-080 | | | 8 | 1 | 45 | 4 | 232 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CER** | 2007-8 | 2 Flutes | 0.7 | 8 | 1 | 45 | 4 | 245 |
| **HLS** | 2007-100 | | | 10 | 1 | 50 | 4 | 232 |
| **C-CER** | 2007-10 | | | 10 | 1 | 50 | 4 | 245 |
| **C-CES** | 2007-0105S | | | — | 1.05 | 45 | 4 | 168 |
| **CSS** | 2007-0140 | | | — | 1.4 | 45 | 4 | 141 |
| **C-CES** | 2007-0140 | | | — | 1.4 | 45 | 4 | 155 |
| **CPR** | 2007-4 | | | 4 | 1.4 | 38 | 3 | 258 |
| **DCLS** | 2007-040 | | | 4 | 1.4 | 45 | 4 | 255 |
| **CPR** | 2007-6 | | | 6 | 1.4 | 38 | 3 | 258 |
| **DCLS** | 2007-060 | | | 6 | 1.4 | 45 | 4 | 255 |
| **DCLS** | 2007-080 | | | 8 | 1.4 | 45 | 4 | 255 |
| **DCLS** | 2007-100 | | | 10 | 1.4 | 45 | 4 | 255 |
| **CSS** | 2007-0175 | | | — | 1.75 | 45 | 4 | 141 |
| **C-CES** | 2007-0175 | | | — | 1.75 | 45 | 4 | 155 |
| **CSS** | 2007-0210 | | | — | 2.1 | 45 | 4 | 141 |
| **C-CES** | 2007-0210 | | | — | 2.1 | 45 | 4 | 155 |
| **CPS** | 2007 | | | — | 2.1 | 45 | 4 | 178 |
| **C-CES** | 2007-0280 | | | — | 2.8 | 45 | 4 | 155 |
| **CSS** | 2008-0080 | 2 Flutes | 0.8 | — | 0.8 | 45 | 4 | 141 |
| **CSS** | 2008-0120-3 | | | — | 1.2 | 38 | 3 | 141 |
| **C-CES** | 2008 | | | — | 1.2 | 38 | 3 | 155 |
| **CSS** | 2008-0120-4 | | | — | 1.2 | 45 | 4 | 141 |
| **C-CES** | 2008-0120 | | | — | 1.2 | 45 | 4 | 155 |
| **C-CES** | 2008-0120S | | | — | 1.2 | 45 | 4 | 168 |
| **HLS** | 2008-030 | | | 3 | 1.2 | 45 | 4 | 232 |
| **HLS** | 2008-040 | | | 4 | 1.2 | 45 | 4 | 232 |
| **C-CER** | 2008-4 | | | 4 | 1.2 | 45 | 4 | 245 |
| **HLS** | 2008-050 | | | 5 | 1.2 | 45 | 4 | 232 |
| **HLS** | 2008-060 | | | 6 | 1.2 | 45 | 4 | 232 |
| **C-CER** | 2008-6 | | | 6 | 1.2 | 45 | 4 | 245 |
| **HLS** | 2008-080 | | | 8 | 1.2 | 45 | 4 | 232 |
| **C-CER** | 2008-8 | | | 8 | 1.2 | 45 | 4 | 245 |
| **HLS** | 2008-100 | | | 10 | 1.2 | 50 | 4 | 232 |
| **C-CER** | 2008-10 | | | 10 | 1.2 | 50 | 4 | 245 |
| **HLS** | 2008-120 | | | 12 | 1.2 | 50 | 4 | 232 |
| **C-CER** | 2008-12 | | | 12 | 1.2 | 50 | 4 | 245 |
| **HLS** | 2008-160 | | | 16 | 1.2 | 50 | 4 | 232 |
| **HLS** | 2008-240 | | | 24 | 1.2 | 60 | 4 | 232 |
| **CSS** | 2008-0160 | | | — | 1.6 | 45 | 4 | 141 |
| **C-CES** | 2008-0160 | | | — | 1.6 | 45 | 4 | 155 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **DCLS** | 2008-040 | 2 Flutes | 0.8 | 4 | 1.6 | 45 | 4 | 255 |
| **DCLS** | 2008-060 | | | 6 | 1.6 | 45 | 4 | 255 |
| **CPR** | 2008-6 | | | 6 | 1.6 | 45 | 4 | 258 |
| **DCLS** | 2008-080 | | | 8 | 1.6 | 45 | 4 | 255 |
| **CPR** | 2008-8 | | | 8 | 1.6 | 45 | 4 | 258 |
| **DCLS** | 2008-100 | | | 10 | 1.6 | 45 | 4 | 255 |
| **CSS** | 2008-0200 | | | — | 2 | 45 | 4 | 141 |
| **C-CES** | 2008-0200 | | | — | 2 | 45 | 4 | 155 |
| **CRN-ES** | 2008-0240 | | | — | 2.4 | 40 | 4 | 174 |
| **CSS** | 2008-0240 | | | — | 2.4 | 45 | 4 | 141 |
| **C-CES** | 2008-0240 | | | — | 2.4 | 45 | 4 | 155 |
| **C-CES** | 2008-0240S | | | — | 2.4 | 45 | 4 | 168 |
| **CPS** | 2008 | | | — | 2.4 | 45 | 4 | 178 |
| **C-CES** | 2008-0320 | | | — | 3.2 | 45 | 4 | 155 |
| **CSS** | 2009-0090 | 2 Flutes | 0.9 | — | 0.9 | 45 | 4 | 141 |
| **CSS** | 2009-0120 | | | — | 1.2 | 38 | 3 | 141 |
| **C-CES** | 2009 | | | — | 1.2 | 38 | 3 | 155 |
| **HLS** | 2009-040 | | | 4 | 1.3 | 45 | 4 | 232 |
| **C-CER** | 2009-4 | | | 4 | 1.3 | 45 | 4 | 245 |
| **HLS** | 2009-060 | | | 6 | 1.3 | 45 | 4 | 232 |
| **C-CER** | 2009-6 | | | 6 | 1.3 | 45 | 4 | 245 |
| **HLS** | 2009-080 | | | 8 | 1.3 | 45 | 4 | 232 |
| **C-CER** | 2009-8 | | | 8 | 1.3 | 45 | 4 | 245 |
| **HLS** | 2009-100 | | | 10 | 1.3 | 45 | 4 | 232 |
| **C-CER** | 2009-10 | | | 10 | 1.3 | 45 | 4 | 245 |
| **HLS** | 2009-150 | | | 15 | 1.3 | 50 | 4 | 232 |
| **C-CER** | 2009-15 | | | 15 | 1.3 | 50 | 4 | 245 |
| **C-CES** | 2009-0135S | | | — | 1.35 | 45 | 4 | 168 |
| **CSS** | 2009-0180 | | | — | 1.8 | 45 | 4 | 141 |
| **C-CES** | 2009-0180 | | | — | 1.8 | 45 | 4 | 155 |
| **CPR** | 2009-6 | | | 6 | 1.8 | 45 | 4 | 258 |
| **CPR** | 2009-10 | | | 10 | 1.8 | 45 | 4 | 258 |
| **CSS** | 2009-0225 | | | — | 2.25 | 45 | 4 | 141 |
| **C-CES** | 2009-0225 | | | — | 2.25 | 45 | 4 | 155 |
| **CSS** | 2009-0270 | | | — | 2.7 | 45 | 4 | 141 |
| **C-CES** | 2009-0270 | | | — | 2.7 | 45 | 4 | 155 |
| **CPS** | 2009 | | | — | 2.7 | 45 | 4 | 178 |
| **C-CES** | 2009-0360 | | | — | 3.6 | 45 | 4 | 155 |
| **CSS** | 2010-0100 | 2 Flutes | 1 | — | 1 | 45 | 4 | 141 |
| **HLS** | 4010-040 | 4 Flutes | | 4 | 1 | 50 | 4 | 276 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 4010-060 | 4 Flutes | 1 | 6 | 1 | 50 | 4 | 276 |
| **HLS** | 4010-080 | | | 8 | 1 | 50 | 4 | 276 |
| **HLS** | 4010-100 | | | 10 | 1 | 50 | 4 | 276 |
| **HLS** | 4010-120 | | | 12 | 1 | 50 | 4 | 276 |
| **HLS** | 4010-160 | | | 16 | 1 | 60 | 4 | 276 |
| **CSS** | 2010-0150 | 2 Flutes | | — | 1.5 | 45 | 4 | 141 |
| **C-CES** | 2010-0150 | | | — | 1.5 | 45 | 4 | 156 |
| **C-CES** | 2010-0150S | | | — | 1.5 | 45 | 4 | 168 |
| **CAS** | 2010-0150 | | | — | 1.5 | 45 | 4 | 180 |
| **HLS** | 2010-030 | | | 3 | 1.5 | 45 | 4 | 232 |
| **HLS** | 2010-040 | | | 4 | 1.5 | 45 | 4 | 232 |
| **C-CER** | 2010-4 | | | 4 | 1.5 | 45 | 4 | 245 |
| **HLS** | 2010-050 | | | 5 | 1.5 | 45 | 4 | 232 |
| **HLS** | 2010-060 | | | 6 | 1.5 | 45 | 4 | 232 |
| **C-CER** | 2010-6 | | | 6 | 1.5 | 45 | 4 | 245 |
| **HLS** | 2010-070 | | | 7 | 1.5 | 45 | 4 | 232 |
| **HLS** | 2010-080 | | | 8 | 1.5 | 45 | 4 | 232 |
| **C-CER** | 2010-8 | | | 8 | 1.5 | 45 | 4 | 245 |
| **HLS** | 2010-090 | | | 9 | 1.5 | 45 | 4 | 232 |
| **HLS** | 2010-100 | | | 10 | 1.5 | 45 | 4 | 232 |
| **C-CER** | 2010-10 | | | 10 | 1.5 | 45 | 4 | 245 |
| **HLS** | 2010-120 | | | 12 | 1.5 | 45 | 4 | 232 |
| **C-CER** | 2010-12 | | | 12 | 1.5 | 45 | 4 | 245 |
| **HLS** | 2010-140 | | | 14 | 1.5 | 45 | 4 | 232 |
| **HLS** | 2010-160 | | | 16 | 1.5 | 50 | 4 | 232 |
| **C-CER** | 2010-16 | | | 16 | 1.5 | 50 | 4 | 245 |
| **HLS** | 2010-180 | | | 18 | 1.5 | 55 | 4 | 232 |
| **HLS** | 2010-200 | | | 20 | 1.5 | 55 | 4 | 232 |
| **C-CER** | 2010-20 | | | 20 | 1.5 | 55 | 4 | 245 |
| **HLS** | 2010-250 | | | 25 | 1.5 | 70 | 4 | 232 |
| **HLS** | 2010-300 | | | 30 | 1.5 | 70 | 4 | 232 |
| **CZS** | 4010-0150 | 4 Flutes | | — | 1.5 | 50 | 4 | 182 |
| **CXS** | 4010-030 | | | 3 | 1.5 | 50 | 4 | 282 |
| **CXS** | 4010-050 | | | 5 | 1.5 | 70 | 4 | 282 |
| **CXS** | 4010-060 | | | 6 | 1.5 | 70 | 4 | 282 |
| **CSS** | 2010-0200 | 2 Flutes | | — | 2 | 45 | 4 | 141 |
| **C-CES** | 2010-0200 | | | — | 2 | 45 | 4 | 156 |
| **DCLS** | 2010-040 | | | 4 | 2 | 45 | 4 | 255 |
| **DCLS** | 2010-060 | | | 6 | 2 | 45 | 4 | 255 |
| **CPR** | 2010-6 | | | 6 | 2 | 45 | 4 | 258 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| CPRL | 2010-6 | 2 Flutes | 1 | 6 | 2 | 80 | 4 | 262 |
| DCLS | 2010-080 | | | 8 | 2 | 45 | 4 | 255 |
| CPR | 2010-8 | | | 8 | 2 | 45 | 4 | 258 |
| CPRL | 2010-8 | | | 8 | 2 | 80 | 4 | 262 |
| DCLS | 2010-100 | | | 10 | 2 | 45 | 4 | 255 |
| CPR | 2010-10 | | | 10 | 2 | 45 | 4 | 258 |
| CPRL | 2010-10 | | | 10 | 2 | 80 | 4 | 262 |
| CPR | 2010-12 | | | 12 | 2 | 45 | 4 | 258 |
| CPRL | 2010-12 | | | 12 | 2 | 80 | 4 | 262 |
| CPRL | 2010-14 | | | 14 | 2 | 80 | 4 | 262 |
| DCLS | 2010-160 | | | 16 | 2 | 50 | 4 | 255 |
| CPR | 2010-16 | | | 16 | 2 | 50 | 4 | 258 |
| CPRL | 2010-16 | | | 16 | 2 | 80 | 4 | 262 |
| CPRL | 2010-18 | | | 18 | 2 | 80 | 4 | 262 |
| DCLS | 2010-210 | | | 21 | 2 | 55 | 4 | 255 |
| CPR | 2010-21 | | | 21 | 2 | 55 | 4 | 258 |
| CPRL | 2010-21 | | | 21 | 2 | 80 | 4 | 262 |
| AZS | 3010-030 | 3 Flutes | | 3 | 2 | 60 | 4 | 267 |
| DLC-AZS | 3010-030 | | | 3 | 2 | 60 | 4 | 270 |
| AZS | 3010-050 | | | 5 | 2 | 60 | 4 | 267 |
| DLC-AZS | 3010-050 | | | 5 | 2 | 60 | 4 | 270 |
| CSS | 2010-0250 | 2 Flutes | | — | 2.5 | 45 | 4 | 141 |
| C-CES | 2010 | | | — | 2.5 | 45 | 4 | 156 |
| HMS | 3010-0250 | 3 Flutes | | — | 2.5 | 45 | 4 | 226 |
| C-CES | 4010 | 4 Flutes | | — | 2.5 | 45 | 4 | 208 |
| C-CES | 4010S | | | — | 2.5 | 45 | 4 | 214 |
| CZS | 4010-0250 | | | — | 2.5 | 50 | 4 | 182 |
| CXES | 4010-0250 | | | — | 2.5 | 50 | 4 | 196 |
| CSS | 2010-0300 | 2 Flutes | | — | 3 | 45 | 4 | 141 |
| C-CES | 2010-0300 | | | — | 3 | 45 | 4 | 156 |
| C-CES | 2010-0300S | | | — | 3 | 45 | 4 | 168 |
| CRN-ES | 2010-0300 | | | — | 3 | 45 | 4 | 174 |
| DCES | 2010-0300 | | | — | 3 | 45 | 4 | 176 |
| CPS | 2010 | | | — | 3 | 50 | 4 | 178 |
| C-CES | 4010-0300 | 4 Flutes | | — | 3 | 45 | 4 | 208 |
| CXES | 4010-0300 | | | — | 3 | 60 | 4 | 196 |
| HMS | 3010-0350 | 3 Flutes | | — | 3.5 | 45 | 4 | 226 |
| C-CES | 2010-0400 | 2 Flutes | | — | 4 | 45 | 4 | 156 |
| CRN-ES | 2010-0400 | | | — | 4 | 50 | 4 | 174 |
| C-CES | 4010-0400 | 4 Flutes | | — | 4 | 45 | 4 | 208 |
| CXES | 4010-0400 | 4 Flutes | 1 | — | 4 | 60 | 4 | 196 |
| CXES | 4010-0500 | | | — | 5 | 60 | 4 | 196 |
| C-CES | 2011 | 2 Flutes | 1.1 | — | 2.5 | 45 | 4 | 156 |
| CZS | 4011-0250 | 4 Flutes | | — | 2.5 | 50 | 4 | 182 |
| HLS | 4012-060 | 4 Flutes | 1.2 | 6 | 1.2 | 50 | 4 | 276 |
| HLS | 4012-080 | | | 8 | 1.2 | 50 | 4 | 276 |
| HLS | 4012-100 | | | 10 | 1.2 | 50 | 4 | 276 |
| HLS | 4012-120 | | | 12 | 1.2 | 50 | 4 | 276 |
| HLS | 4012-160 | | | 16 | 1.2 | 60 | 4 | 276 |
| C-CES | 2012-0180 | 2 Flutes | | — | 1.8 | 45 | 4 | 156 |
| C-CES | 2012-0180S | | | — | 1.8 | 45 | 4 | 168 |
| HLS | 2012-040 | | | 4 | 1.8 | 45 | 4 | 233 |
| HLS | 2012-060 | | | 6 | 1.8 | 45 | 4 | 233 |
| C-CER | 2012-6 | | | 6 | 1.8 | 45 | 4 | 245 |
| HLS | 2012-080 | | | 8 | 1.8 | 45 | 4 | 233 |
| C-CER | 2012-8 | | | 8 | 1.8 | 45 | 4 | 245 |
| HLS | 2012-100 | | | 10 | 1.8 | 45 | 4 | 233 |
| C-CER | 2012-10 | | | 10 | 1.8 | 45 | 4 | 245 |
| HLS | 2012-120 | | | 12 | 1.8 | 45 | 4 | 233 |
| C-CER | 2012-12 | | | 12 | 1.8 | 45 | 4 | 245 |
| HLS | 2012-160 | | | 16 | 1.8 | 50 | 4 | 233 |
| C-CER | 2012-16 | | | 16 | 1.8 | 50 | 4 | 245 |
| HLS | 2012-200 | | | 20 | 1.8 | 60 | 4 | 233 |
| C-CES | 2012-0240 | | | — | 2.4 | 45 | 4 | 156 |
| CPR | 2012-6 | | | 6 | 2.4 | 45 | 4 | 258 |
| CPR | 2012-8 | | | 8 | 2.4 | 45 | 4 | 258 |
| CPR | 2012-10 | | | 10 | 2.4 | 45 | 4 | 258 |
| CPR | 2012-12 | | | 12 | 2.4 | 50 | 4 | 258 |
| CZS | 4012-0250 | 4 Flutes | | — | 2.5 | 50 | 4 | 182 |
| C-CES | 2012-0300 | 2 Flutes | | — | 3 | 45 | 4 | 156 |
| C-CES | 2012-0360 | | | — | 3.6 | 45 | 4 | 156 |
| C-CES | 2012-0360S | | | — | 3.6 | 45 | 4 | 168 |
| CPS | 2012 | | | — | 3.6 | 50 | 4 | 178 |
| C-CES | 2012 | | | — | 4 | 45 | 4 | 156 |
| C-CES | 2012-0480 | | | — | 4.8 | 45 | 4 | 156 |
| CZS | 4013-0300 | 4 Flutes | 1.3 | — | 3 | 50 | 4 | 182 |
| C-CES | 2013 | 2 Flutes | | — | 4 | 45 | 4 | 156 |
| HLS | 4014-060 | 4 Flutes | 1.4 | 6 | 1.4 | 50 | 4 | 277 |
| HLS | 4014-080 | | | 8 | 1.4 | 50 | 4 | 277 |
| HLS | 4014-100 | | | 10 | 1.4 | 50 | 4 | 277 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 4014-120 | 4 Flutes | 1.4 | 12 | 1.4 | 50 | 4 | 277 |
| **HLS** | 4014-140 | | | 14 | 1.4 | 60 | 4 | 277 |
| **HLS** | 4014-160 | | | 16 | 1.4 | 60 | 4 | 277 |
| **HLS** | 4014-220 | | | 22 | 1.4 | 60 | 4 | 277 |
| **HLS** | 2014-060 | 2 Flutes | | 6 | 2.1 | 45 | 4 | 233 |
| **C-CER** | 2014-6 | | | 6 | 2.1 | 45 | 4 | 245 |
| **HLS** | 2014-080 | | | 8 | 2.1 | 45 | 4 | 233 |
| **C-CER** | 2014-8 | | | 8 | 2.1 | 45 | 4 | 245 |
| **HLS** | 2014-100 | | | 10 | 2.1 | 45 | 4 | 233 |
| **C-CER** | 2014-10 | | | 10 | 2.1 | 45 | 4 | 245 |
| **HLS** | 2014-120 | | | 12 | 2.1 | 45 | 4 | 233 |
| **C-CER** | 2014-12 | | | 12 | 2.1 | 45 | 4 | 245 |
| **HLS** | 2014-140 | | | 14 | 2.1 | 45 | 4 | 233 |
| **C-CER** | 2014-14 | | | 14 | 2.1 | 45 | 4 | 245 |
| **HLS** | 2014-160 | | | 16 | 2.1 | 50 | 4 | 233 |
| **C-CER** | 2014-16 | | | 16 | 2.1 | 50 | 4 | 245 |
| **HLS** | 2014-220 | | | 22 | 2.1 | 55 | 4 | 233 |
| **C-CER** | 2014-22 | | | 22 | 2.1 | 55 | 4 | 245 |
| **CPR** | 2014-6 | | | 6 | 2.8 | 45 | 4 | 259 |
| **CPR** | 2014-10 | | | 10 | 2.8 | 45 | 4 | 259 |
| **CPR** | 2014-16 | | | 16 | 2.8 | 50 | 4 | 259 |
| **CZS** | 4014-0300 | 4 Flutes | | — | 3 | 50 | 4 | 182 |
| **C-CES** | 2014 | 2 Flutes | | — | 4 | 45 | 4 | 156 |
| **CSS** | 2015-0150 | 2 Flutes | 1.5 | — | 1.5 | 45 | 4 | 141 |
| **HLS** | 4015-060 | 4 Flutes | | 6 | 1.5 | 50 | 4 | 277 |
| **HLS** | 4015-080 | | | 8 | 1.5 | 50 | 4 | 277 |
| **HLS** | 4015-100 | | | 10 | 1.5 | 50 | 4 | 277 |
| **HLS** | 4015-120 | | | 12 | 1.5 | 50 | 4 | 277 |
| **HLS** | 4015-140 | | | 14 | 1.5 | 60 | 4 | 277 |
| **HLS** | 4015-160 | | | 16 | 1.5 | 60 | 4 | 277 |
| **HLS** | 4015-180 | | | 18 | 1.5 | 60 | 4 | 277 |
| **HLS** | 4015-200 | | | 20 | 1.5 | 60 | 4 | 277 |
| **CSS** | 2015-0225 | 2 Flutes | | — | 2.25 | 45 | 4 | 141 |
| **C-CES** | 2015-0225 | | | — | 2.25 | 45 | 4 | 156 |
| **C-CES** | 2015-0225S | | | — | 2.25 | 45 | 4 | 169 |
| **CAS** | 2015-0225 | | | — | 2.25 | 45 | 4 | 180 |
| **CZS** | 4015-0225 | 4 Flutes | | — | 2.25 | 50 | 4 | 182 |
| **CXS** | 4015-045 | | | 4.5 | 2.25 | 50 | 4 | 282 |
| **CXS** | 4015-070 | | | 7 | 2.25 | 70 | 4 | 282 |
| **CXS** | 4015-085 | | | 8.5 | 2.25 | 70 | 4 | 282 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 2015-040 | 2 Flutes | 1.5 | 4 | 2.3 | 45 | 4 | 233 |
| **HLS** | 2015-060 | | | 6 | 2.3 | 45 | 4 | 233 |
| **C-CER** | 2015-6 | | | 6 | 2.3 | 45 | 4 | 246 |
| **HLS** | 2015-080 | | | 8 | 2.3 | 45 | 4 | 233 |
| **C-CER** | 2015-8 | | | 8 | 2.3 | 45 | 4 | 246 |
| **HLS** | 2015-100 | | | 10 | 2.3 | 45 | 4 | 233 |
| **C-CER** | 2015-10 | | | 10 | 2.3 | 45 | 4 | 246 |
| **HLS** | 2015-120 | | | 12 | 2.3 | 45 | 4 | 233 |
| **C-CER** | 2015-12 | | | 12 | 2.3 | 45 | 4 | 246 |
| **HLS** | 2015-140 | | | 14 | 2.3 | 50 | 4 | 233 |
| **C-CER** | 2015-14 | | | 14 | 2.3 | 50 | 4 | 246 |
| **HLS** | 2015-160 | | | 16 | 2.3 | 50 | 4 | 233 |
| **C-CER** | 2015-16 | | | 16 | 2.3 | 50 | 4 | 246 |
| **HLS** | 2015-180 | | | 18 | 2.3 | 55 | 4 | 233 |
| **C-CER** | 2015-18 | | | 18 | 2.3 | 55 | 4 | 246 |
| **HLS** | 2015-200 | | | 20 | 2.3 | 55 | 4 | 233 |
| **C-CER** | 2015-20 | | | 20 | 2.3 | 55 | 4 | 246 |
| **HLS** | 2015-250 | | | 25 | 2.3 | 70 | 4 | 233 |
| **HLS** | 2015-300 | | | 30 | 2.3 | 70 | 4 | 233 |
| **HLS** | 2015-350 | | | 35 | 2.3 | 70 | 4 | 233 |
| **HLS** | 2015-400 | | | 40 | 2.3 | 80 | 4 | 233 |
| **HLS** | 2015-450 | | | 45 | 2.3 | 80 | 4 | 233 |
| **CSS** | 2015-0300 | | | — | 3 | 45 | 4 | 141 |
| **C-CES** | 2015-0300 | | | — | 3 | 45 | 4 | 156 |
| **DCLS** | 2015-060 | | | 6 | 3 | 45 | 4 | 255 |
| **CPR** | 2015-6 | | | 6 | 3 | 45 | 4 | 259 |
| **CPRL** | 2015-6 | | | 6 | 3 | 80 | 4 | 262 |
| **CPRL** | 2015-8 | | | 8 | 3 | 80 | 4 | 262 |
| **DCLS** | 2015-100 | | | 10 | 3 | 45 | 4 | 255 |
| **CPR** | 2015-10 | | | 10 | 3 | 45 | 4 | 259 |
| **CPRL** | 2015-10 | | | 10 | 3 | 80 | 4 | 262 |
| **CPR** | 2015-14 | | | 14 | 3 | 50 | 4 | 259 |
| **CPRL** | 2015-14 | | | 14 | 3 | 80 | 4 | 262 |
| **DCLS** | 2015-160 | | | 16 | 3 | 50 | 4 | 255 |
| **CPR** | 2015-16 | | | 16 | 3 | 50 | 4 | 259 |
| **CPRL** | 2015-16 | | | 16 | 3 | 80 | 4 | 262 |
| **DCLS** | 2015-210 | | | 21 | 3 | 55 | 4 | 255 |
| **CPR** | 2015-21 | | | 21 | 3 | 55 | 4 | 259 |
| **CPRL** | 2015-21 | | | 21 | 3 | 80 | 4 | 262 |
| **AZS** | 3015-045 | 3 Flutes | | 4.5 | 3 | 60 | 4 | 267 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **DLC-AZS** | 3015-045 | 3 Flutes | 1.5 | 4.5 | 3 | 60 | 4 | 270 |
| **CSS** | 2015-0375 | 2 Flutes | 1.5 | — | 3.75 | 45 | 4 | 141 |
| **C-CES** | 2015-0375 | 2 Flutes | 1.5 | — | 3.75 | 45 | 4 | 156 |
| **C-CES** | 4015 | 4 Flutes | 1.5 | — | 3.75 | 45 | 4 | 208 |
| **C-CES** | 4015S | 4 Flutes | 1.5 | — | 3.75 | 45 | 4 | 214 |
| **CXES** | 4015-0375 | 4 Flutes | 1.5 | — | 3.75 | 50 | 4 | 196 |
| **C-CES** | 2015 | 2 Flutes | 1.5 | — | 4 | 45 | 4 | 156 |
| **HMS** | 3015-0400 | 3 Flutes | 1.5 | — | 4 | 45 | 4 | 226 |
| **CZS** | 4015-0400 | 4 Flutes | 1.5 | — | 4 | 50 | 4 | 182 |
| **CSS** | 2015-0450 | 2 Flutes | 1.5 | — | 4.5 | 45 | 4 | 141 |
| **C-CES** | 2015-0450 | 2 Flutes | 1.5 | — | 4.5 | 45 | 4 | 156 |
| **C-CES** | 2015-0450S | 2 Flutes | 1.5 | — | 4.5 | 45 | 4 | 169 |
| **CRN-ES** | 2015-0450 | 2 Flutes | 1.5 | — | 4.5 | 45 | 4 | 174 |
| **DCES** | 2015-0450 | 2 Flutes | 1.5 | — | 4.5 | 45 | 4 | 176 |
| **CPS** | 2015 | 2 Flutes | 1.5 | — | 4.5 | 50 | 4 | 178 |
| **C-CES** | 4015-0450 | 4 Flutes | 1.5 | — | 4.5 | 45 | 4 | 208 |
| **C-CES** | 2015-0600 | 2 Flutes | 1.5 | — | 6 | 45 | 4 | 156 |
| **CRN-ES** | 2015-0600 | 2 Flutes | 1.5 | — | 6 | 50 | 4 | 174 |
| **HMS** | 3015-0600 | 3 Flutes | 1.5 | — | 6 | 45 | 4 | 226 |
| **C-CES** | 4015-0600 | 4 Flutes | 1.5 | — | 6 | 45 | 4 | 208 |
| **CXES** | 4015-0600 | 4 Flutes | 1.5 | — | 6 | 50 | 4 | 196 |
| **HLS** | 4016-060 | 4 Flutes | 1.6 | 6 | 1.6 | 50 | 4 | 277 |
| **HLS** | 4016-080 | 4 Flutes | 1.6 | 8 | 1.6 | 50 | 4 | 277 |
| **HLS** | 4016-100 | 4 Flutes | 1.6 | 10 | 1.6 | 50 | 4 | 277 |
| **HLS** | 4016-120 | 4 Flutes | 1.6 | 12 | 1.6 | 50 | 4 | 277 |
| **HLS** | 4016-140 | 4 Flutes | 1.6 | 14 | 1.6 | 60 | 4 | 277 |
| **HLS** | 4016-160 | 4 Flutes | 1.6 | 16 | 1.6 | 60 | 4 | 277 |
| **HLS** | 4016-180 | 4 Flutes | 1.6 | 18 | 1.6 | 60 | 4 | 277 |
| **HLS** | 4016-200 | 4 Flutes | 1.6 | 20 | 1.6 | 60 | 4 | 277 |
| **HLS** | 4016-260 | 4 Flutes | 1.6 | 26 | 1.6 | 60 | 4 | 277 |
| **HLS** | 2016-060 | 2 Flutes | 1.6 | 6 | 2.4 | 45 | 4 | 233 |
| **C-CER** | 2016-6 | 2 Flutes | 1.6 | 6 | 2.4 | 45 | 4 | 246 |
| **HLS** | 2016-080 | 2 Flutes | 1.6 | 8 | 2.4 | 45 | 4 | 233 |
| **C-CER** | 2016-8 | 2 Flutes | 1.6 | 8 | 2.4 | 45 | 4 | 246 |
| **HLS** | 2016-100 | 2 Flutes | 1.6 | 10 | 2.4 | 45 | 4 | 233 |
| **C-CER** | 2016-10 | 2 Flutes | 1.6 | 10 | 2.4 | 45 | 4 | 246 |
| **HLS** | 2016-120 | 2 Flutes | 1.6 | 12 | 2.4 | 45 | 4 | 233 |
| **C-CER** | 2016-12 | 2 Flutes | 1.6 | 12 | 2.4 | 45 | 4 | 246 |
| **HLS** | 2016-140 | 2 Flutes | 1.6 | 14 | 2.4 | 50 | 4 | 233 |
| **C-CER** | 2016-14 | 2 Flutes | 1.6 | 14 | 2.4 | 50 | 4 | 246 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 2016-160 | 2 Flutes | 1.6 | 16 | 2.4 | 50 | 4 | 233 |
| **C-CER** | 2016-16 | 2 Flutes | 1.6 | 16 | 2.4 | 50 | 4 | 246 |
| **HLS** | 2016-180 | 2 Flutes | 1.6 | 18 | 2.4 | 55 | 4 | 233 |
| **C-CER** | 2016-18 | 2 Flutes | 1.6 | 18 | 2.4 | 55 | 4 | 246 |
| **HLS** | 2016-200 | 2 Flutes | 1.6 | 20 | 2.4 | 55 | 4 | 233 |
| **C-CER** | 2016-20 | 2 Flutes | 1.6 | 20 | 2.4 | 55 | 4 | 246 |
| **HLS** | 2016-260 | 2 Flutes | 1.6 | 26 | 2.4 | 60 | 4 | 233 |
| **C-CER** | 2016-26 | 2 Flutes | 1.6 | 26 | 2.4 | 60 | 4 | 246 |
| **CPR** | 2016-6 | 2 Flutes | 1.6 | 6 | 3.2 | 50 | 4 | 259 |
| **CZS** | 4016-0400 | 4 Flutes | 1.6 | — | 4 | 50 | 4 | 182 |
| **C-CES** | 2016 | 2 Flutes | 1.6 | — | 5 | 45 | 4 | 156 |
| **CZS** | 4017-0400 | 4 Flutes | 1.7 | — | 4 | 50 | 4 | 182 |
| **C-CES** | 2017 | 2 Flutes | 1.7 | — | 5 | 45 | 4 | 156 |
| **HLS** | 4018-060 | 4 Flutes | 1.8 | 6 | 1.8 | 50 | 4 | 277 |
| **HLS** | 4018-080 | 4 Flutes | 1.8 | 8 | 1.8 | 50 | 4 | 277 |
| **HLS** | 4018-100 | 4 Flutes | 1.8 | 10 | 1.8 | 50 | 4 | 277 |
| **HLS** | 4018-120 | 4 Flutes | 1.8 | 12 | 1.8 | 50 | 4 | 277 |
| **HLS** | 4018-140 | 4 Flutes | 1.8 | 14 | 1.8 | 60 | 4 | 277 |
| **HLS** | 4018-160 | 4 Flutes | 1.8 | 16 | 1.8 | 60 | 4 | 277 |
| **HLS** | 4018-180 | 4 Flutes | 1.8 | 18 | 1.8 | 60 | 4 | 277 |
| **HLS** | 4018-200 | 4 Flutes | 1.8 | 20 | 1.8 | 60 | 4 | 277 |
| **HLS** | 4018-250 | 4 Flutes | 1.8 | 25 | 1.8 | 70 | 4 | 277 |
| **C-CES** | 2018-0270 | 2 Flutes | 1.8 | — | 2.7 | 45 | 4 | 156 |
| **C-CES** | 2018-0270S | 2 Flutes | 1.8 | — | 2.7 | 45 | 4 | 169 |
| **HLS** | 2018-060 | 2 Flutes | 1.8 | 6 | 2.7 | 45 | 4 | 234 |
| **C-CER** | 2018-6 | 2 Flutes | 1.8 | 6 | 2.7 | 45 | 4 | 246 |
| **HLS** | 2018-080 | 2 Flutes | 1.8 | 8 | 2.7 | 45 | 4 | 234 |
| **C-CER** | 2018-8 | 2 Flutes | 1.8 | 8 | 2.7 | 45 | 4 | 246 |
| **HLS** | 2018-100 | 2 Flutes | 1.8 | 10 | 2.7 | 45 | 4 | 234 |
| **C-CER** | 2018-10 | 2 Flutes | 1.8 | 10 | 2.7 | 45 | 4 | 246 |
| **HLS** | 2018-120 | 2 Flutes | 1.8 | 12 | 2.7 | 45 | 4 | 234 |
| **C-CER** | 2018-12 | 2 Flutes | 1.8 | 12 | 2.7 | 45 | 4 | 246 |
| **HLS** | 2018-140 | 2 Flutes | 1.8 | 14 | 2.7 | 50 | 4 | 234 |
| **C-CER** | 2018-14 | 2 Flutes | 1.8 | 14 | 2.7 | 50 | 4 | 246 |
| **HLS** | 2018-160 | 2 Flutes | 1.8 | 16 | 2.7 | 50 | 4 | 234 |
| **C-CER** | 2018-16 | 2 Flutes | 1.8 | 16 | 2.7 | 50 | 4 | 246 |
| **HLS** | 2018-180 | 2 Flutes | 1.8 | 18 | 2.7 | 55 | 4 | 234 |
| **C-CER** | 2018-18 | 2 Flutes | 1.8 | 18 | 2.7 | 55 | 4 | 246 |
| **HLS** | 2018-200 | 2 Flutes | 1.8 | 20 | 2.7 | 55 | 4 | 234 |
| **C-CER** | 2018-20 | 2 Flutes | 1.8 | 20 | 2.7 | 55 | 4 | 246 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 2018-250 | 2 Flutes | 1.8 | 25 | 2.7 | 60 | 4 | 234 |
| **C-CER** | 2018-25 | | | 25 | 2.7 | 60 | 4 | 246 |
| **C-CES** | 2018-0360 | | | — | 3.6 | 45 | 4 | 156 |
| **CZS** | 4018-0400 | 4 Flutes | | — | 4 | 50 | 4 | 182 |
| **C-CES** | 2018-0450 | 2 Flutes | | — | 4.5 | 45 | 4 | 156 |
| **C-CES** | 2018 | | | — | 5 | 45 | 4 | 156 |
| **C-CES** | 2018-0540 | | | — | 5.4 | 45 | 4 | 156 |
| **C-CES** | 2018-0540S | | | — | 5.4 | 45 | 4 | 169 |
| **C-CES** | 2018-0720 | | | — | 7.2 | 45 | 4 | 156 |
| **CZS** | 4019-0400 | 4 Flutes | 1.9 | — | 4 | 50 | 4 | 182 |
| **C-CES** | 2019 | 2 Flutes | | — | 5 | 45 | 4 | 156 |
| **CSS** | 2020-0200 | 2 Flutes | 2 | — | 2 | 45 | 4 | 141 |
| **HLS** | 4020-060 | 4 Flutes | | 6 | 2 | 50 | 4 | 277 |
| **HLS** | 4020-080 | | | 8 | 2 | 50 | 4 | 277 |
| **HLS** | 4020-100 | | | 10 | 2 | 50 | 4 | 277 |
| **HLS** | 4020-120 | | | 12 | 2 | 50 | 4 | 277 |
| **HLS** | 4020-140 | | | 14 | 2 | 60 | 4 | 277 |
| **HLS** | 4020-160 | | | 16 | 2 | 60 | 4 | 277 |
| **HLS** | 4020-180 | | | 18 | 2 | 60 | 4 | 277 |
| **HLS** | 4020-200 | | | 20 | 2 | 60 | 4 | 277 |
| **HLS** | 4020-250 | | | 25 | 2 | 70 | 4 | 277 |
| **HLS** | 4020-300 | | | 30 | 2 | 70 | 4 | 277 |
| **CSS** | 2020-0300 | 2 Flutes | | — | 3 | 45 | 4 | 141 |
| **C-CES** | 2020-0300 | | | — | 3 | 45 | 4 | 156 |
| **C-CES** | 2020-0300S | | | — | 3 | 45 | 4 | 169 |
| **CAS** | 2020-0300 | | | — | 3 | 45 | 4 | 180 |
| **HLS** | 2020-060 | | | 6 | 3 | 45 | 4 | 234 |
| **C-CER** | 2020-6 | | | 6 | 3 | 45 | 4 | 246 |
| **HLS** | 2020-080 | | | 8 | 3 | 45 | 4 | 234 |
| **C-CER** | 2020-8 | | | 8 | 3 | 45 | 4 | 246 |
| **HLS** | 2020-100 | | | 10 | 3 | 45 | 4 | 234 |
| **C-CER** | 2020-10 | | | 10 | 3 | 45 | 4 | 246 |
| **HLS** | 2020-120 | | | 12 | 3 | 45 | 4 | 234 |
| **C-CER** | 2020-12 | | | 12 | 3 | 45 | 4 | 246 |
| **HLS** | 2020-140 | | | 14 | 3 | 50 | 4 | 234 |
| **C-CER** | 2020-14 | | | 14 | 3 | 50 | 4 | 246 |
| **HLS** | 2020-160 | | | 16 | 3 | 50 | 4 | 234 |
| **C-CER** | 2020-16 | | | 16 | 3 | 50 | 4 | 246 |
| **HLS** | 2020-180 | | | 18 | 3 | 55 | 4 | 234 |
| **C-CER** | 2020-18 | | | 18 | 3 | 55 | 4 | 246 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 2020-200 | 2 Flutes | 2 | 20 | 3 | 55 | 4 | 234 |
| **C-CER** | 2020-20 | | | 20 | 3 | 55 | 4 | 246 |
| **HLS** | 2020-250 | | | 25 | 3 | 60 | 4 | 234 |
| **C-CER** | 2020-25 | | | 25 | 3 | 60 | 4 | 246 |
| **HLS** | 2020-300 | | | 30 | 3 | 70 | 4 | 234 |
| **C-CER** | 2020-30 | | | 30 | 3 | 70 | 4 | 246 |
| **HLS** | 2020-350 | | | 35 | 3 | 80 | 4 | 234 |
| **HLS** | 2020-400 | | | 40 | 3 | 90 | 4 | 234 |
| **HLS** | 2020-500 | | | 50 | 3 | 100 | 4 | 234 |
| **HLS** | 2020-600 | | | 60 | 3 | 110 | 4 | 234 |
| **CZS** | 4020-0300 | 4 Flutes | | — | 3 | 50 | 4 | 183 |
| **CXS** | 4020-060 | | | 6 | 3 | 50 | 4 | 282 |
| **CXS** | 4020-090 | | | 9 | 3 | 70 | 4 | 282 |
| **CXS** | 4020-110 | | | 11 | 3 | 70 | 4 | 282 |
| **CSS** | 2020-0400 | 2 Flutes | | — | 4 | 45 | 4 | 141 |
| **C-CES** | 2020-0400 | | | — | 4 | 45 | 4 | 156 |
| **DCLS** | 2020-060 | | | 6 | 4 | 50 | 4 | 255 |
| **CPR** | 2020-8 | | | 8 | 4 | 50 | 4 | 259 |
| **CPRL** | 2020-8 | | | 8 | 4 | 80 | 4 | 263 |
| **DCLS** | 2020-100 | | | 10 | 4 | 50 | 4 | 255 |
| **CPR** | 2020-10 | | | 10 | 4 | 50 | 4 | 259 |
| **CPRL** | 2020-10 | | | 10 | 4 | 80 | 4 | 263 |
| **CPR** | 2020-12 | | | 12 | 4 | 50 | 4 | 259 |
| **CPRL** | 2020-12 | | | 12 | 4 | 80 | 4 | 263 |
| **CPR** | 2020-14 | | | 14 | 4 | 50 | 4 | 259 |
| **CPRL** | 2020-14 | | | 14 | 4 | 80 | 4 | 263 |
| **DCLS** | 2020-160 | | | 16 | 4 | 50 | 4 | 255 |
| **CPR** | 2020-16 | | | 16 | 4 | 50 | 4 | 259 |
| **CPRL** | 2020-16 | | | 16 | 4 | 80 | 4 | 263 |
| **CPR** | 2020-18 | | | 18 | 4 | 55 | 4 | 259 |
| **CPRL** | 2020-18 | | | 18 | 4 | 80 | 4 | 263 |
| **DCLS** | 2020-210 | | | 21 | 4 | 55 | 4 | 255 |
| **CPR** | 2020-21 | | | 21 | 4 | 55 | 4 | 259 |
| **CPRL** | 2020-21 | | | 21 | 4 | 80 | 4 | 263 |
| **DCLS** | 2020-260 | | | 26 | 4 | 55 | 4 | 255 |
| **CPR** | 2020-26 | | | 26 | 4 | 55 | 4 | 259 |
| **CPRL** | 2020-26 | | | 26 | 4 | 80 | 4 | 263 |
| **CPR** | 2020-32 | | | 32 | 4 | 70 | 4 | 259 |
| **CPRL** | 2020-32 | | | 32 | 4 | 80 | 4 | 263 |
| **CPRL** | 2020-40 | | | 40 | 4 | 100 | 4 | 263 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HMS** | 3020-0400 | 3 Flutes | 2 | — | 4 | 45 | 4 | 226 |
| **AZS** | 3020-060 | | | 6 | 4 | 60 | 4 | 267 |
| **DLC-AZS** | 3020-060 | | | 6 | 4 | 60 | 4 | 270 |
| **AZS** | 3020-100 | | | 10 | 4 | 60 | 4 | 267 |
| **DLC-AZS** | 3020-100 | | | 10 | 4 | 60 | 4 | 270 |
| **CSS** | 2020-0500 | 2 Flutes | | — | 5 | 45 | 4 | 141 |
| **C-CES** | 2020-0500 | | | — | 5 | 45 | 4 | 156 |
| **C-CES** | 4020 | 4 Flutes | | — | 5 | 45 | 4 | 208 |
| **CXES** | 4020-0500 | | | — | 5 | 50 | 4 | 196 |
| **CSS** | 2020-0600 | 2 Flutes | | — | 6 | 45 | 4 | 141 |
| **C-CES** | 2020 | | | — | 6 | 45 | 4 | 156 |
| **C-CES** | 2020-0600S | | | — | 6 | 45 | 4 | 169 |
| **CRN-ES** | 2020-0600 | | | — | 6 | 45 | 4 | 174 |
| **DCES** | 2020-0600 | | | — | 6 | 45 | 4 | 176 |
| **CPS** | 2020 | | | — | 6 | 55 | 4 | 178 |
| **C-CES** | 4020-0600 | 4 Flutes | | — | 6 | 45 | 4 | 208 |
| **C-CES** | 4020S | | | — | 6 | 45 | 4 | 214 |
| **CZS** | 4020-0600 | | | — | 6 | 50 | 4 | 183 |
| **CXES** | 4020-0600 | | | — | 6 | 60 | 4 | 196 |
| **HMS** | 3020-0700 | 3 Flutes | | — | 7 | 45 | 4 | 226 |
| **C-CES** | 2020-0800 | 2 Flutes | | — | 8 | 45 | 4 | 156 |
| **CRN-ES** | 2020-0800 | | | — | 8 | 50 | 4 | 174 |
| **C-CES** | 4020-0800 | 4 Flutes | | — | 8 | 45 | 4 | 208 |
| **CXES** | 4020-0800 | | | — | 8 | 60 | 4 | 196 |
| **CXES** | 4020-1000 | | | — | 10 | 60 | 4 | 196 |
| **CGE** | 4020 | | | — | 15 | 60 | 3 | 224 |
| **C-CES** | 2021 | 2 Flutes | 2.1 | — | 6 | 45 | 4 | 156 |
| **CZS** | 4021-0600 | 4 Flutes | | — | 6 | 50 | 4 | 183 |
| **C-CES** | 2022 | 2 Flutes | 2.2 | — | 6 | 45 | 4 | 156 |
| **CZS** | 4022-0600 | 4 Flutes | | — | 6 | 50 | 4 | 183 |
| **C-CES** | 2023 | 2 Flutes | 2.3 | — | 6 | 45 | 4 | 156 |
| **CZS** | 4023-0600 | 4 Flutes | | — | 6 | 50 | 4 | 183 |
| **CZS** | 4024-0600 | 4 Flutes | 2.4 | — | 6 | 50 | 4 | 183 |
| **C-CES** | 2024 | 2 Flutes | | — | 8 | 45 | 4 | 156 |
| **CSS** | 2025-0250 | 2 Flutes | 2.5 | — | 2.5 | 50 | 4 | 142 |
| **HLS** | 4025-080 | 4 Flutes | | 8 | 2.5 | 50 | 4 | 278 |
| **HLS** | 4025-120 | | | 12 | 2.5 | 50 | 4 | 278 |
| **HLS** | 4025-160 | | | 16 | 2.5 | 60 | 4 | 278 |
| **HLS** | 4025-200 | | | 20 | 2.5 | 60 | 4 | 278 |
| **HLS** | 4025-250 | | | 25 | 2.5 | 70 | 4 | 278 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HLS** | 4025-300 | 4 Flutes | 2.5 | 30 | 2.5 | 70 | 4 | 278 |
| **HLS** | 2025-080 | 2 Flutes | | 8 | 3.7 | 45 | 4 | 234 |
| **C-CER** | 2025-8 | | | 8 | 3.7 | 45 | 4 | 246 |
| **HLS** | 2025-100 | | | 10 | 3.7 | 45 | 4 | 234 |
| **C-CER** | 2025-10 | | | 10 | 3.7 | 45 | 4 | 246 |
| **HLS** | 2025-120 | | | 12 | 3.7 | 45 | 4 | 234 |
| **C-CER** | 2025-12 | | | 12 | 3.7 | 45 | 4 | 246 |
| **HLS** | 2025-140 | | | 14 | 3.7 | 50 | 4 | 234 |
| **C-CER** | 2025-14 | | | 14 | 3.7 | 50 | 4 | 246 |
| **HLS** | 2025-160 | | | 16 | 3.7 | 50 | 4 | 234 |
| **C-CER** | 2025-16 | | | 16 | 3.7 | 50 | 4 | 246 |
| **HLS** | 2025-180 | | | 18 | 3.7 | 55 | 4 | 234 |
| **C-CER** | 2025-18 | | | 18 | 3.7 | 55 | 4 | 246 |
| **HLS** | 2025-200 | | | 20 | 3.7 | 55 | 4 | 234 |
| **C-CER** | 2025-20 | | | 20 | 3.7 | 55 | 4 | 246 |
| **HLS** | 2025-250 | | | 25 | 3.7 | 60 | 4 | 234 |
| **C-CER** | 2025-25 | | | 25 | 3.7 | 60 | 4 | 246 |
| **HLS** | 2025-300 | | | 30 | 3.7 | 70 | 4 | 234 |
| **C-CER** | 2025-30 | | | 30 | 3.7 | 70 | 4 | 246 |
| **HLS** | 2025-400 | | | 40 | 3.7 | 90 | 4 | 234 |
| **HLS** | 2025-500 | | | 50 | 3.7 | 100 | 4 | 234 |
| **C-CES** | 2025-0375 | | | — | 3.75 | 45 | 4 | 157 |
| **C-CES** | 2025-0375S | | | — | 3.75 | 45 | 4 | 169 |
| **CSS** | 2025-0375 | | | — | 3.75 | 50 | 4 | 142 |
| **CAS** | 2025-0375 | | | — | 3.75 | 50 | 6 | 180 |
| **CZS** | 4025-0375 | 4 Flutes | | — | 3.75 | 50 | 4 | 183 |
| **CXS** | 4025-075 | | | 7.5 | 3.75 | 50 | 4 | 282 |
| **CXS** | 4025-110 | | | 11 | 3.75 | 70 | 4 | 282 |
| **CXS** | 4025-135 | | | 13.5 | 3.75 | 70 | 4 | 282 |
| **C-CES** | 2025-0500 | 2 Flutes | | — | 5 | 45 | 4 | 157 |
| **CSS** | 2025-0500 | | | — | 5 | 50 | 4 | 142 |
| **CPR** | 2025-12 | | | 12 | 5 | 55 | 4 | 259 |
| **CPR** | 2025-21 | | | 21 | 5 | 55 | 4 | 259 |
| **AZS** | 3025-075 | 3 Flutes | | 7.5 | 5 | 60 | 4 | 267 |
| **DLC-AZS** | 3025-075 | | | 7.5 | 5 | 60 | 4 | 270 |
| **C-CES** | 2025-0625 | 2 Flutes | | — | 6.25 | 45 | 4 | 157 |
| **CSS** | 2025-0625 | | | — | 6.25 | 50 | 4 | 142 |
| **C-CES** | 4025 | 4 Flutes | | — | 6.25 | 45 | 4 | 208 |
| **C-CES** | 4025S | | | — | 6.25 | 45 | 4 | 214 |
| **CXES** | 4025-0625 | | | — | 6.25 | 50 | 4 | 196 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CES** | 2025-0750 | 2 Flutes | 2.5 | — | 7.5 | 45 | 4 | 157 |
| **CRN-ES** | 2025-0750 | | | — | 7.5 | 45 | 4 | 174 |
| **CSS** | 2025-0750 | | | — | 7.5 | 50 | 4 | 142 |
| **CPS** | 2025 | | | — | 7.5 | 55 | 4 | 178 |
| **C-CES** | 4025-0750 | 4 Flutes | | — | 7.5 | 50 | 4 | 208 |
| **C-CES** | 2025 | 2 Flutes | | — | 8 | 45 | 4 | 157 |
| **CZS** | 4025-0800 | 4 Flutes | | — | 8 | 50 | 4 | 183 |
| **C-CES** | 2025-1000 | 2 Flutes | | — | 10 | 50 | 4 | 157 |
| **CXES** | 4025-1000 | 4 Flutes | | — | 10 | 50 | 4 | 196 |
| **C-CES** | 4025-1000 | | | — | 10 | 50 | 4 | 208 |
| **C-CES** | 2026 | 2 Flutes | 2.6 | — | 8 | 45 | 6 | 157 |
| **CZS** | 4026-0800 | 4 Flutes | | — | 8 | 50 | 4 | 183 |
| **C-CES** | 2027 | 2 Flutes | 2.7 | — | 8 | 45 | 6 | 157 |
| **CZS** | 4027-0800 | 4 Flutes | | — | 8 | 50 | 4 | 183 |
| **C-CES** | 2028 | 2 Flutes | 2.8 | — | 8 | 45 | 6 | 157 |
| **CZS** | 4028-0800 | 4 Flutes | | — | 8 | 50 | 4 | 183 |
| **C-CES** | 2029 | 2 Flutes | 2.9 | — | 8 | 45 | 6 | 157 |
| **CZS** | 4029-0800 | 4 Flutes | | — | 8 | 50 | 4 | 183 |
| **CSS** | 2030-0300 | 2 Flutes | 3 | — | 3 | 50 | 6 | 142 |
| **HLS** | 4030-080 | 4 Flutes | | 8 | 3 | 50 | 6 | 278 |
| **HLS** | 4030-120 | | | 12 | 3 | 50 | 6 | 278 |
| **HLS** | 4030-160 | | | 16 | 3 | 60 | 6 | 278 |
| **HLS** | 4030-200 | | | 20 | 3 | 60 | 6 | 278 |
| **HLS** | 4030-250 | | | 25 | 3 | 70 | 6 | 278 |
| **HLS** | 4030-300 | | | 30 | 3 | 70 | 6 | 278 |
| **HLS** | 4030-400 | | | 40 | 3 | 80 | 6 | 278 |
| **C-CES** | 2030-0450 | 2 Flutes | | — | 4.5 | 45 | 6 | 157 |
| **C-CES** | 2030-0450S | | | — | 4.5 | 45 | 6 | 169 |
| **CSS** | 2030-0450 | | | — | 4.5 | 50 | 6 | 142 |
| **CAS** | 2030-0450 | | | — | 4.5 | 50 | 6 | 180 |
| **CPS** | 2030SS | | | — | 4.5 | 60 | 3 | 178 |
| **HLS** | 2030-080 | | | 8 | 4.5 | 45 | 6 | 235 |
| **C-CER** | 2030-8 | | | 8 | 4.5 | 45 | 6 | 247 |
| **HLS** | 2030-100 | | | 10 | 4.5 | 45 | 6 | 235 |
| **C-CER** | 2030-10 | | | 10 | 4.5 | 45 | 6 | 247 |
| **HLS** | 2030-120 | | | 12 | 4.5 | 50 | 6 | 235 |
| **C-CER** | 2030-12 | | | 12 | 4.5 | 50 | 6 | 247 |
| **HLS** | 2030-140 | | | 14 | 4.5 | 50 | 6 | 235 |
| **C-CER** | 2030-14 | | | 14 | 4.5 | 50 | 6 | 247 |
| **HLS** | 2030-160 | | | 16 | 4.5 | 60 | 6 | 235 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CER** | 2030-16 | 2 Flutes | 3 | 16 | 4.5 | 60 | 6 | 247 |
| **HLS** | 2030-180 | | | 18 | 4.5 | 60 | 6 | 235 |
| **C-CER** | 2030-18 | | | 18 | 4.5 | 60 | 6 | 247 |
| **HLS** | 2030-200 | | | 20 | 4.5 | 60 | 6 | 235 |
| **C-CER** | 2030-20 | | | 20 | 4.5 | 60 | 6 | 247 |
| **HLS** | 2030-250 | | | 25 | 4.5 | 70 | 6 | 235 |
| **C-CER** | 2030-25 | | | 25 | 4.5 | 70 | 6 | 247 |
| **HLS** | 2030-300 | | | 30 | 4.5 | 80 | 6 | 235 |
| **C-CER** | 2030-30 | | | 30 | 4.5 | 80 | 6 | 247 |
| **HLS** | 2030-350 | | | 35 | 4.5 | 80 | 6 | 235 |
| **C-CER** | 2030-35 | | | 35 | 4.5 | 80 | 6 | 247 |
| **HLS** | 2030-400 | | | 40 | 4.5 | 90 | 6 | 235 |
| **C-CER** | 2030-40 | | | 40 | 4.5 | 90 | 6 | 247 |
| **HLS** | 2030-500 | | | 50 | 4.5 | 100 | 6 | 235 |
| **CZS** | 4030-0450 | 4 Flutes | | — | 4.5 | 60 | 6 | 183 |
| **CXS** | 4030-090 | | | 9 | 4.5 | 50 | 6 | 283 |
| **CXS** | 4030-130 | | | 13 | 4.5 | 70 | 6 | 283 |
| **CXS** | 4030-160 | | | 16 | 4.5 | 70 | 6 | 283 |
| **C-CES** | 2030-0600 | 2 Flutes | | — | 6 | 45 | 6 | 157 |
| **CSS** | 2030-0600 | | | — | 6 | 50 | 6 | 142 |
| **CPS** | 2030SSL | | | — | 6 | 100 | 3 | 178 |
| **CPR** | 2030-8 | | | 8 | 6 | 70 | 6 | 259 |
| **CPR** | 2030-12 | | | 12 | 6 | 70 | 6 | 259 |
| **CPRL** | 2030-12 | | | 12 | 6 | 100 | 6 | 263 |
| **DCLS** | 2030-160 | | | 16 | 6 | 70 | 6 | 255 |
| **CPR** | 2030-16 | | | 16 | 6 | 70 | 6 | 259 |
| **CPRL** | 2030-16 | | | 16 | 6 | 100 | 6 | 263 |
| **DCLS** | 2030-210 | | | 21 | 6 | 70 | 6 | 255 |
| **CPR** | 2030-21 | | | 21 | 6 | 70 | 6 | 259 |
| **CPRL** | 2030-21 | | | 21 | 6 | 100 | 6 | 263 |
| **DCLS** | 2030-260 | | | 26 | 6 | 70 | 6 | 255 |
| **CPR** | 2030-26 | | | 26 | 6 | 70 | 6 | 259 |
| **CPRL** | 2030-26 | | | 26 | 6 | 100 | 6 | 263 |
| **DCLS** | 2030-320 | | | 32 | 6 | 80 | 6 | 255 |
| **CPR** | 2030-32 | | | 32 | 6 | 80 | 6 | 259 |
| **CPRL** | 2030-32 | | | 32 | 6 | 100 | 6 | 263 |
| **CPR** | 2030-42 | | | 42 | 6 | 90 | 6 | 259 |
| **HMS** | 3030-0600 | 3 Flutes | | — | 6 | 50 | 6 | 226 |
| **AZS** | 3030-090 | | | 9 | 6 | 70 | 6 | 267 |
| **DLC-AZS** | 3030-090 | | | 9 | 6 | 70 | 6 | 270 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **AZS** | 3030-150 | 3 Flutes | 3 | 15 | 6 | 70 | 6 | 267 |
| **DLC-AZS** | 3030-150 | | | 15 | 6 | 70 | 6 | 270 |
| **C-CES** | 2030-0750 | 2 Flutes | | — | 7.5 | 45 | 6 | 157 |
| **CSS** | 2030-0750 | | | — | 7.5 | 50 | 6 | 142 |
| **C-CES** | 4030-0750 | 4 Flutes | | — | 7.5 | 45 | 6 | 208 |
| **CXES** | 4030-0750 | | | — | 7.5 | 50 | 6 | 197 |
| **C-CES** | 2030 | 2 Flutes | | — | 8 | 45 | 6 | 157 |
| **C-CES** | 4030 | 4 Flutes | | — | 8 | 45 | 6 | 208 |
| **C-CES** | 4030S | | | — | 8 | 45 | 6 | 214 |
| **CZS** | 4030-0800 | | | — | 8 | 60 | 6 | 183 |
| **C-CES** | 2030-0900 | 2 Flutes | | — | 9 | 45 | 6 | 157 |
| **C-CES** | 2030-0900S | | | — | 9 | 45 | 6 | 169 |
| **DCES** | 2030-0900 | | | — | 9 | 45 | 6 | 176 |
| **CSS** | 2030-0900 | | | — | 9 | 50 | 6 | 142 |
| **CRN-ES** | 2030-0900 | | | — | 9 | 50 | 6 | 174 |
| **CAS** | 2030-0900 | | | — | 9 | 50 | 6 | 180 |
| **CPS** | 2030 | | | — | 9 | 60 | 6 | 178 |
| **C-CES** | 4030-0900 | 4 Flutes | | — | 9 | 50 | 6 | 208 |
| **DCES** | 4030-0900 | | | — | 9 | 50 | 6 | 222 |
| **CRN-ES** | 4030-0900 | | | — | 9 | 50 | 6 | 220 |
| **CXES** | 4030-0900 | | | — | 9 | 60 | 6 | 197 |
| **HMS** | 3030-1000 | 3 Flutes | | — | 10 | 60 | 6 | 226 |
| **C-CES** | 2030-1200 | 2 Flutes | | — | 12 | 50 | 6 | 157 |
| **CRN-ES** | 2030-1200 | | | — | 12 | 55 | 6 | 174 |
| **C-CES** | 4030-1200 | 4 Flutes | | — | 12 | 50 | 6 | 208 |
| **DCES** | 4030-1200 | | | — | 12 | 50 | 6 | 222 |
| **CRN-ES** | 4030-1200 | | | — | 12 | 55 | 6 | 220 |
| **CXES** | 4030-1200 | | | — | 12 | 60 | 6 | 197 |
| **HMS** | 3030-1500 | 3 Flutes | | — | 15 | 60 | 6 | 226 |
| **CXES** | 4030-1500 | 4 Flutes | | — | 15 | 60 | 6 | 197 |
| **CGE** | 4030 | | | — | 30 | 80 | 3 | 224 |
| **CZS** | 4031-0800 | 4 Flutes | 3.1 | — | 8 | 60 | 6 | 183 |
| **C-CES** | 2031 | 2 Flutes | | — | 10 | 45 | 6 | 157 |
| **CZS** | 4032-0800 | 4 Flutes | 3.2 | — | 8 | 60 | 6 | 183 |
| **C-CES** | 2032 | 2 Flutes | | — | 10 | 45 | 6 | 157 |
| **CZS** | 4033-0800 | 4 Flutes | 3.3 | — | 8 | 60 | 6 | 183 |
| **C-CES** | 2033 | 2 Flutes | | — | 10 | 45 | 6 | 157 |
| **CZS** | 4034-0800 | 4 Flutes | 3.4 | — | 8 | 60 | 6 | 183 |
| **C-CES** | 2034 | 2 Flutes | | — | 10 | 45 | 6 | 157 |
| **C-CER** | 2035-12 | 2 Flutes | 3.5 | 12 | 5 | 50 | 6 | 247 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CER** | 2035-15 | 2 Flutes | 3.5 | 15 | 5 | 60 | 6 | 247 |
| **C-CER** | 2035-16 | | | 16 | 5 | 60 | 6 | 247 |
| **C-CER** | 2035-20 | | | 20 | 5 | 60 | 6 | 247 |
| **C-CER** | 2035-25 | | | 25 | 5 | 70 | 6 | 247 |
| **C-CER** | 2035-30 | | | 30 | 5 | 70 | 6 | 247 |
| **C-CER** | 2035-35 | | | 35 | 5 | 80 | 6 | 247 |
| **AZS** | 3035-105 | 3 Flutes | | 10.5 | 7 | 70 | 6 | 267 |
| **DLC-AZS** | 3035-105 | | | 10.5 | 7 | 70 | 6 | 271 |
| **CXES** | 4035-0900 | 4 Flutes | | — | 9 | 60 | 6 | 197 |
| **C-CES** | 2035 | 2 Flutes | | — | 10 | 45 | 6 | 157 |
| **C-CES** | 4035 | 4 Flutes | | — | 10 | 45 | 6 | 208 |
| **CZS** | 4035-1000 | | | — | 10 | 60 | 6 | 183 |
| **C-CES** | 2036 | 2 Flutes | 3.6 | — | 10 | 45 | 6 | 157 |
| **CZS** | 4036-1000 | 4 Flutes | | — | 10 | 60 | 6 | 183 |
| **C-CES** | 2037 | 2 Flutes | 3.7 | — | 10 | 45 | 6 | 157 |
| **CZS** | 4037-1000 | 4 Flutes | | — | 10 | 60 | 6 | 183 |
| **CZS** | 4038-1000 | 4 Flutes | 3.8 | — | 10 | 60 | 6 | 183 |
| **C-CES** | 2038 | 2 Flutes | | — | 11 | 45 | 6 | 157 |
| **CZS** | 4039-1000 | 4 Flutes | 3.9 | — | 10 | 60 | 6 | 183 |
| **C-CES** | 2039 | 2 Flutes | | — | 11 | 45 | 6 | 157 |
| **CSS** | 2040-0400 | 2 Flutes | 4 | — | 4 | 50 | 6 | 142 |
| **HLS** | 4040-120 | 4 Flutes | | 12 | 4 | 50 | 6 | 278 |
| **HLS** | 4040-160 | | | 16 | 4 | 60 | 6 | 278 |
| **HLS** | 4040-200 | | | 20 | 4 | 60 | 6 | 278 |
| **HLS** | 4040-250 | | | 25 | 4 | 70 | 6 | 278 |
| **HLS** | 4040-300 | | | 30 | 4 | 70 | 6 | 278 |
| **HLS** | 4040-350 | | | 35 | 4 | 80 | 6 | 278 |
| **HLS** | 4040-400 | | | 40 | 4 | 90 | 6 | 278 |
| **HLS** | 4040-450 | | | 45 | 4 | 90 | 6 | 278 |
| **HLS** | 4040-500 | | | 50 | 4 | 100 | 6 | 278 |
| **CSS** | 2040-0600 | 2 Flutes | | — | 6 | 50 | 6 | 142 |
| **C-CES** | 2040-0600 | | | — | 6 | 50 | 6 | 157 |
| **C-CES** | 2040-0600S | | | — | 6 | 50 | 6 | 169 |
| **CAS** | 2040-0600 | | | — | 6 | 50 | 6 | 180 |
| **CPS** | 2040SS | | | — | 6 | 60 | 4 | 178 |
| **HLS** | 2040-120 | | | 12 | 6 | 50 | 6 | 235 |
| **C-CER** | 2040-12 | | | 12 | 6 | 50 | 6 | 247 |
| **HLS** | 2040-160 | | | 16 | 6 | 60 | 6 | 235 |
| **C-CER** | 2040-16 | | | 16 | 6 | 60 | 6 | 247 |
| **HLS** | 2040-200 | | | 20 | 6 | 60 | 6 | 235 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CER** | 2040-20 | 2 Flutes | 4 | 20 | 6 | 60 | 6 | 247 |
| **HLS** | 2040-250 | | | 25 | 6 | 70 | 6 | 235 |
| **C-CER** | 2040-25 | | | 25 | 6 | 70 | 6 | 247 |
| **HLS** | 2040-300 | | | 30 | 6 | 70 | 6 | 235 |
| **C-CER** | 2040-30 | | | 30 | 6 | 70 | 6 | 247 |
| **HLS** | 2040-350 | | | 35 | 6 | 80 | 6 | 235 |
| **C-CER** | 2040-35 | | | 35 | 6 | 80 | 6 | 247 |
| **HLS** | 2040-400 | | | 40 | 6 | 90 | 6 | 235 |
| **C-CER** | 2040-40 | | | 40 | 6 | 90 | 6 | 247 |
| **HLS** | 2040-450 | | | 45 | 6 | 90 | 6 | 235 |
| **C-CER** | 2040-45 | | | 45 | 6 | 90 | 6 | 247 |
| **HLS** | 2040-500 | | | 50 | 6 | 100 | 6 | 235 |
| **C-CER** | 2040-50 | | | 50 | 6 | 100 | 6 | 247 |
| **HLS** | 2040-600 | | | 60 | 6 | 110 | 6 | 235 |
| **CZS** | 4040-0600 | 4 Flutes | | — | 6 | 60 | 6 | 183 |
| **CXS** | 4040-120 | | | 12 | 6 | 50 | 6 | 283 |
| **CXS** | 4040-170 | | | 17 | 6 | 70 | 6 | 283 |
| **CXS** | 4040-210 | | | 21 | 6 | 70 | 6 | 283 |
| **CSS** | 2040-0800 | 2 Flutes | | — | 8 | 50 | 6 | 142 |
| **C-CES** | 2040-0800 | | | — | 8 | 50 | 6 | 157 |
| **CPS** | 2040SSL | | | — | 8 | 100 | 4 | 178 |
| **CPR** | 2040-12 | | | 12 | 8 | 70 | 6 | 259 |
| **CPR** | 2040-16 | | | 16 | 8 | 70 | 6 | 259 |
| **CPR** | 2040-18 | | | 18 | 8 | 70 | 6 | 259 |
| **CPRL** | 2040-18 | | | 18 | 8 | 100 | 6 | 263 |
| **DCLS** | 2040-210 | | | 21 | 8 | 70 | 6 | 255 |
| **CPR** | 2040-21 | | | 21 | 8 | 70 | 6 | 259 |
| **CPR** | 2040-24 | | | 24 | 8 | 70 | 6 | 259 |
| **CPRL** | 2040-24 | | | 24 | 8 | 100 | 6 | 263 |
| **DCLS** | 2040-260 | | | 26 | 8 | 70 | 6 | 255 |
| **DCLS** | 2040-320 | | | 32 | 8 | 70 | 6 | 255 |
| **CPR** | 2040-32 | | | 32 | 8 | 70 | 6 | 259 |
| **CPRL** | 2040-32 | | | 32 | 8 | 100 | 6 | 263 |
| **CPR** | 2040-36 | | | 36 | 8 | 70 | 6 | 259 |
| **DCLS** | 2040-420 | | | 42 | 8 | 80 | 6 | 255 |
| **CPR** | 2040-42 | | | 42 | 8 | 80 | 6 | 259 |
| **CPR** | 2040-52 | | | 52 | 8 | 100 | 6 | 259 |
| **AZS** | 3040-120 | 3 Flutes | | 12 | 8 | 70 | 6 | 267 |
| **DLC-AZS** | 3040-120 | | | 12 | 8 | 70 | 6 | 271 |
| **AZS** | 3040-200 | | | 20 | 8 | 70 | 6 | 267 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **DLC-AZS** | 3040-200 | 3 Flutes | 4 | 20 | 8 | 70 | 6 | 271 |
| **HMS** | 4040-0800 | 4 Flutes | | — | 8 | 50 | 6 | 226 |
| **CSS** | 2040-1000 | 2 Flutes | | — | 10 | 50 | 6 | 142 |
| **C-CES** | 2040-1000 | | | — | 10 | 50 | 6 | 157 |
| **CXES** | 4040-1000 | 4 Flutes | | — | 10 | 50 | 6 | 197 |
| **C-CES** | 2040 | 2 Flutes | | — | 11 | 45 | 6 | 157 |
| **C-CES** | 4040 | 4 Flutes | | — | 11 | 45 | 6 | 209 |
| **C-CES** | 4040S | | | — | 11 | 45 | 6 | 214 |
| **CZS** | 4040-1100 | | | — | 11 | 60 | 6 | 183 |
| **CSS** | 2040-1200 | 2 Flutes | | — | 12 | 50 | 6 | 142 |
| **C-CES** | 2040-1200 | | | — | 12 | 50 | 6 | 157 |
| **C-CES** | 2040-1200S | | | — | 12 | 50 | 6 | 169 |
| **CRN-ES** | 2040-1200 | | | — | 12 | 50 | 6 | 174 |
| **DCES** | 2040-1200 | | | — | 12 | 50 | 6 | 176 |
| **CAS** | 2040-1200 | | | — | 12 | 50 | 6 | 180 |
| **CPS** | 2040 | | | — | 12 | 60 | 6 | 178 |
| **DCES** | 4040-1200 | 4 Flutes | | — | 12 | 50 | 6 | 222 |
| **CRN-ES** | 4040-1200 | | | — | 12 | 50 | 6 | 220 |
| **CXES** | 4040-1200 | | | — | 12 | 60 | 6 | 197 |
| **C-CES** | 4040-1200 | | | — | 12 | 60 | 6 | 209 |
| **HMS** | 4040-1200 | | | — | 12 | 60 | 6 | 226 |
| **CRN-ES** | 2040-1600 | 2 Flutes | | — | 16 | 55 | 6 | 174 |
| **C-CES** | 2040-1600 | | | — | 16 | 60 | 6 | 157 |
| **CRN-ES** | 4040-1600 | 4 Flutes | | — | 16 | 55 | 6 | 220 |
| **CXES** | 4040-1600 | | | — | 16 | 60 | 6 | 197 |
| **C-CES** | 4040-1600 | | | — | 16 | 60 | 6 | 209 |
| **DCES** | 4040-1600 | | | — | 16 | 60 | 6 | 222 |
| **CXES** | 4040-2000 | | | — | 20 | 60 | 6 | 197 |
| **HMS** | 4040-2000 | | | — | 20 | 70 | 6 | 226 |
| **CGE** | 4040 | | | — | 30 | 90 | 4 | 224 |
| **C-CES** | 2041 | 2 Flutes | 4.1 | — | 11 | 45 | 6 | 157 |
| **CZS** | 4041-1100 | 4 Flutes | | — | 11 | 60 | 6 | 183 |
| **C-CES** | 2042 | 2 Flutes | 4.2 | — | 11 | 45 | 6 | 157 |
| **CZS** | 4042-1100 | 4 Flutes | | — | 11 | 60 | 6 | 183 |
| **C-CES** | 2043 | 2 Flutes | 4.3 | — | 11 | 45 | 6 | 157 |
| **CZS** | 4043-1100 | 4 Flutes | | — | 11 | 60 | 6 | 183 |
| **C-CES** | 2044 | 2 Flutes | 4.4 | — | 11 | 45 | 6 | 157 |
| **CZS** | 4044-1100 | 4 Flutes | | — | 11 | 60 | 6 | 183 |
| **AZS** | 3045-135 | 3 Flutes | 4.5 | 13.5 | 9 | 70 | 6 | 267 |
| **DLC-AZS** | 3045-135 | | | 13.5 | 9 | 70 | 6 | 271 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| C-CES | 2045 | 2 Flutes | 4.5 | — | 11 | 45 | 6 | 157 |
| C-CES | 4045 | 4 Flutes | | — | 11 | 45 | 6 | 209 |
| CZS | 4045-1100 | | | — | 11 | 60 | 6 | 183 |
| CXES | 4045-1150 | | | — | 11.5 | 60 | 6 | 197 |
| C-CES | 2046 | 2 Flutes | 4.6 | — | 11 | 45 | 6 | 157 |
| CZS | 4046-1100 | 4 Flutes | | — | 11 | 60 | 6 | 183 |
| C-CES | 2047 | 2 Flutes | 4.7 | — | 11 | 45 | 6 | 157 |
| CZS | 4047-1100 | 4 Flutes | | — | 11 | 60 | 6 | 183 |
| CZS | 4048-1100 | 4 Flutes | 4.8 | — | 11 | 60 | 6 | 183 |
| C-CES | 2048 | 2 Flutes | | — | 13 | 50 | 6 | 157 |
| CZS | 4049-1100 | 4 Flutes | 4.9 | — | 11 | 60 | 6 | 183 |
| C-CES | 2049 | 2 Flutes | | — | 13 | 50 | 6 | 157 |
| CSS | 2050-0500 | 2 Flutes | 5 | — | 5 | 50 | 6 | 142 |
| HLS | 4050-160 | 4 Flutes | | 16 | 5 | 60 | 6 | 278 |
| HLS | 4050-250 | | | 25 | 5 | 70 | 6 | 278 |
| HLS | 4050-350 | | | 35 | 5 | 80 | 6 | 278 |
| HLS | 4050-500 | | | 50 | 5 | 110 | 6 | 278 |
| CSS | 2050-0750 | 2 Flutes | | — | 7.5 | 50 | 6 | 142 |
| C-CES | 2050-0750 | | | — | 7.5 | 50 | 6 | 158 |
| C-CES | 2050-0750S | | | — | 7.5 | 50 | 6 | 169 |
| CAS | 2050-0750 | | | — | 7.5 | 50 | 6 | 180 |
| HLS | 2050-160 | | | 16 | 7.5 | 60 | 6 | 235 |
| C-CER | 2050-16 | | | 16 | 7.5 | 60 | 6 | 247 |
| HLS | 2050-200 | | | 20 | 7.5 | 60 | 6 | 235 |
| C-CER | 2050-20 | | | 20 | 7.5 | 60 | 6 | 247 |
| HLS | 2050-250 | | | 25 | 7.5 | 60 | 6 | 235 |
| C-CER | 2050-25 | | | 25 | 7.5 | 60 | 6 | 247 |
| HLS | 2050-300 | | | 30 | 7.5 | 80 | 6 | 235 |
| C-CER | 2050-30 | | | 30 | 7.5 | 80 | 6 | 247 |
| HLS | 2050-350 | | | 35 | 7.5 | 80 | 6 | 235 |
| C-CER | 2050-35 | | | 35 | 7.5 | 80 | 6 | 247 |
| HLS | 2050-400 | | | 40 | 7.5 | 80 | 6 | 235 |
| C-CER | 2050-40 | | | 40 | 7.5 | 80 | 6 | 247 |
| HLS | 2050-500 | | | 50 | 7.5 | 110 | 6 | 235 |
| C-CER | 2050-50 | | | 50 | 7.5 | 110 | 6 | 247 |
| HLS | 2050-600 | | | 60 | 7.5 | 120 | 6 | 235 |
| CZS | 4050-0750 | 4 Flutes | | — | 7.5 | 60 | 6 | 184 |
| CXS | 4050-150 | | | 15 | 7.5 | 50 | 6 | 283 |
| CXS | 4050-210 | | | 21 | 7.5 | 70 | 6 | 283 |
| CXS | 4050-260 | | | 26 | 7.5 | 70 | 6 | 283 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| CSS | 2050-1000 | 2 Flutes | 5 | — | 10 | 50 | 6 | 142 |
| C-CES | 2050-1000 | | | — | 10 | 50 | 6 | 158 |
| CPR | 2050-16 | | | 16 | 10 | 80 | 6 | 259 |
| CPR | 2050-22 | | | 22 | 10 | 80 | 6 | 259 |
| CPR | 2050-32 | | | 32 | 10 | 80 | 6 | 259 |
| AZS | 3050-150 | 3 Flutes | | 15 | 10 | 70 | 6 | 267 |
| DLC-AZS | 3050-150 | | | 15 | 10 | 70 | 6 | 271 |
| AZS | 3050-250 | | | 25 | 10 | 70 | 6 | 267 |
| DLC-AZS | 3050-250 | | | 25 | 10 | 70 | 6 | 271 |
| HMS | 4050-1000 | 4 Flutes | | — | 10 | 50 | 6 | 226 |
| C-CES | 2050-1250 | 2 Flutes | | — | 12.5 | 50 | 6 | 158 |
| CSS | 2050-1250 | | | — | 12.5 | 60 | 6 | 142 |
| CXES | 4050-1250 | 4 Flutes | | — | 12.5 | 50 | 6 | 197 |
| C-CES | 4050-1250 | | | — | 12.5 | 50 | 6 | 209 |
| C-CES | 2050 | 2 Flutes | | — | 13 | 50 | 6 | 158 |
| C-CES | 4050 | 4 Flutes | | — | 13 | 50 | 6 | 209 |
| C-CES | 4050S | | | — | 13 | 50 | 6 | 214 |
| CZS | 4050-1300 | | | — | 13 | 60 | 6 | 184 |
| C-CES | 2050-1500 | 2 Flutes | | — | 15 | 50 | 6 | 158 |
| C-CES | 2050-1500S | | | — | 15 | 50 | 6 | 169 |
| CAS | 2050-1500 | | | — | 15 | 50 | 6 | 180 |
| CRN-ES | 2050-1500 | | | — | 15 | 55 | 6 | 174 |
| CSS | 2050-1500 | | | — | 15 | 60 | 6 | 142 |
| CPS | 2050 | | | — | 15 | 60 | 6 | 178 |
| CRN-ES | 4050-1500 | 4 Flutes | | — | 15 | 55 | 6 | 220 |
| CXES | 4050-1500 | | | — | 15 | 60 | 6 | 197 |
| C-CES | 4050-1500 | | | — | 15 | 60 | 6 | 209 |
| HMS | 4050-1500 | | | — | 15 | 60 | 6 | 226 |
| C-CES | 2050-2000 | 2 Flutes | | — | 20 | 60 | 6 | 158 |
| CXES | 4050-2000 | 4 Flutes | | — | 20 | 60 | 6 | 197 |
| C-CES | 4050-2000 | | | — | 20 | 60 | 6 | 209 |
| CXES | 4050-2500 | | | — | 25 | 70 | 6 | 197 |
| HMS | 4050-2500 | | | — | 25 | 70 | 6 | 226 |
| CGE | 4050 | | | — | 35 | 100 | 6 | 224 |
| C-CES | 2051 | 2 Flutes | 5.1 | — | 13 | 50 | 6 | 158 |
| CZS | 4051-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| C-CES | 2052 | 2 Flutes | 5.2 | — | 13 | 50 | 6 | 158 |
| CZS | 4052-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| C-CES | 2053 | 2 Flutes | 5.3 | — | 13 | 50 | 6 | 158 |
| CZS | 4053-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| C-CES | 2054 | 2 Flutes | 5.4 | — | 13 | 50 | 6 | 158 |
| CZS | 4054-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| C-CES | 2055 | 2 Flutes | 5.5 | — | 13 | 50 | 6 | 158 |
| C-CES | 4055 | 4 Flutes | | — | 13 | 50 | 6 | 209 |
| CZS | 4055-1300 | | | — | 13 | 60 | 6 | 184 |
| CXES | 4055-1400 | | | — | 14 | 60 | 6 | 197 |
| C-CES | 2056 | 2 Flutes | 5.6 | — | 13 | 50 | 6 | 158 |
| CZS | 4056-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| C-CES | 2057 | 2 Flutes | 5.7 | — | 13 | 50 | 6 | 158 |
| CZS | 4057-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| C-CES | 2058 | 2 Flutes | 5.8 | — | 13 | 50 | 6 | 158 |
| CZS | 4058-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| C-CES | 2059 | 2 Flutes | 5.9 | — | 13 | 50 | 6 | 158 |
| CZS | 4059-1300 | 4 Flutes | | — | 13 | 60 | 6 | 184 |
| CSS | 2060-0600 | 2 Flutes | 6 | — | 6 | 50 | 6 | 142 |
| HLS | 4060-200 | 4 Flutes | | 20 | 6 | 80 | 6 | 278 |
| HLS | 4060-300 | | | 30 | 6 | 90 | 6 | 278 |
| HLS | 4060-400 | | | 40 | 6 | 100 | 6 | 278 |
| HLS | 4060-500 | | | 50 | 6 | 110 | 6 | 278 |
| CSS | 2060-0900 | 2 Flutes | | — | 9 | 50 | 6 | 142 |
| C-CES | 2060-0900 | | | — | 9 | 50 | 6 | 158 |
| C-CES | 2060-0900S | | | — | 9 | 50 | 6 | 169 |
| CAS | 2060-0900 | | | — | 9 | 50 | 6 | 180 |
| HLS | 2060-200 | | | 20 | 9 | 80 | 6 | 235 |
| C-CER | 2060-20 | | | 20 | 9 | 80 | 6 | 247 |
| HLS | 2060-300 | | | 30 | 9 | 80 | 6 | 235 |
| C-CER | 2060-30 | | | 30 | 9 | 80 | 6 | 247 |
| HLS | 2060-400 | | | 40 | 9 | 100 | 6 | 235 |
| C-CER | 2060-40 | | | 40 | 9 | 100 | 6 | 247 |
| HLS | 2060-500 | | | 50 | 9 | 120 | 6 | 235 |
| C-CER | 2060-50 | | | 50 | 9 | 120 | 6 | 247 |
| HLS | 2060-600 | | | 60 | 9 | 120 | 6 | 235 |
| C-CER | 2060-60 | | | 60 | 9 | 120 | 6 | 247 |
| CZS | 4060-0900 | 4 Flutes | | — | 9 | 60 | 6 | 184 |
| CESUS | 4060-0900 | | | — | 9 | 60 | 6 | 217 |
| CXS | 4060-180 | | | 18 | 9 | 50 | 6 | 283 |
| CXS | 4060-260 | | | 26 | 9 | 70 | 6 | 283 |
| CXS | 4060-320 | | | 32 | 9 | 70 | 6 | 283 |
| CSS | 2060-1200 | 2 Flutes | | — | 12 | 50 | 6 | 142 |
| C-CES | 2060-1200 | | | — | 12 | 50 | 6 | 158 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| CPR | 2060-12 | 2 Flutes | 6 | — | 12 | 80 | 6 | 259 |
| DCLS | 2060-320 | | | 32 | 12 | 80 | 6 | 255 |
| DCLS | 2060-420 | | | 42 | 12 | 80 | 6 | 255 |
| CPR | 2060-42 | | | 42 | 12 | 80 | 6 | 259 |
| CPR | 2060-52 | | | 52 | 12 | 120 | 6 | 259 |
| DCLS | 2060-630 | | | 63 | 12 | 120 | 6 | 255 |
| CPR | 2060-63 | | | 63 | 12 | 120 | 6 | 259 |
| AZS | 3060-180 | 3 Flutes | | 18 | 12 | 70 | 6 | 267 |
| DLC-AZS | 3060-180 | | | 18 | 12 | 70 | 6 | 271 |
| AZS | 3060-300 | | | 30 | 12 | 70 | 6 | 267 |
| DLC-AZS | 3060-300 | | | 30 | 12 | 70 | 6 | 271 |
| C-CES | 2060 | 2 Flutes | | — | 13 | 50 | 6 | 158 |
| C-CES | 4060 | 4 Flutes | | — | 13 | 50 | 6 | 209 |
| C-CES | 4060S | | | — | 13 | 50 | 6 | 214 |
| CZS | 4060-1300 | | | — | 13 | 60 | 6 | 184 |
| CESUS | 4060-1300 | | | — | 13 | 60 | 6 | 217 |
| HMS | 6060-1300 | 6 Flutes | | — | 13 | 50 | 6 | 226 |
| C-CES | 2060-1500 | 2 Flutes | | — | 15 | 50 | 6 | 158 |
| CAS | 2060-1500 | | | — | 15 | 50 | 6 | 180 |
| CSS | 2060-1500 | | | — | 15 | 60 | 6 | 142 |
| CXES | 4060-1500 | 4 Flutes | | — | 15 | 50 | 6 | 197 |
| C-CES | 4060-1500 | | | — | 15 | 50 | 6 | 209 |
| C-CES | 2060-1800 | 2 Flutes | | — | 18 | 50 | 6 | 158 |
| C-CES | 2060-1800S | | | — | 18 | 50 | 6 | 169 |
| CSS | 2060-1800 | | | — | 18 | 60 | 6 | 142 |
| CRN-ES | 2060-1800 | | | — | 18 | 60 | 6 | 174 |
| DCES | 2060-1800 | | | — | 18 | 60 | 6 | 176 |
| CPS | 2060 | | | — | 18 | 60 | 6 | 178 |
| CZS | 4060-1800 | 4 Flutes | | — | 18 | 60 | 6 | 184 |
| CXES | 4060-1800 | | | — | 18 | 60 | 6 | 197 |
| C-CES | 4060-1800 | | | — | 18 | 60 | 6 | 209 |
| CESUS | 4060-1800 | | | — | 18 | 60 | 6 | 217 |
| DCES | 4060-1800 | | | — | 18 | 60 | 6 | 222 |
| CRN-ES | 4060-1800 | | | — | 18 | 60 | 6 | 220 |
| DCES | 4060-1800L | | | — | 18 | 100 | 6 | 222 |
| HMS | 6060-1800 | 6 Flutes | | — | 18 | 60 | 6 | 226 |
| C-CES | 2060-2400 | 2 Flutes | | — | 24 | 60 | 6 | 158 |
| CRN-ES | 2060-2400 | | | — | 24 | 65 | 6 | 174 |
| C-CES | 4060-2400 | 4 Flutes | | — | 24 | 60 | 6 | 209 |
| DCES | 4060-2400 | | | — | 24 | 60 | 6 | 222 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CRN-ES** | 4060-2400 | 4 Flutes | 6 | — | 24 | 65 | 6 | 220 |
| **CXES** | 4060-2400 | | | — | 24 | 70 | 6 | 197 |
| **HMS** | 6060-2600 | 6 Flutes | | — | 26 | 70 | 6 | 226 |
| **CXES** | 4060-3000 | 4 Flutes | | — | 30 | 80 | 6 | 197 |
| **CGE** | 4060 | | | — | 40 | 150 | 6 | 224 |
| **C-CES** | 2061 | 2 Flutes | 6.1 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2062 | 2 Flutes | 6.2 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2063 | 2 Flutes | 6.3 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2064 | 2 Flutes | 6.4 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2065 | 2 Flutes | 6.5 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 4065 | 4 Flutes | | — | 16 | 60 | 8 | 209 |
| **CZS** | 4065-1600 | | | — | 16 | 70 | 8 | 184 |
| **CXES** | 4065-1650 | | | — | 16.5 | 60 | 8 | 197 |
| **C-CES** | 2066 | 2 Flutes | 6.6 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2067 | 2 Flutes | 6.7 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2068 | 2 Flutes | 6.8 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2069 | 2 Flutes | 6.9 | — | 16 | 60 | 8 | 158 |
| **CZS** | 4070-1050 | 4 Flutes | 7 | — | 10.5 | 70 | 8 | 184 |
| **CESUS** | 4070-1050 | | | — | 10.5 | 70 | 8 | 217 |
| **CXES** | 4070-1050 | | | — | 10.5 | 100 | 6 | 197 |
| **AZS** | 3070-210 | 3 Flutes | | 21 | 14 | 80 | 8 | 267 |
| **DLC-AZS** | 3070-210 | | | 21 | 14 | 80 | 8 | 271 |
| **AZS** | 3070-350 | | | 35 | 14 | 80 | 8 | 267 |
| **DLC-AZS** | 3070-350 | | | 35 | 14 | 80 | 8 | 271 |
| **C-CES** | 2070 | 2 Flutes | | — | 16 | 60 | 8 | 158 |
| **C-CES** | 4070 | 4 Flutes | | — | 16 | 60 | 8 | 209 |
| **CZS** | 4070-1600 | | | — | 16 | 70 | 8 | 184 |
| **CESUS** | 4070-1600 | | | — | 16 | 70 | 8 | 217 |
| **CSS** | 2070-1750 | 2 Flutes | | — | 17.5 | 70 | 8 | 142 |
| **CXES** | 4070-1750 | 4 Flutes | | — | 17.5 | 70 | 8 | 197 |
| **CSS** | 2070-2100 | 2 Flutes | | — | 21 | 80 | 8 | 142 |
| **CZS** | 4070-2100 | 4 Flutes | | — | 21 | 70 | 8 | 184 |
| **CESUS** | 4070-2100 | | | — | 21 | 70 | 8 | 217 |
| **C-CES** | 2071 | 2 Flutes | 7.1 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2072 | 2 Flutes | 7.2 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2073 | 2 Flutes | 7.3 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2074 | 2 Flutes | 7.4 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 2075 | 2 Flutes | 7.5 | — | 16 | 60 | 8 | 158 |
| **C-CES** | 4075 | 4 Flutes | | — | 16 | 60 | 8 | 209 |
| **CZS** | 4075-1600 | | | — | 16 | 70 | 8 | 184 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CXES** | 4075-1900 | 4 Flutes | 7.5 | — | 19 | 60 | 8 | 197 |
| **C-CES** | 2076 | 2 Flutes | 7.6 | — | 19 | 60 | 8 | 158 |
| **C-CES** | 2077 | 2 Flutes | 7.7 | — | 19 | 60 | 8 | 158 |
| **C-CES** | 2078 | 2 Flutes | 7.8 | — | 19 | 60 | 8 | 158 |
| **C-CES** | 2079 | 2 Flutes | 7.9 | — | 19 | 60 | 8 | 158 |
| **CSS** | 2080-0800 | 2 Flutes | 8 | — | 8 | 70 | 8 | 142 |
| **CSS** | 2080-1200 | | | — | 12 | 70 | 8 | 142 |
| **CAS** | 2080-1200 | | | — | 12 | 80 | 8 | 180 |
| **CZS** | 4080-1200 | 4 Flutes | | — | 12 | 70 | 8 | 184 |
| **CESUS** | 4080-1200 | | | — | 12 | 70 | 8 | 217 |
| **CXS** | 4080-240 | | | 24 | 12 | 60 | 8 | 283 |
| **CXS** | 4080-340 | | | 34 | 12 | 90 | 8 | 283 |
| **CXS** | 4080-420 | | | 42 | 12 | 90 | 8 | 283 |
| **C-CES** | 2080-1600 | 2 Flutes | | — | 16 | 60 | 8 | 159 |
| **CSS** | 2080-1600 | | | — | 16 | 70 | 8 | 142 |
| **AZS** | 3080-240 | 3 Flutes | | 24 | 16 | 80 | 8 | 267 |
| **DLC-AZS** | 3080-240 | | | 24 | 16 | 80 | 8 | 271 |
| **AZS** | 3080-400 | | | 40 | 16 | 80 | 8 | 267 |
| **DLC-AZS** | 3080-400 | | | 40 | 16 | 80 | 8 | 271 |
| **C-CES** | 2080 | 2 Flutes | | — | 19 | 60 | 8 | 159 |
| **C-CES** | 4080 | 4 Flutes | | — | 19 | 60 | 8 | 209 |
| **C-CES** | 4080S | | | — | 19 | 60 | 8 | 214 |
| **CZS** | 4080-1900 | | | — | 19 | 70 | 8 | 184 |
| **CESUS** | 4080-1900 | | | — | 19 | 70 | 8 | 217 |
| **HMS** | 6080-1900 | 6 Flutes | | — | 19 | 60 | 8 | 226 |
| **C-CES** | 2080-2000 | 2 Flutes | | — | 20 | 60 | 8 | 159 |
| **CSS** | 2080-2000 | | | — | 20 | 70 | 8 | 142 |
| **CAS** | 2080-2000 | | | — | 20 | 80 | 8 | 180 |
| **CXES** | 4080-2000 | 4 Flutes | | — | 20 | 60 | 8 | 197 |
| **C-CES** | 4080-2000 | | | — | 20 | 60 | 8 | 209 |
| **CSS** | 2080-2400 | 2 Flutes | | — | 24 | 80 | 8 | 142 |
| **C-CES** | 2080-2400 | | | — | 24 | 80 | 8 | 159 |
| **C-CES** | 2080-2400S | | | — | 24 | 80 | 8 | 169 |
| **CRN-ES** | 2080-2400 | | | — | 24 | 80 | 8 | 174 |
| **CPS** | 2080 | | | — | 24 | 80 | 8 | 178 |
| **CZS** | 4080-2400 | 4 Flutes | | — | 24 | 70 | 8 | 184 |
| **CXES** | 4080-2400 | | | — | 24 | 70 | 8 | 197 |
| **CESUS** | 4080-2400 | | | — | 24 | 70 | 8 | 217 |
| **C-CES** | 4080-2400 | | | — | 24 | 80 | 8 | 209 |
| **DCES** | 4080-2400 | | | — | 24 | 80 | 8 | 222 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CRN-ES** | 4080-2400 | 4 Flutes | 8 | — | 24 | 80 | 8 | 220 |
| **HMS** | 6080-2400 | 6 Flutes | | — | 24 | 70 | 8 | 226 |
| **C-CES** | 2080-3200 | 2 Flutes | | — | 32 | 80 | 8 | 159 |
| **CXES** | 4080-3200 | 4 Flutes | | — | 32 | 80 | 8 | 197 |
| **C-CES** | 4080-3200 | | | — | 32 | 80 | 8 | 209 |
| **DCES** | 4080-3200 | | | — | 32 | 80 | 8 | 222 |
| **HMS** | 6080-3600 | 6 Flutes | | — | 36 | 90 | 8 | 226 |
| **CXES** | 4080-4000 | 4 Flutes | | — | 40 | 90 | 8 | 197 |
| **CGE** | 4080 | | | — | 40 | 150 | 8 | 224 |
| **C-CES** | 2081 | 2 Flutes | 8.1 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2082 | 2 Flutes | 8.2 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2083 | 2 Flutes | 8.3 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2084 | 2 Flutes | 8.4 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2085 | 2 Flutes | 8.5 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 4085 | 4 Flutes | | — | 19 | 70 | 10 | 209 |
| **CZS** | 4085-1900 | | | — | 19 | 80 | 10 | 184 |
| **CXES** | 4085-2150 | | | — | 21.5 | 70 | 10 | 197 |
| **C-CES** | 2086 | 2 Flutes | 8.6 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2087 | 2 Flutes | 8.7 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2088 | 2 Flutes | 8.8 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2089 | 2 Flutes | 8.9 | — | 19 | 70 | 10 | 159 |
| **CZS** | 4090-1350 | 4 Flutes | 9 | — | 13.5 | 80 | 10 | 184 |
| **CESUS** | 4090-1350 | | | — | 13.5 | 80 | 10 | 217 |
| **CXES** | 4090-1350 | | | — | 13.5 | 140 | 8 | 197 |
| **AZS** | 3090-270 | 3 Flutes | | 27 | 18 | 90 | 10 | 267 |
| **DLC-AZS** | 3090-270 | | | 27 | 18 | 90 | 10 | 271 |
| **AZS** | 3090-450 | | | 45 | 18 | 90 | 10 | 267 |
| **DLC-AZS** | 3090-450 | | | 45 | 18 | 90 | 10 | 271 |
| **C-CES** | 2090 | 2 Flutes | | — | 19 | 70 | 10 | 159 |
| **C-CES** | 4090 | 4 Flutes | | — | 19 | 70 | 10 | 209 |
| **CZS** | 4090-1900 | | | — | 19 | 80 | 10 | 184 |
| **CESUS** | 4090-1900 | | | — | 19 | 80 | 10 | 217 |
| **CSS** | 2090-2250 | 2 Flutes | | — | 22.5 | 80 | 10 | 142 |
| **CXES** | 4090-2250 | 4 Flutes | | — | 22.5 | 80 | 10 | 197 |
| **CSS** | 2090-2700 | 2 Flutes | | — | 27 | 80 | 10 | 142 |
| **CZS** | 4090-2700 | 4 Flutes | | — | 27 | 80 | 10 | 184 |
| **CESUS** | 4090-2700 | | | — | 27 | 80 | 10 | 217 |
| **C-CES** | 2091 | 2 Flutes | 9.1 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2092 | 2 Flutes | 9.2 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2093 | 2 Flutes | 9.3 | — | 19 | 70 | 10 | 159 |

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **C-CES** | 2094 | 2 Flutes | 9.4 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 2095 | 2 Flutes | 9.5 | — | 19 | 70 | 10 | 159 |
| **C-CES** | 4095 | 4 Flutes | | — | 19 | 70 | 10 | 209 |
| **CZS** | 4095-1900 | | | — | 19 | 80 | 10 | 184 |
| **CXES** | 4095-2400 | | | — | 24 | 70 | 10 | 197 |
| **C-CES** | 2096 | 2 Flutes | 9.6 | — | 22 | 70 | 10 | 159 |
| **C-CES** | 2097 | 2 Flutes | 9.7 | — | 22 | 70 | 10 | 159 |
| **C-CES** | 2098 | 2 Flutes | 9.8 | — | 22 | 70 | 10 | 159 |
| **C-CES** | 2099 | 2 Flutes | 9.9 | — | 22 | 70 | 10 | 159 |
| **CSS** | 2100-1000 | 2 Flutes | 10 | — | 10 | 70 | 10 | 142 |
| **CSS** | 2100-1500 | | | — | 15 | 70 | 10 | 142 |
| **CAS** | 2100-1500 | | | — | 15 | 80 | 10 | 180 |
| **CZS** | 4100-1500 | 4 Flutes | | — | 15 | 80 | 10 | 184 |
| **CESUS** | 4100-1500 | | | — | 15 | 80 | 10 | 217 |
| **CXS** | 4100-300 | | | 30 | 15 | 70 | 10 | 283 |
| **CXS** | 4100-420 | | | 42 | 15 | 100 | 10 | 283 |
| **CXS** | 4100-520 | | | 52 | 15 | 100 | 10 | 283 |
| **CSS** | 2100-2000 | 2 Flutes | | — | 20 | 70 | 10 | 142 |
| **C-CES** | 2100-2000 | | | — | 20 | 70 | 10 | 159 |
| **AZS** | 3100-300 | 3 Flutes | | 30 | 20 | 90 | 10 | 267 |
| **DLC-AZS** | 3100-300 | | | 30 | 20 | 90 | 10 | 271 |
| **AZS** | 3100-500 | | | 50 | 20 | 90 | 10 | 267 |
| **DLC-AZS** | 3100-500 | | | 50 | 20 | 90 | 10 | 271 |
| **C-CES** | 2100 | 2 Flutes | | — | 22 | 70 | 10 | 159 |
| **C-CES** | 4100 | 4 Flutes | | — | 22 | 70 | 10 | 209 |
| **C-CES** | 4100S | | | — | 22 | 70 | 10 | 214 |
| **CZS** | 4100-2200 | | | — | 22 | 80 | 10 | 184 |
| **CESUS** | 4100-2200 | | | — | 22 | 80 | 10 | 217 |
| **HMS** | 6100-2200 | 6 Flutes | | — | 22 | 70 | 10 | 226 |
| **C-CES** | 2100-2500 | 2 Flutes | | — | 25 | 70 | 10 | 159 |
| **CSS** | 2100-2500 | | | — | 25 | 80 | 10 | 142 |
| **CAS** | 2100-2500 | | | — | 25 | 80 | 10 | 180 |
| **CXES** | 4100-2500 | 4 Flutes | | — | 25 | 70 | 10 | 197 |
| **C-CES** | 4100-2500 | | | — | 25 | 70 | 10 | 209 |
| **CSS** | 2100-3000 | 2 Flutes | | — | 30 | 80 | 10 | 142 |
| **C-CES** | 2100-3000 | | | — | 30 | 80 | 10 | 159 |
| **C-CES** | 2100-3000S | | | — | 30 | 80 | 10 | 169 |
| **CPS** | 2100 | | | — | 30 | 80 | 10 | 178 |
| **CRN-ES** | 2100-3000 | | | — | 30 | 100 | 10 | 174 |
| **CZS** | 4100-3000 | 4 Flutes | | — | 30 | 80 | 10 | 184 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CXES** | 4100-3000 | 4 Flutes | 10 | — | 30 | 80 | 10 | 197 |
| **CESUS** | 4100-3000 | | | — | 30 | 80 | 10 | 217 |
| **C-CES** | 4100-3000 | | | — | 30 | 90 | 10 | 209 |
| **DCES** | 4100-3000 | | | — | 30 | 90 | 10 | 222 |
| **CRN-ES** | 4100-3000 | | | — | 30 | 100 | 10 | 220 |
| **HMS** | 6100-3000 | 6 Flutes | | — | 30 | 80 | 10 | 226 |
| **C-CES** | 2100-4000 | 2 Flutes | | — | 40 | 90 | 10 | 159 |
| **CRN-ES** | 2100-4000 | | | — | 40 | 100 | 10 | 174 |
| **CXES** | 4100-4000 | 4 Flutes | | — | 40 | 90 | 10 | 197 |
| **C-CES** | 4100-4000 | | | — | 40 | 90 | 10 | 209 |
| **DCES** | 4100-4000 | | | — | 40 | 90 | 10 | 222 |
| **CGE** | 4100 | | | — | 45 | 180 | 10 | 224 |
| **HMS** | 6100-4600 | 6 Flutes | | — | 46 | 100 | 10 | 226 |
| **CXES** | 4100-5000 | 4 Flutes | | — | 50 | 100 | 10 | 197 |
| **C-CES** | 2105 | 2 Flutes | 10.5 | — | 22 | 75 | 12 | 159 |
| **C-CES** | 4105 | 4 Flutes | | — | 22 | 75 | 12 | 209 |
| **CZS** | 4105-2200 | | | — | 22 | 100 | 12 | 184 |
| **CZS** | 4110-1650 | 4 Flutes | 11 | — | 16.5 | 100 | 12 | 184 |
| **CESUS** | 4110-1650 | | | — | 16.5 | 100 | 12 | 217 |
| **CXES** | 4110-1650 | | | — | 16.5 | 150 | 10 | 197 |
| **C-CES** | 2110 | 2 Flutes | | — | 22 | 75 | 12 | 159 |
| **AZS** | 3110-330 | 3 Flutes | | 33 | 22 | 110 | 12 | 267 |
| **DLC-AZS** | 3110-330 | | | 33 | 22 | 110 | 12 | 271 |
| **AZS** | 3110-550 | | | 55 | 22 | 110 | 12 | 267 |
| **DLC-AZS** | 3110-550 | | | 55 | 22 | 110 | 12 | 271 |
| **C-CES** | 4110 | 4 Flutes | | — | 22 | 75 | 12 | 209 |
| **CZS** | 4110-2200 | | | — | 22 | 100 | 12 | 184 |
| **CESUS** | 4110-2200 | | | — | 22 | 100 | 12 | 217 |
| **CSS** | 2110-2750 | 2 Flutes | | — | 27.5 | 80 | 12 | 142 |
| **CXES** | 4110-2750 | 4 Flutes | | — | 27.5 | 100 | 12 | 197 |
| **CSS** | 2110-3300 | 2 Flutes | | — | 33 | 80 | 12 | 142 |
| **CZS** | 4110-3300 | 4 Flutes | | — | 33 | 100 | 12 | 184 |
| **CESUS** | 4110-3300 | | | — | 33 | 100 | 12 | 217 |
| **C-CES** | 2115 | 2 Flutes | 11.5 | — | 22 | 75 | 12 | 159 |
| **C-CES** | 4115 | 4 Flutes | | — | 22 | 75 | 12 | 209 |
| **CZS** | 4115-2200 | | | — | 22 | 100 | 12 | 185 |
| **CSS** | 2120-1200 | 2 Flutes | 12 | — | 12 | 80 | 12 | 142 |
| **CSS** | 2120-1800 | | | — | 18 | 80 | 12 | 142 |
| **CAS** | 2120-1800 | | | — | 18 | 90 | 12 | 180 |
| **CZS** | 4120-1800 | 4 Flutes | | — | 18 | 100 | 12 | 185 |
| **CESUS** | 4120-1800 | | | — | 18 | 100 | 12 | 217 |
| **CXS** | 4120-360 | 4 Flutes | | 36 | 18 | 90 | 12 | 283 |
| **CXS** | 4120-520 | | | 52 | 18 | 110 | 12 | 283 |
| **CXS** | 4120-620 | | | 62 | 18 | 110 | 12 | 283 |
| **C-CES** | 2120-2400 | 2 Flutes | | — | 24 | 75 | 12 | 159 |
| **CSS** | 2120-2400 | | | — | 24 | 80 | 12 | 142 |
| **AZS** | 3120-360 | 3 Flutes | | 36 | 24 | 110 | 12 | 267 |
| **DLC-AZS** | 3120-360 | | | 36 | 24 | 110 | 12 | 271 |
| **AZS** | 3120-600 | | | 60 | 24 | 110 | 12 | 267 |
| **DLC-AZS** | 3120-600 | | | 60 | 24 | 110 | 12 | 271 |
| **C-CES** | 2120 | 2 Flutes | | — | 26 | 75 | 12 | 159 |
| **C-CES** | 4120 | 4 Flutes | | — | 26 | 75 | 12 | 209 |
| **C-CES** | 4120S | | | — | 26 | 75 | 12 | 214 |
| **CZS** | 4120-2600 | | | — | 26 | 100 | 12 | 185 |
| **CESUS** | 4120-2600 | | | — | 26 | 100 | 12 | 217 |
| **HMS** | 6120-2600 | 6 Flutes | | — | 26 | 75 | 12 | 226 |
| **C-CES** | 2120-3000 | 2 Flutes | | — | 30 | 75 | 12 | 159 |
| **CSS** | 2120-3000 | | | — | 30 | 80 | 12 | 142 |
| **CAS** | 2120-3000 | | | — | 30 | 90 | 12 | 180 |
| **C-CES** | 4120-3000 | 4 Flutes | 12 | — | 30 | 75 | 12 | 209 |
| **CXES** | 4120-3000 | | | — | 30 | 90 | 12 | 197 |
| **CSS** | 2120-3600 | 2 Flutes | | — | 36 | 90 | 12 | 142 |
| **C-CES** | 2120-3600 | | | — | 36 | 90 | 12 | 159 |
| **C-CES** | 2120-3600S | | | — | 36 | 90 | 12 | 169 |
| **CPS** | 2120 | | | — | 36 | 90 | 12 | 178 |
| **CRN-ES** | 2120-3600 | | | — | 36 | 100 | 12 | 174 |
| **C-CES** | 4120-3600 | 4 Flutes | | — | 36 | 90 | 12 | 209 |
| **CZS** | 4120-3600 | | | — | 36 | 100 | 12 | 185 |
| **CXES** | 4120-3600 | | | — | 36 | 100 | 12 | 197 |
| **CESUS** | 4120-3600 | | | — | 36 | 100 | 12 | 217 |
| **CRN-ES** | 4120-3600 | | | — | 36 | 100 | 12 | 220 |
| **HMS** | 6120-3600 | 6 Flutes | | — | 36 | 100 | 12 | 226 |
| **C-CES** | 2120-4800 | 2 Flutes | | — | 48 | 100 | 12 | 159 |
| **C-CES** | 4120-4800 | 4 Flutes | | — | 48 | 100 | 12 | 209 |
| **CXES** | 4120-4800 | | | — | 48 | 110 | 12 | 197 |
| **C-CES** | 4120-5000 | | | — | 50 | 100 | 12 | 209 |
| **CGE** | 4120 | | | — | 55 | 200 | 12 | 224 |
| **HMS** | 6120-5600 | 6 Flutes | | — | 56 | 120 | 12 | 226 |
| **CXES** | 4120-6000 | 4 Flutes | | — | 60 | 120 | 12 | 197 |
| **CXES** | 4130-1950 | 4 Flutes | 13 | — | 19.5 | 160 | 12 | 197 |

# Simplified Table

## Square

| Model Number | | Number of Flutes | Outside Diameter | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CZS** | 4130-2600 | 4 Flutes | 13 | — | 26 | 110 | 12 | 185 |
| **C-CES** | 4140 | 4 Flutes | 14 | — | 26 | 80 | 12 | 209 |
| **CZS** | 4160-2400 | 4 Flutes | 16 | — | 24 | 110 | 16 | 185 |
| **C-CES** | 2160 | 2 Flutes | | — | 32 | 110 | 16 | 159 |
| **CZS** | 4160-3200 | 4 Flutes | | — | 32 | 110 | 16 | 185 |
| **C-CES** | 4160 | | | — | 32 | 110 | 16 | 209 |
| **CXES** | 4160-4000 | | | — | 40 | 110 | 16 | 197 |
| **CGE** | 4160 | | | — | 70 | 200 | 16 | 224 |
| **C-CES** | 2180 | 2 Flutes | 18 | — | 32 | 110 | 20 | 159 |
| **C-CES** | 4180 | 4 Flutes | | — | 32 | 110 | 20 | 209 |
| **CZS** | 4200-3000 | 4 Flutes | 20 | — | 30 | 125 | 20 | 185 |
| **C-CES** | 2200 | 2 Flutes | | — | 38 | 110 | 20 | 159 |
| **C-CES** | 4200 | 4 Flutes | | — | 38 | 110 | 20 | 209 |
| **CZS** | 4200-4000 | | | — | 40 | 125 | 20 | 185 |
| **CGE** | 4200 | | | — | 70 | 200 | 20 | 224 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSB** | 20006-0006 | 2 Flutes | R0.03 | — | 0.06 | 50 | 4 | 398 |
| **HSB** | 20008-0008 | 2 Flutes | R0.04 | — | 0.08 | 50 | 4 | 398 |
| **HSB** | 1001-0020-6 | 1 Flutes | R0.05 | — | 0.2 | 50 | 6 | 398 |
| **CSEB** | 1001-0020-6 | | | — | 0.2 | 50 | 6 | 406 |
| **HGB** | 2001-0010 | 2 Flutes | | — | 0.1 | 50 | 4 | 396 |
| **HSB** | 2001-0010 | | | — | 0.1 | 50 | 4 | 398 |
| **CSEB** | 2001-0010 | | | — | 0.1 | 50 | 4 | 406 |
| **HGLB** | 2001-002 | | | 0.2 | 0.08 | 45 | 4 | 437 |
| **HSLB** | 2001-002 | | | 0.2 | 0.08 | 45 | 4 | 446 |
| **CSELB** | 2001-002 | | | 0.2 | 0.08 | 45 | 4 | 468 |
| **CBN-LBSF** | 2001-003 | | | 0.3 | 0.07 | 50 | 4 | 114 |
| **HGLB** | 2001-003 | | | 0.3 | 0.08 | 45 | 4 | 437 |
| **HSLB** | 2001-003 | | | 0.3 | 0.08 | 45 | 4 | 446 |
| **CSELB** | 2001-003 | | | 0.3 | 0.08 | 45 | 4 | 468 |
| **DLCLB** | 2001-003 | | | 0.3 | 0.08 | 45 | 4 | 488 |
| **CBN-LBF** | 2001-003 | | | 0.3 | 0.08 | 50 | 4 | 120 |
| **CBN-LBSF** | 2001-005 | | | 0.5 | 0.07 | 50 | 4 | 114 |
| **HGLB** | 2001-005 | | | 0.5 | 0.08 | 45 | 4 | 437 |
| **HSLB** | 2001-005 | | | 0.5 | 0.08 | 45 | 4 | 446 |
| **CSELB** | 2001-005 | | | 0.5 | 0.08 | 45 | 4 | 468 |
| **DLCLB** | 2001-005 | | | 0.5 | 0.08 | 45 | 4 | 488 |
| **CBN-LBF** | 2001-005 | | | 0.5 | 0.08 | 50 | 4 | 120 |
| **HGB** | 20015-0015 | 2 Flutes | R0.075 | — | 0.15 | 50 | 4 | 396 |
| **HGLB** | 20015-003 | | | 0.3 | 0.12 | 45 | 4 | 437 |
| **HSLB** | 20015-003 | | | 0.3 | 0.12 | 45 | 4 | 446 |
| **CSELB** | 20015-003 | | | 0.3 | 0.12 | 45 | 4 | 468 |
| **DLCLB** | 20015-003 | | | 0.3 | 0.12 | 45 | 4 | 488 |
| **CBN-LBSF** | 20015-0045 | | | 0.45 | 0.1 | 50 | 4 | 114 |
| **CBN-LBF** | 20015-0045 | | | 0.45 | 0.15 | 50 | 4 | 120 |
| **HGLB** | 20015-005 | | | 0.5 | 0.12 | 45 | 4 | 437 |
| **HSLB** | 20015-005 | | | 0.5 | 0.12 | 45 | 4 | 446 |
| **CSELB** | 20015-005 | | | 0.5 | 0.12 | 45 | 4 | 468 |
| **DLCLB** | 20015-005 | | | 0.5 | 0.12 | 45 | 4 | 488 |
| **CBN-LBSF** | 20015-0075 | | | 0.75 | 0.1 | 50 | 4 | 114 |
| **HGLB** | 20015-0075 | | | 0.75 | 0.12 | 45 | 4 | 437 |
| **CBN-LBF** | 20015-0075 | | | 0.75 | 0.15 | 50 | 4 | 120 |
| **HGLB** | 20015-010 | | | 1 | 0.12 | 45 | 4 | 437 |
| **HSLB** | 20015-010 | | | 1 | 0.12 | 45 | 4 | 446 |
| **CSELB** | 20015-010 | | | 1 | 0.12 | 45 | 4 | 468 |
| **DLCLB** | 20015-010 | | | 1 | 0.12 | 45 | 4 | 488 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **UDCBF** | 2002-0014 | 2 Flutes | R0.1 | — | 0.14 | 50 | 4 | 80 |
| **UDCB** | 2002-0014 | | | — | 0.14 | 50 | 4 | 94 |
| **HSB** | 2002-0020S | | | — | 0.2 | 35 | 4 | 403 |
| **HSB** | 2002-0020-6 | | | — | 0.2 | 50 | 6 | 398 |
| **CSEB** | 2002-0020-6 | | | — | 0.2 | 50 | 6 | 406 |
| **HGB** | 2002-0030 | | | — | 0.3 | 50 | 4 | 396 |
| **HSB** | 2002-0030 | | | — | 0.3 | 50 | 4 | 398 |
| **CSEB** | 2002-0030 | | | — | 0.3 | 50 | 4 | 406 |
| **CBN-LBSF** | 2002-003 | | | 0.3 | 0.13 | 50 | 4 | 114 |
| **UDCLBF** | 2002-0030 | | | 0.3 | 0.14 | 50 | 4 | 82 |
| **UDCLB** | 2002-0030 | | | 0.3 | 0.14 | 50 | 4 | 98 |
| **HGLB** | 2002-003 | | | 0.3 | 0.16 | 45 | 4 | 437 |
| **HSLB** | 2002-003 | | | 0.3 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-003 | | | 0.3 | 0.16 | 45 | 4 | 469 |
| **DLCLB** | 2002-003 | | | 0.3 | 0.16 | 45 | 4 | 488 |
| **CBN-LBF** | 2002-003 | | | 0.3 | 0.16 | 50 | 4 | 120 |
| **UPDLB** | 1002-004 | 1 Flutes | | 0.4 | 0.1 | 40 | 4 | 434 |
| **UDCLBF** | 2002-0050 | 2 Flutes | | 0.5 | 0.14 | 50 | 4 | 82 |
| **UDCLB** | 2002-0050 | | | 0.5 | 0.14 | 50 | 4 | 98 |
| **HSLB** | 2002-005S | | | 0.5 | 0.16 | 35 | 4 | 465 |
| **HGLB** | 2002-005 | | | 0.5 | 0.16 | 45 | 4 | 437 |
| **HSLB** | 2002-005 | | | 0.5 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-005 | | | 0.5 | 0.16 | 45 | 4 | 469 |
| **DLCLB** | 2002-005 | | | 0.5 | 0.16 | 45 | 4 | 488 |
| **HSLB** | 2002-005-6 | | | 0.5 | 0.16 | 50 | 6 | 447 |
| **CSELB** | 2002-005-6 | | | 0.5 | 0.16 | 50 | 6 | 469 |
| **CBN-LBSF** | 2002-006 | | | 0.6 | 0.13 | 50 | 4 | 114 |
| **CBN-LBF** | 2002-006 | | | 0.6 | 0.16 | 50 | 4 | 120 |
| **UDCLBF** | 2002-0075 | | | 0.75 | 0.14 | 50 | 4 | 82 |
| **UDCLB** | 2002-0075 | | | 0.75 | 0.14 | 50 | 4 | 98 |
| **HGLB** | 2002-0075 | | | 0.75 | 0.16 | 45 | 4 | 437 |
| **HSLB** | 2002-0075 | | | 0.75 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-0075 | | | 0.75 | 0.16 | 45 | 4 | 469 |
| **UDCLBF** | 2002-0100 | | | 1 | 0.14 | 50 | 4 | 82 |
| **UDCLB** | 2002-0100 | | | 1 | 0.14 | 50 | 4 | 98 |
| **HSLB** | 2002-010S | | | 1 | 0.16 | 35 | 4 | 465 |
| **HGLB** | 2002-010 | | | 1 | 0.16 | 45 | 4 | 437 |
| **HSLB** | 2002-010 | | | 1 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-010 | | | 1 | 0.16 | 45 | 4 | 469 |
| **DLCLB** | 2002-010 | | | 1 | 0.16 | 45 | 4 | 488 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CBN-LBF** | 2002-010 | 2 Flutes | R0.1 | 1 | 0.16 | 50 | 4 | 120 |
| **HSLB** | 2002-010-6 | | | 1 | 0.16 | 50 | 6 | 447 |
| **CSELB** | 2002-010-6 | | | 1 | 0.16 | 50 | 6 | 469 |
| **HSLB** | 2002-0125 | | | 1.25 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-0125 | | | 1.25 | 0.16 | 45 | 4 | 469 |
| **HGLB** | 2002-015 | | | 1.5 | 0.16 | 45 | 4 | 437 |
| **HSLB** | 2002-015 | | | 1.5 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-015 | | | 1.5 | 0.16 | 45 | 4 | 469 |
| **DLCLB** | 2002-015 | | | 1.5 | 0.16 | 45 | 4 | 488 |
| **HSLB** | 2002-015-6 | | | 1.5 | 0.16 | 50 | 6 | 447 |
| **CSELB** | 2002-015-6 | | | 1.5 | 0.16 | 50 | 6 | 469 |
| **HSLB** | 2002-0175 | | | 1.75 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-0175 | | | 1.75 | 0.16 | 45 | 4 | 469 |
| **HGLB** | 2002-020 | | | 2 | 0.16 | 45 | 4 | 437 |
| **HSLB** | 2002-020 | | | 2 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-020 | | | 2 | 0.16 | 45 | 4 | 469 |
| **HSLB** | 2002-020-6 | | | 2 | 0.16 | 50 | 6 | 447 |
| **CSELB** | 2002-020-6 | | | 2 | 0.16 | 50 | 6 | 469 |
| **HSLB** | 2002-0225 | | | 2.25 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-0225 | | | 2.25 | 0.16 | 45 | 4 | 469 |
| **HSLB** | 2002-025 | | | 2.5 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-025 | | | 2.5 | 0.16 | 45 | 4 | 469 |
| **HSLB** | 2002-030 | | | 3 | 0.16 | 45 | 4 | 447 |
| **CSELB** | 2002-030 | | | 3 | 0.16 | 45 | 4 | 469 |
| **UDCBF** | 2003-0021 | 2 Flutes | R0.15 | — | 0.21 | 50 | 4 | 80 |
| **UDCB** | 2003-0021 | | | — | 0.21 | 50 | 4 | 94 |
| **HSB** | 2003-0030S | | | — | 0.3 | 35 | 4 | 403 |
| **HGB** | 2003-0030 | | | — | 0.3 | 50 | 4 | 396 |
| **HSB** | 2003-0030 | | | — | 0.3 | 50 | 4 | 398 |
| **CSEB** | 2003-0030 | | | — | 0.3 | 50 | 4 | 406 |
| **HSB** | 2003-0030-6 | | | — | 0.3 | 50 | 6 | 398 |
| **CSEB** | 2003-0030-6 | | | — | 0.3 | 50 | 6 | 406 |
| **HGB** | 2003-0045 | | | — | 0.45 | 50 | 4 | 396 |
| **HSB** | 2003-0045 | | | — | 0.45 | 50 | 4 | 398 |
| **CSEB** | 2003-0045 | | | — | 0.45 | 50 | 4 | 406 |
| **UDCLBF** | 2003-0050 | | | 0.5 | 0.21 | 50 | 4 | 82 |
| **CBN-LBSF** | 2003-005 | | | 0.5 | 0.22 | 50 | 4 | 115 |
| **HSLB** | 2003-005S | | | 0.5 | 0.24 | 35 | 4 | 465 |
| **HGLB** | 2003-005 | | | 0.5 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-005 | | | 0.5 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-005 | | | 0.5 | 0.24 | 45 | 4 | 469 |
| **CBN-LBF** | 2003-005 | | | 0.5 | 0.24 | 50 | 4 | 120 |
| **HSLB** | 2003-006 | | | 0.6 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-006 | | | 0.6 | 0.24 | 45 | 4 | 469 |
| **DLCLB** | 2003-006 | | | 0.6 | 0.24 | 45 | 4 | 488 |
| **UDCLBF** | 2003-0075 | | | 0.75 | 0.21 | 50 | 4 | 82 |
| **CBN-LBSF** | 2003-0075 | | | 0.75 | 0.22 | 50 | 4 | 115 |
| **HSLB** | 2003-0075S | | | 0.75 | 0.24 | 35 | 4 | 465 |
| **HGLB** | 2003-0075 | | | 0.75 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-0075 | | | 0.75 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-0075 | | | 0.75 | 0.24 | 45 | 4 | 469 |
| **CBN-LBF** | 2003-0075 | | | 0.75 | 0.24 | 50 | 4 | 120 |
| **CBN-LBSF** | 2003-009 | | | 0.9 | 0.22 | 50 | 4 | 115 |
| **CBN-LBF** | 2003-009 | | | 0.9 | 0.24 | 50 | 4 | 120 |
| **UDCLBF** | 2003-0100 | | | 1 | 0.21 | 50 | 4 | 82 |
| **HSLB** | 2003-010S | | | 1 | 0.24 | 35 | 4 | 465 |
| **HGLB** | 2003-010 | | | 1 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-010 | | | 1 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-010 | | | 1 | 0.24 | 45 | 4 | 469 |
| **DLCLB** | 2003-010 | 2 Flutes | R0.15 | 1 | 0.24 | 45 | 4 | 488 |
| **HSLB** | 2003-010-6 | | | 1 | 0.24 | 50 | 6 | 447 |
| **CSELB** | 2003-010-6 | | | 1 | 0.24 | 50 | 6 | 469 |
| **HSLB** | 2003-0125 | | | 1.25 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-0125 | | | 1.25 | 0.24 | 45 | 4 | 469 |
| **HSLB** | 2003-015S | | | 1.5 | 0.24 | 35 | 4 | 465 |
| **HGLB** | 2003-015 | | | 1.5 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-015 | | | 1.5 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-015 | | | 1.5 | 0.24 | 45 | 4 | 469 |
| **DLCLB** | 2003-015 | | | 1.5 | 0.24 | 45 | 4 | 488 |
| **CBN-LBF** | 2003-015 | | | 1.5 | 0.24 | 50 | 4 | 120 |
| **HSLB** | 2003-015-6 | | | 1.5 | 0.24 | 50 | 6 | 447 |
| **CSELB** | 2003-015-6 | | | 1.5 | 0.24 | 50 | 6 | 469 |
| **HSLB** | 2003-0175 | | | 1.75 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-0175 | | | 1.75 | 0.24 | 45 | 4 | 469 |
| **HGLB** | 2003-020 | | | 2 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-020 | | | 2 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-020 | | | 2 | 0.24 | 45 | 4 | 469 |
| **DLCLB** | 2003-020 | | | 2 | 0.24 | 45 | 4 | 488 |
| **HSLB** | 2003-020-6 | | | 2 | 0.24 | 50 | 6 | 447 |
| **CSELB** | 2003-020-6 | | | 2 | 0.24 | 50 | 6 | 469 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2003-0225 | 2 Flutes | R0.15 | 2.25 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-0225 | | | 2.25 | 0.24 | 45 | 4 | 469 |
| **HGLB** | 2003-025 | | | 2.5 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-025 | | | 2.5 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-025 | | | 2.5 | 0.24 | 45 | 4 | 469 |
| **HGLB** | 2003-030 | | | 3 | 0.24 | 45 | 4 | 437 |
| **HSLB** | 2003-030 | | | 3 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-030 | | | 3 | 0.24 | 45 | 4 | 469 |
| **HSLB** | 2003-040 | | | 4 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-040 | | | 4 | 0.24 | 45 | 4 | 469 |
| **HSLB** | 2003-050 | | | 5 | 0.24 | 45 | 4 | 447 |
| **CSELB** | 2003-050 | | | 5 | 0.24 | 45 | 4 | 469 |
| **UDCBF** | 2004-0028 | 2 Flutes | R0.2 | — | 0.28 | 50 | 4 | 80 |
| **UDCB** | 2004-0028 | | | — | 0.28 | 50 | 4 | 94 |
| **HSB** | 2004-0040S | | | — | 0.4 | 35 | 4 | 403 |
| **HGB** | 2004-0040 | | | — | 0.4 | 50 | 4 | 396 |
| **HSB** | 2004-0040 | | | — | 0.4 | 50 | 4 | 398 |
| **CSEB** | 2004-0040 | | | — | 0.4 | 50 | 4 | 406 |
| **HSB** | 2004-0040-6 | | | — | 0.4 | 50 | 6 | 398 |
| **CSEB** | 2004-0040-6 | | | — | 0.4 | 50 | 6 | 406 |
| **HGB** | 2004-0060 | | | — | 0.6 | 50 | 4 | 396 |
| **HSB** | 2004-0060 | | | — | 0.6 | 50 | 4 | 398 |
| **CSEB** | 2004-0060 | | | — | 0.6 | 50 | 4 | 406 |
| **CGB** | 2004 | | | — | 0.8 | 60 | 4 | 414 |
| **UDCLBF** | 2004-0050 | | | 0.5 | 0.28 | 50 | 4 | 82 |
| **UDCLB** | 2004-0050 | | | 0.5 | 0.28 | 50 | 4 | 98 |
| **HSLB** | 2004-005S | | | 0.5 | 0.32 | 35 | 4 | 465 |
| **HGLB** | 2004-005 | | | 0.5 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-005 | | | 0.5 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-005 | | | 0.5 | 0.32 | 45 | 4 | 469 |
| **CBN-LBF** | 2004-005 | | | 0.5 | 0.32 | 50 | 4 | 121 |
| **HGLB** | 2004-0075 | | | 0.75 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-0075 | | | 0.75 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-0075 | | | 0.75 | 0.32 | 45 | 4 | 469 |
| **CBN-LBSF** | 2004-0075 | | | 0.75 | 0.32 | 50 | 4 | 115 |
| **CBN-LBF** | 2004-0075 | | | 0.75 | 0.32 | 50 | 4 | 121 |
| **UPDLB** | 1004-008 | 1 Flutes | | 0.8 | 0.2 | 40 | 4 | 434 |
| **UDCLBF** | 2004-0100 | 2 Flutes | | 1 | 0.28 | 50 | 4 | 82 |
| **UDCLB** | 2004-0100 | | | 1 | 0.28 | 50 | 4 | 98 |
| **HSLB** | 2004-010S | | | 1 | 0.32 | 35 | 4 | 465 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HGLB** | 2004-010 | 2 Flutes | R0.2 | 1 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-010 | | | 1 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-010 | | | 1 | 0.32 | 45 | 4 | 469 |
| **DLCLB** | 2004-010 | | | 1 | 0.32 | 45 | 4 | 488 |
| **CBN-LBSF** | 2004-010 | | | 1 | 0.32 | 50 | 4 | 115 |
| **CBN-LBF** | 2004-010 | | | 1 | 0.32 | 50 | 4 | 121 |
| **HGLB** | 2004-010-6 | | | 1 | 0.32 | 50 | 6 | 437 |
| **HSLB** | 2004-010-6 | | | 1 | 0.32 | 50 | 6 | 447 |
| **CSELB** | 2004-010-6 | | | 1 | 0.32 | 50 | 6 | 469 |
| **CPRB** | 2004-1 | | | 1 | 0.4 | 45 | 4 | 498 |
| **CBN-LBSF** | 2004-012 | | | 1.2 | 0.32 | 50 | 4 | 115 |
| **CBN-LBF** | 2004-012 | | | 1.2 | 0.32 | 50 | 4 | 121 |
| **HGLB** | 2004-0125 | | | 1.25 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-0125 | | | 1.25 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-0125 | | | 1.25 | 0.32 | 45 | 4 | 469 |
| **UDCLBF** | 2004-0150 | | | 1.5 | 0.28 | 50 | 4 | 82 |
| **UDCLB** | 2004-0150 | | | 1.5 | 0.28 | 50 | 4 | 98 |
| **HSLB** | 2004-015S | | | 1.5 | 0.32 | 35 | 4 | 465 |
| **HGLB** | 2004-015 | | | 1.5 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-015 | | | 1.5 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-015 | | | 1.5 | 0.32 | 45 | 4 | 469 |
| **HGLB** | 2004-015-6 | | | 1.5 | 0.32 | 50 | 6 | 437 |
| **HSLB** | 2004-015-6 | | | 1.5 | 0.32 | 50 | 6 | 447 |
| **CSELB** | 2004-015-6 | | | 1.5 | 0.32 | 50 | 6 | 469 |
| **HSLB** | 2004-0175 | | | 1.75 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-0175 | | | 1.75 | 0.32 | 45 | 4 | 469 |
| **UDCLBF** | 2004-0200 | | | 2 | 0.28 | 50 | 4 | 82 |
| **UDCLB** | 2004-0200 | | | 2 | 0.28 | 50 | 4 | 98 |
| **HSLB** | 2004-020S | | | 2 | 0.32 | 35 | 4 | 465 |
| **HGLB** | 2004-020 | | | 2 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-020 | | | 2 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-020 | | | 2 | 0.32 | 45 | 4 | 469 |
| **DCLB** | 2004-0020 | | | 2 | 0.32 | 45 | 4 | 484 |
| **DLCLB** | 2004-020 | | | 2 | 0.32 | 45 | 4 | 488 |
| **CBN-LBF** | 2004-020 | | | 2 | 0.32 | 50 | 4 | 121 |
| **HGLB** | 2004-020-6 | | | 2 | 0.32 | 50 | 6 | 437 |
| **HSLB** | 2004-020-6 | | | 2 | 0.32 | 50 | 6 | 447 |
| **CSELB** | 2004-020-6 | | | 2 | 0.32 | 50 | 6 | 469 |
| **CPRB** | 2004-2 | | | 2 | 0.4 | 45 | 4 | 498 |
| **HSLB** | 2004-0225 | | | 2.25 | 0.32 | 45 | 4 | 447 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2004-0225 | 2 Flutes | R0.2 | 2.25 | 0.32 | 45 | 4 | 469 |
| **UDCLBF** | 2004-0250 | | | 2.5 | 0.28 | 50 | 4 | 82 |
| **HSLB** | 2004-025S | | | 2.5 | 0.32 | 35 | 4 | 465 |
| **HGLB** | 2004-025 | | | 2.5 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-025 | | | 2.5 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-025 | | | 2.5 | 0.32 | 45 | 4 | 469 |
| **HGLB** | 2004-025-6 | | | 2.5 | 0.32 | 50 | 6 | 437 |
| **HSLB** | 2004-025-6 | | | 2.5 | 0.32 | 50 | 6 | 447 |
| **CSELB** | 2004-025-6 | | | 2.5 | 0.32 | 50 | 6 | 469 |
| **HSLB** | 2004-030S | | | 3 | 0.32 | 35 | 4 | 465 |
| **HGLB** | 2004-030 | | | 3 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-030 | | | 3 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-030 | | | 3 | 0.32 | 45 | 4 | 469 |
| **DCLB** | 2004-0030 | | | 3 | 0.32 | 45 | 4 | 484 |
| **DLCLB** | 2004-030 | | | 3 | 0.32 | 45 | 4 | 488 |
| **CBN-LBF** | 2004-030 | | | 3 | 0.32 | 50 | 4 | 121 |
| **HGLB** | 2004-030-6 | | | 3 | 0.32 | 50 | 6 | 437 |
| **HSLB** | 2004-030-6 | | | 3 | 0.32 | 50 | 6 | 447 |
| **CSELB** | 2004-030-6 | | | 3 | 0.32 | 50 | 6 | 469 |
| **CPRB** | 2004-3 | | | 3 | 0.4 | 45 | 4 | 498 |
| **HGLB** | 2004-035 | | | 3.5 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-035 | | | 3.5 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-035 | | | 3.5 | 0.32 | 45 | 4 | 469 |
| **HGLB** | 2004-040 | | | 4 | 0.32 | 45 | 4 | 437 |
| **HSLB** | 2004-040 | | | 4 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-040 | | | 4 | 0.32 | 45 | 4 | 469 |
| **DCLB** | 2004-0040 | | | 4 | 0.32 | 45 | 4 | 484 |
| **DLCLB** | 2004-040 | | | 4 | 0.32 | 45 | 4 | 488 |
| **HSLB** | 2004-040-6 | | | 4 | 0.32 | 50 | 6 | 447 |
| **CSELB** | 2004-040-6 | | | 4 | 0.32 | 50 | 6 | 469 |
| **HSLB** | 2004-045 | | | 4.5 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-045 | | | 4.5 | 0.32 | 45 | 4 | 469 |
| **HSLB** | 2004-050 | | | 5 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-050 | | | 5 | 0.32 | 45 | 4 | 469 |
| **DCLB** | 2004-0050 | | | 5 | 0.32 | 45 | 4 | 484 |
| **HSLB** | 2004-060 | | | 6 | 0.32 | 45 | 4 | 447 |
| **CSELB** | 2004-060 | | | 6 | 0.32 | 45 | 4 | 469 |
| **UDCBF** | 2005-0035 | 2 Flutes | R0.25 | — | 0.35 | 50 | 4 | 80 |
| **UDCB** | 2005-0035 | | | — | 0.35 | 50 | 4 | 94 |
| **HGB** | 2005-0050 | | | — | 0.5 | 50 | 4 | 396 |
| **HSB** | 2005-0050 | | | — | 0.5 | 50 | 4 | 398 |
| **CSEB** | 2005-0050 | | | — | 0.5 | 50 | 4 | 406 |
| **HSB** | 2005-0050-6 | | | — | 0.5 | 50 | 6 | 398 |
| **CSEB** | 2005-0050-6 | | | — | 0.5 | 50 | 6 | 406 |
| **HGB** | 2005-0075 | | | — | 0.75 | 50 | 4 | 396 |
| **HSB** | 2005-0075 | | | — | 0.75 | 50 | 4 | 398 |
| **CSEB** | 2005-0075 | | | — | 0.75 | 50 | 4 | 406 |
| **HSLB** | 2005-010S | | | 1 | 0.4 | 35 | 4 | 465 |
| **HGLB** | 2005-010 | | | 1 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-010 | | | 1 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-010 | | | 1 | 0.4 | 45 | 4 | 470 |
| **DLCLB** | 2005-010 | | | 1 | 0.4 | 45 | 4 | 488 |
| **CBN-LBSF** | 2005-010 | | | 1 | 0.4 | 50 | 4 | 115 |
| **CBN-LBF** | 2005-010 | | | 1 | 0.4 | 50 | 4 | 121 |
| **HSLB** | 2005-0125 | | | 1.25 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-0125 | | | 1.25 | 0.4 | 45 | 4 | 470 |
| **HSLB** | 2005-015S | | | 1.5 | 0.4 | 35 | 4 | 465 |
| **HGLB** | 2005-015 | | | 1.5 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-015 | | | 1.5 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-015 | 2 Flutes | R0.25 | 1.5 | 0.4 | 45 | 4 | 470 |
| **CBN-LBSF** | 2005-015 | | | 1.5 | 0.4 | 50 | 4 | 115 |
| **CBN-LBF** | 2005-015 | | | 1.5 | 0.4 | 50 | 4 | 121 |
| **HSLB** | 2005-015-6 | | | 1.5 | 0.4 | 50 | 6 | 448 |
| **CSELB** | 2005-015-6 | | | 1.5 | 0.4 | 50 | 6 | 470 |
| **HSLB** | 2005-0175 | | | 1.75 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-0175 | | | 1.75 | 0.4 | 45 | 4 | 470 |
| **HSLB** | 2005-020S | | | 2 | 0.4 | 35 | 4 | 465 |
| **HGLB** | 2005-020 | | | 2 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-020 | | | 2 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-020 | | | 2 | 0.4 | 45 | 4 | 470 |
| **DCLB** | 2005-0020 | | | 2 | 0.4 | 45 | 4 | 484 |
| **DLCLB** | 2005-020 | | | 2 | 0.4 | 45 | 4 | 488 |
| **HSLB** | 2005-020-6 | | | 2 | 0.4 | 50 | 6 | 448 |
| **CSELB** | 2005-020-6 | | | 2 | 0.4 | 50 | 6 | 470 |
| **CPRB** | 2005-2 | | | 2 | 0.8 | 45 | 4 | 498 |
| **HSLB** | 2005-0225 | | | 2.25 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-0225 | | | 2.25 | 0.4 | 45 | 4 | 470 |
| **HSLB** | 2005-025S | | | 2.5 | 0.4 | 35 | 4 | 465 |
| **HGLB** | 2005-025 | | | 2.5 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-025 | | | 2.5 | 0.4 | 45 | 4 | 448 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2005-025 | 2 Flutes | R0.25 | 2.5 | 0.4 | 45 | 4 | 470 |
| **CBN-LBF** | 2005-025 | | | 2.5 | 0.4 | 50 | 4 | 121 |
| **HSLB** | 2005-025-6 | | | 2.5 | 0.4 | 50 | 6 | 448 |
| **CSELB** | 2005-025-6 | | | 2.5 | 0.4 | 50 | 6 | 470 |
| **HSLB** | 2005-030S | | | 3 | 0.4 | 35 | 4 | 465 |
| **HGLB** | 2005-030 | | | 3 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-030 | | | 3 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-030 | | | 3 | 0.4 | 45 | 4 | 470 |
| **DCLB** | 2005-0030 | | | 3 | 0.4 | 45 | 4 | 484 |
| **DLCLB** | 2005-030 | | | 3 | 0.4 | 45 | 4 | 488 |
| **HSLB** | 2005-030-6 | | | 3 | 0.4 | 50 | 6 | 448 |
| **CSELB** | 2005-030-6 | | | 3 | 0.4 | 50 | 6 | 470 |
| **HGLB** | 2005-035 | | | 3.5 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-035 | | | 3.5 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-035 | | | 3.5 | 0.4 | 45 | 4 | 470 |
| **CBN-LBF** | 2005-035 | | | 3.5 | 0.4 | 50 | 4 | 121 |
| **HGLB** | 2005-040 | | | 4 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-040 | | | 4 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-040 | | | 4 | 0.4 | 45 | 4 | 470 |
| **DLCLB** | 2005-040 | | | 4 | 0.4 | 45 | 4 | 488 |
| **HSLB** | 2005-040-6 | | | 4 | 0.4 | 50 | 6 | 448 |
| **CSELB** | 2005-040-6 | | | 4 | 0.4 | 50 | 6 | 470 |
| **CPRB** | 2005-4 | | | 4 | 0.8 | 45 | 4 | 498 |
| **HGLB** | 2005-045 | | | 4.5 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-045 | | | 4.5 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-045 | | | 4.5 | 0.4 | 45 | 4 | 470 |
| **HGLB** | 2005-050 | | | 5 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-050 | | | 5 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-050 | | | 5 | 0.4 | 45 | 4 | 470 |
| **DLCLB** | 2005-050 | | | 5 | 0.4 | 45 | 4 | 488 |
| **HSLB** | 2005-055 | | | 5.5 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-055 | | | 5.5 | 0.4 | 45 | 4 | 470 |
| **HGLB** | 2005-060 | | | 6 | 0.4 | 45 | 4 | 437 |
| **HSLB** | 2005-060 | | | 6 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-060 | | | 6 | 0.4 | 45 | 4 | 470 |
| **DCLB** | 2005-0060 | | | 6 | 0.4 | 45 | 4 | 484 |
| **CPRB** | 2005-6 | | | 6 | 0.8 | 45 | 4 | 498 |
| **HSLB** | 2005-070 | | | 7 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-070 | | | 7 | 0.4 | 45 | 4 | 470 |
| **HSLB** | 2005-080 | | | 8 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-080 | 2 Flutes | R0.25 | 8 | 0.4 | 45 | 4 | 470 |
| **CPRB** | 2005-8 | | | 8 | 0.8 | 45 | 4 | 498 |
| **HSLB** | 2005-090 | | | 9 | 0.4 | 45 | 4 | 448 |
| **CSELB** | 2005-090 | | | 9 | 0.4 | 45 | 4 | 470 |
| **DCLB** | 2005-0100 | | | 10 | 0.4 | 45 | 4 | 484 |
| **HSLB** | 2005-100 | | | 10 | 0.4 | 50 | 4 | 448 |
| **CSELB** | 2005-100 | | | 10 | 0.4 | 50 | 4 | 470 |
| **CPRB** | 2005-10 | | | 10 | 0.8 | 50 | 4 | 498 |
| **UDCBF** | 2006-0042 | 2 Flutes | R0.3 | – | 0.42 | 50 | 4 | 80 |
| **UDCB** | 2006-0042 | | | – | 0.42 | 50 | 4 | 94 |
| **HSB** | 2006-0060S | | | – | 0.6 | 35 | 4 | 403 |
| **HGB** | 2006-0060 | | | – | 0.6 | 50 | 4 | 396 |
| **HSB** | 2006-0060 | | | – | 0.6 | 50 | 4 | 399 |
| **CSEB** | 2006-0060 | | | – | 0.6 | 50 | 4 | 406 |
| **HSB** | 2006-0060-6 | | | – | 0.6 | 50 | 6 | 399 |
| **CSEB** | 2006-0060-6 | | | – | 0.6 | 50 | 6 | 406 |
| **HGB** | 2006-0090 | | | – | 0.9 | 50 | 4 | 396 |
| **HSB** | 2006-0090 | | | – | 0.9 | 50 | 4 | 399 |
| **CSEB** | 2006-0090 | | | – | 0.9 | 50 | 4 | 406 |
| **CGB** | 2006 | | | – | 1.2 | 60 | 4 | 414 |
| **CFB** | 3006-0090 | 3 Flutes | | – | 0.9 | 50 | 4 | 416 |
| **DLC-CFB** | 3006-0090 | | | – | 0.9 | 50 | 4 | 422 |
| **UPDLB** | 1006-010 | 1 Flutes | | 1 | 0.3 | 40 | 4 | 434 |
| **UDCLBF** | 2006-0100 | 2 Flutes | | 1 | 0.42 | 50 | 4 | 83 |
| **UDCLB** | 2006-0100 | | | 1 | 0.42 | 50 | 4 | 98 |
| **HSLB** | 2006-010S | | | 1 | 0.48 | 35 | 4 | 465 |
| **HGLB** | 2006-010 | | | 1 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-010 | | | 1 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-010 | | | 1 | 0.48 | 45 | 4 | 470 |
| **DLCLB** | 2006-010 | | | 1 | 0.48 | 45 | 4 | 490 |
| **CBN-LBSF** | 2006-010 | | | 1 | 0.48 | 50 | 4 | 115 |
| **CBN-LBF** | 2006-010 | | | 1 | 0.48 | 50 | 4 | 121 |
| **HSLB** | 2006-0125 | | | 1.25 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-0125 | | | 1.25 | 0.48 | 45 | 4 | 470 |
| **UDCLBF** | 2006-0150 | | | 1.5 | 0.42 | 50 | 4 | 83 |
| **UDCLB** | 2006-0150 | | | 1.5 | 0.42 | 50 | 4 | 98 |
| **HSLB** | 2006-015S | | | 1.5 | 0.48 | 35 | 4 | 465 |
| **HGLB** | 2006-015 | | | 1.5 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-015 | | | 1.5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-015 | | | 1.5 | 0.48 | 45 | 4 | 470 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CBN-LBSF** | 2006-015 | 2 Flutes | R0.3 | 1.5 | 0.48 | 50 | 4 | 115 |
| **CBN-LBF** | 2006-015 | | | 1.5 | 0.48 | 50 | 4 | 121 |
| **HGLB** | 2006-015-6 | | | 1.5 | 0.48 | 50 | 6 | 438 |
| **HSLB** | 2006-015-6 | | | 1.5 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-015-6 | | | 1.5 | 0.48 | 50 | 6 | 470 |
| **HSLB** | 2006-0175 | | | 1.75 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-0175 | | | 1.75 | 0.48 | 45 | 4 | 470 |
| **UDCLBF** | 2006-0200 | | | 2 | 0.42 | 50 | 4 | 83 |
| **UDCLB** | 2006-0200 | | | 2 | 0.42 | 50 | 4 | 98 |
| **HSLB** | 2006-020S | | | 2 | 0.48 | 35 | 4 | 465 |
| **HGLB** | 2006-020 | | | 2 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-020 | | | 2 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-020 | | | 2 | 0.48 | 45 | 4 | 470 |
| **DCLB** | 2006-0020 | | | 2 | 0.48 | 45 | 4 | 484 |
| **DLCLB** | 2006-020 | | | 2 | 0.48 | 45 | 4 | 490 |
| **CFLB** | 3006-020 | | | 2 | 0.48 | 50 | 4 | 502 |
| **CBN-LBSF** | 2006-020 | | | 2 | 0.48 | 50 | 4 | 115 |
| **HGLB** | 2006-020-6 | | | 2 | 0.48 | 50 | 6 | 438 |
| **HSLB** | 2006-020-6 | | | 2 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-020-6 | | | 2 | 0.48 | 50 | 6 | 470 |
| **CPRB** | 2006-2 | | | 2 | 1 | 45 | 4 | 498 |
| **HSLB** | 2006-0225 | | | 2.25 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-0225 | | | 2.25 | 0.48 | 45 | 4 | 470 |
| **HGLB** | 2006-025 | | | 2.5 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-025 | | | 2.5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-025 | | | 2.5 | 0.48 | 45 | 4 | 470 |
| **HGLB** | 2006-025-6 | | | 2.5 | 0.48 | 50 | 6 | 438 |
| **HSLB** | 2006-025-6 | | | 2.5 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-025-6 | | | 2.5 | 0.48 | 50 | 6 | 470 |
| **UDCLBF** | 2006-0300 | | | 3 | 0.42 | 50 | 4 | 83 |
| **UDCLB** | 2006-0300 | | | 3 | 0.42 | 50 | 4 | 98 |
| **HSLB** | 2006-030S | | | 3 | 0.48 | 35 | 4 | 465 |
| **HGLB** | 2006-030 | | | 3 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-030 | | | 3 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-030 | | | 3 | 0.48 | 45 | 4 | 470 |
| **DCLB** | 2006-0030 | | | 3 | 0.48 | 45 | 4 | 484 |
| **DLCLB** | 2006-030 | | | 3 | 0.48 | 45 | 4 | 490 |
| **CFLB** | 3006-030 | | | 3 | 0.48 | 50 | 4 | 502 |
| **CBN-LBF** | 2006-030 | | | 3 | 0.48 | 50 | 4 | 121 |
| **HGLB** | 2006-030-6 | | | 3 | 0.48 | 50 | 6 | 438 |
| **HSLB** | 2006-030-6 | 2 Flutes | R0.3 | 3 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-030-6 | | | 3 | 0.48 | 50 | 6 | 470 |
| **HGLB** | 2006-035 | | | 3.5 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-035 | | | 3.5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-035 | | | 3.5 | 0.48 | 45 | 4 | 470 |
| **UDCLBF** | 2006-0400 | | | 4 | 0.42 | 50 | 4 | 83 |
| **HSLB** | 2006-040S | | | 4 | 0.48 | 40 | 4 | 465 |
| **HGLB** | 2006-040 | | | 4 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-040 | | | 4 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-040 | | | 4 | 0.48 | 45 | 4 | 470 |
| **DCLB** | 2006-0040 | | | 4 | 0.48 | 45 | 4 | 484 |
| **DLCLB** | 2006-040 | | | 4 | 0.48 | 45 | 4 | 490 |
| **CBN-LBF** | 2006-040 | | | 4 | 0.48 | 50 | 4 | 121 |
| **HSLB** | 2006-040-6 | | | 4 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-040-6 | | | 4 | 0.48 | 50 | 6 | 470 |
| **CPRB** | 2006-4 | | | 4 | 1 | 45 | 4 | 498 |
| **CFLB** | 3006-040 | 3 Flutes | | 4 | 0.48 | 50 | 4 | 502 |
| **HGLB** | 2006-045 | 2 Flutes | R0.3 | 4.5 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-045 | | | 4.5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-045 | | | 4.5 | 0.48 | 45 | 4 | 470 |
| **UDCLBF** | 2006-0500 | | | 5 | 0.42 | 50 | 4 | 83 |
| **HSLB** | 2006-050S | | | 5 | 0.48 | 40 | 4 | 465 |
| **HGLB** | 2006-050 | | | 5 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-050 | | | 5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-050 | | | 5 | 0.48 | 45 | 4 | 470 |
| **DLCLB** | 2006-050 | | | 5 | 0.48 | 45 | 4 | 490 |
| **CBN-LBF** | 2006-050 | | | 5 | 0.48 | 50 | 4 | 121 |
| **HSLB** | 2006-050-6 | | | 5 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-050-6 | | | 5 | 0.48 | 50 | 6 | 470 |
| **HGLB** | 2006-055 | | | 5.5 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-055 | | | 5.5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-055 | | | 5.5 | 0.48 | 45 | 4 | 470 |
| **UDCLBF** | 2006-0600 | | | 6 | 0.42 | 50 | 4 | 83 |
| **HSLB** | 2006-060S | | | 6 | 0.48 | 40 | 4 | 465 |
| **HGLB** | 2006-060 | | | 6 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-060 | | | 6 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-060 | | | 6 | 0.48 | 45 | 4 | 470 |
| **DCLB** | 2006-0060 | | | 6 | 0.48 | 45 | 4 | 484 |
| **DLCLB** | 2006-060 | | | 6 | 0.48 | 45 | 4 | 490 |
| **CBN-LBF** | 2006-060 | | | 6 | 0.48 | 50 | 4 | 121 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2006-060-6 | 2 Flutes | R0.3 | 6 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-060-6 | | | 6 | 0.48 | 50 | 6 | 470 |
| **CPRB** | 2006-6 | | | 6 | 1 | 45 | 4 | 498 |
| **CFLB** | 3006-060 | 3 Flutes | | 6 | 0.48 | 50 | 4 | 502 |
| **HSLB** | 2006-065 | 2 Flutes | | 6.5 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-065 | | | 6.5 | 0.48 | 45 | 4 | 470 |
| **HSLB** | 2006-070 | | | 7 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-070 | | | 7 | 0.48 | 45 | 4 | 470 |
| **HGLB** | 2006-080 | | | 8 | 0.48 | 45 | 4 | 438 |
| **HSLB** | 2006-080 | | | 8 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-080 | | | 8 | 0.48 | 45 | 4 | 470 |
| **HSLB** | 2006-080-6 | | | 8 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-080-6 | | | 8 | 0.48 | 50 | 6 | 470 |
| **CPRB** | 2006-8 | | | 8 | 1 | 45 | 4 | 498 |
| **HSLB** | 2006-090 | | | 9 | 0.48 | 45 | 4 | 448 |
| **CSELB** | 2006-090 | | | 9 | 0.48 | 45 | 4 | 470 |
| **HGLB** | 2006-100 | | | 10 | 0.48 | 45 | 4 | 438 |
| **DCLB** | 2006-0100 | | | 10 | 0.48 | 45 | 4 | 484 |
| **HSLB** | 2006-100 | | | 10 | 0.48 | 50 | 4 | 448 |
| **CSELB** | 2006-100 | | | 10 | 0.48 | 50 | 4 | 470 |
| **HSLB** | 2006-100-6 | | | 10 | 0.48 | 50 | 6 | 448 |
| **CSELB** | 2006-100-6 | | | 10 | 0.48 | 50 | 6 | 470 |
| **DCLB** | 2006-0120 | | | 12 | 0.48 | 45 | 4 | 484 |
| **HSLB** | 2006-120 | | | 12 | 0.48 | 50 | 4 | 448 |
| **CSELB** | 2006-120 | | | 12 | 0.48 | 50 | 4 | 470 |
| **UDCBF** | 2007-0049 | 2 Flutes | R0.35 | — | 0.49 | 50 | 4 | 80 |
| **UDCB** | 2007-0049 | | | — | 0.49 | 50 | 4 | 94 |
| **HSB** | 2007-0100 | | | — | 1 | 50 | 4 | 399 |
| **CSEB** | 2007-0100 | | | — | 1 | 50 | 4 | 406 |
| **HSLB** | 2007-020 | | | 2 | 0.56 | 45 | 4 | 449 |
| **CSELB** | 2007-020 | | | 2 | 0.56 | 45 | 4 | 471 |
| **HSLB** | 2007-040 | | | 4 | 0.56 | 45 | 4 | 449 |
| **CSELB** | 2007-040 | | | 4 | 0.56 | 45 | 4 | 471 |
| **HSLB** | 2007-060 | | | 6 | 0.56 | 45 | 4 | 449 |
| **CSELB** | 2007-060 | | | 6 | 0.56 | 45 | 4 | 471 |
| **HSLB** | 2007-080 | | | 8 | 0.56 | 45 | 4 | 449 |
| **CSELB** | 2007-080 | | | 8 | 0.56 | 45 | 4 | 471 |
| **UDCBH** | 2008-0056 | 2 Flutes | R0.4 | — | 0.56 | 50 | 4 | 78 |
| **UDCBF** | 2008-0056 | | | — | 0.56 | 50 | 4 | 80 |
| **UDCB** | 2008-0056 | | | — | 0.56 | 50 | 4 | 94 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSB** | 2008-0080S | 2 Flutes | R0.4 | — | 0.8 | 35 | 4 | 403 |
| **HSB** | 2008-0080 | | | — | 0.8 | 50 | 4 | 399 |
| **CSEB** | 2008-0080 | | | — | 0.8 | 50 | 4 | 406 |
| **HSB** | 2008-0080-6 | | | — | 0.8 | 50 | 6 | 399 |
| **CSEB** | 2008-0080-6 | | | — | 0.8 | 50 | 6 | 406 |
| **HGB** | 2008-0120 | | | — | 1.2 | 50 | 4 | 396 |
| **HSB** | 2008-0120 | | | — | 1.2 | 50 | 4 | 399 |
| **CSEB** | 2008-0120 | | | — | 1.2 | 50 | 4 | 406 |
| **CFB** | 3008-0120 | 3 Flutes | | — | 1.2 | 50 | 4 | 416 |
| **DLC-CFB** | 3008-0120 | | | — | 1.2 | 50 | 4 | 422 |
| **UDCLBF** | 2008-0200 | 2 Flutes | | 2 | 0.56 | 50 | 4 | 83 |
| **UDCLB** | 2008-0200 | | | 2 | 0.56 | 50 | 4 | 98 |
| **CBN-LBSF** | 2008-020 | | | 2 | 0.6 | 50 | 4 | 115 |
| **CBN-LBF** | 2008-020 | | | 2 | 0.6 | 50 | 4 | 121 |
| **HSLB** | 2008-020S | | | 2 | 0.64 | 35 | 4 | 465 |
| **HGLB** | 2008-020 | | | 2 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-020 | | | 2 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-020 | | | 2 | 0.64 | 45 | 4 | 471 |
| **DLCLB** | 2008-020 | | | 2 | 0.64 | 45 | 4 | 490 |
| **HSLB** | 2008-020-6 | | | 2 | 0.64 | 50 | 6 | 449 |
| **CSELB** | 2008-020-6 | | | 2 | 0.64 | 50 | 6 | 471 |
| **CPRB** | 2008-2 | | | 2 | 1.1 | 45 | 4 | 498 |
| **HGLB** | 2008-025 | | | 2.5 | 0.64 | 45 | 4 | 438 |
| **UDCLBF** | 2008-0300 | | | 3 | 0.56 | 50 | 4 | 83 |
| **UDCLB** | 2008-0300 | | | 3 | 0.56 | 50 | 4 | 98 |
| **HSLB** | 2008-030S | | | 3 | 0.64 | 35 | 4 | 465 |
| **HGLB** | 2008-030 | | | 3 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-030 | | | 3 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-030 | | | 3 | 0.64 | 45 | 4 | 471 |
| **DLCLB** | 2008-030 | | | 3 | 0.64 | 45 | 4 | 490 |
| **HSLB** | 2008-030-6 | | | 3 | 0.64 | 50 | 6 | 449 |
| **CSELB** | 2008-030-6 | | | 3 | 0.64 | 50 | 6 | 471 |
| **UDCLBF** | 2008-0400 | | | 4 | 0.56 | 50 | 4 | 83 |
| **UDCLB** | 2008-0400 | | | 4 | 0.56 | 50 | 4 | 98 |
| **CBN-LBSF** | 2008-040 | | | 4 | 0.6 | 50 | 4 | 115 |
| **CBN-LBF** | 2008-040 | | | 4 | 0.6 | 50 | 4 | 121 |
| **HSLB** | 2008-040S | | | 4 | 0.64 | 35 | 4 | 465 |
| **HGLB** | 2008-040 | | | 4 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-040 | | | 4 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-040 | | | 4 | 0.64 | 45 | 4 | 471 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **DLCLB** | 2008-040 | 2 Flutes | R0.4 | 4 | 0.64 | 45 | 4 | 490 |
| **HSLB** | 2008-040-6 | | | 4 | 0.64 | 50 | 6 | 449 |
| **CSELB** | 2008-040-6 | | | 4 | 0.64 | 50 | 6 | 471 |
| **CPRB** | 2008-4 | | | 4 | 1.1 | 45 | 4 | 498 |
| **CFLB** | 3008-040 | 3 Flutes | | 4 | 0.64 | 50 | 4 | 502 |
| **UDCLBF** | 2008-0500 | 2 Flutes | | 5 | 0.56 | 50 | 4 | 83 |
| **HGLB** | 2008-050 | | | 5 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-050 | | | 5 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-050 | | | 5 | 0.64 | 45 | 4 | 471 |
| **UDCLBF** | 2008-0600 | | | 6 | 0.56 | 50 | 4 | 83 |
| **CBN-LBF** | 2008-060 | | | 6 | 0.6 | 50 | 4 | 121 |
| **HSLB** | 2008-060S | | | 6 | 0.64 | 40 | 4 | 465 |
| **HGLB** | 2008-060 | | | 6 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-060 | | | 6 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-060 | | | 6 | 0.64 | 45 | 4 | 471 |
| **DLCLB** | 2008-060 | | | 6 | 0.64 | 45 | 4 | 490 |
| **HSLB** | 2008-060-6 | | | 6 | 0.64 | 50 | 6 | 449 |
| **CSELB** | 2008-060-6 | | | 6 | 0.64 | 50 | 6 | 471 |
| **CPRB** | 2008-6 | | | 6 | 1.1 | 45 | 4 | 498 |
| **CFLB** | 3008-060 | 3 Flutes | | 6 | 0.64 | 50 | 4 | 502 |
| **HGLB** | 2008-070 | 2 Flutes | | 7 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-070 | | | 7 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-070 | | | 7 | 0.64 | 45 | 4 | 471 |
| **UDCLBF** | 2008-0800 | | | 8 | 0.56 | 50 | 4 | 83 |
| **HGLB** | 2008-080 | | | 8 | 0.64 | 45 | 4 | 438 |
| **HSLB** | 2008-080 | | | 8 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-080 | | | 8 | 0.64 | 45 | 4 | 471 |
| **DLCLB** | 2008-080 | | | 8 | 0.64 | 45 | 4 | 490 |
| **HSLB** | 2008-080-6 | | | 8 | 0.64 | 50 | 6 | 449 |
| **CSELB** | 2008-080-6 | | | 8 | 0.64 | 50 | 6 | 471 |
| **CPRB** | 2008-8 | | | 8 | 1.1 | 45 | 4 | 498 |
| **CFLB** | 3008-080 | 3 Flutes | | 8 | 0.64 | 50 | 4 | 502 |
| **HSLB** | 2008-090 | 2 Flutes | | 9 | 0.64 | 45 | 4 | 449 |
| **CSELB** | 2008-090 | | | 9 | 0.64 | 45 | 4 | 471 |
| **DCLB** | 2008-0100 | | | 10 | 0.64 | 45 | 4 | 484 |
| **HSLB** | 2008-100 | | | 10 | 0.64 | 50 | 4 | 449 |
| **CSELB** | 2008-100 | | | 10 | 0.64 | 50 | 4 | 471 |
| **HSLB** | 2008-100-6 | | | 10 | 0.64 | 50 | 6 | 449 |
| **CSELB** | 2008-100-6 | | | 10 | 0.64 | 50 | 6 | 471 |
| **CPRB** | 2008-10 | | | 10 | 1.1 | 50 | 4 | 498 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2008-120 | 2 Flutes | R0.4 | 12 | 0.64 | 45 | 4 | 471 |
| **HSLB** | 2008-120 | | | 12 | 0.64 | 50 | 4 | 449 |
| **DCLB** | 2008-0120 | | | 12 | 0.64 | 50 | 4 | 484 |
| **HSLB** | 2008-160 | | | 16 | 0.64 | 50 | 4 | 449 |
| **CSELB** | 2008-160 | | | 16 | 0.64 | 50 | 4 | 471 |
| **DCLB** | 2008-0160 | | | 16 | 0.64 | 50 | 4 | 484 |
| **UDCBF** | 2009-0063 | 2 Flutes | R0.45 | — | 0.63 | 50 | 4 | 80 |
| **UDCB** | 2009-0063 | | | — | 0.63 | 50 | 4 | 94 |
| **HSB** | 2009-0130 | | | — | 1.3 | 50 | 4 | 399 |
| **CSEB** | 2009-0130 | | | — | 1.3 | 50 | 4 | 407 |
| **HSLB** | 2009-020 | | | 2 | 0.72 | 45 | 4 | 449 |
| **CSELB** | 2009-020 | | | 2 | 0.72 | 45 | 4 | 471 |
| **HSLB** | 2009-040 | | | 4 | 0.72 | 45 | 4 | 449 |
| **CSELB** | 2009-040 | | | 4 | 0.72 | 45 | 4 | 471 |
| **HSLB** | 2009-060 | | | 6 | 0.72 | 45 | 4 | 449 |
| **CSELB** | 2009-060 | | | 6 | 0.72 | 45 | 4 | 471 |
| **HSLB** | 2009-080 | | | 8 | 0.72 | 45 | 4 | 449 |
| **CSELB** | 2009-080 | | | 8 | 0.72 | 45 | 4 | 471 |
| **HSLB** | 2009-100 | | | 10 | 0.72 | 45 | 4 | 449 |
| **CSELB** | 2009-100 | | | 10 | 0.72 | 45 | 4 | 471 |
| **CSELB** | 2009-120 | | | 12 | 0.72 | 45 | 4 | 471 |
| **HSLB** | 2009-120 | | | 12 | 0.72 | 50 | 4 | 449 |
| **HSLB** | 2009-140 | | | 14 | 0.72 | 50 | 4 | 449 |
| **CSELB** | 2009-140 | | | 14 | 0.72 | 50 | 4 | 471 |
| **HSLB** | 2009-160 | | | 16 | 0.72 | 50 | 4 | 449 |
| **CSELB** | 2009-160 | | | 16 | 0.72 | 50 | 4 | 471 |
| **HSLB** | 2009-180 | | | 18 | 0.72 | 55 | 4 | 449 |
| **CSELB** | 2009-180 | | | 18 | 0.72 | 55 | 4 | 471 |
| **UDCBH** | 2010-0070 | 2 Flutes | R0.5 | — | 0.7 | 50 | 4 | 78 |
| **UDCBF** | 2010-0070 | | | — | 0.7 | 50 | 4 | 80 |
| **UDCB** | 2010-0070 | | | — | 0.7 | 50 | 4 | 94 |
| **HSB** | 2010-0100S | | | — | 1 | 35 | 4 | 403 |
| **HSB** | 2010-0100 | | | — | 1 | 50 | 4 | 399 |
| **CSEB** | 2010-0100 | | | — | 1 | 50 | 4 | 407 |
| **HSB** | 2010-0100-6 | | | — | 1 | 50 | 6 | 399 |
| **CSEB** | 2010-0100-6 | | | — | 1 | 50 | 6 | 407 |
| **HGB** | 2010-0150 | | | — | 1.5 | 50 | 4 | 396 |
| **HSB** | 2010-0150 | | | — | 1.5 | 50 | 4 | 399 |
| **CSEB** | 2010-0150 | | | — | 1.5 | 50 | 4 | 407 |
| **HSB** | 2010-0250 | | | — | 2.5 | 50 | 4 | 399 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSEB** | 2010-0250 | 2 Flutes | R0.5 | — | 2.5 | 50 | 4 | 407 |
| **DCB** | 2010 | | | — | 5 | 60 | 4 | 412 |
| **CGB** | 2010 | | | — | 5 | 60 | 4 | 414 |
| **CFB** | 3010-0150 | 3 Flutes | | — | 1.5 | 50 | 4 | 416 |
| **DLC-CFB** | 3010-0150 | | | — | 1.5 | 50 | 4 | 422 |
| **UDCLBF** | 2010-0150 | 2 Flutes | | 1.5 | 0.7 | 50 | 4 | 83 |
| **CBN-LBSF** | 2010-015 | | | 1.5 | 0.7 | 50 | 4 | 115 |
| **CBN-LBF** | 2010-015 | | | 1.5 | 0.7 | 50 | 4 | 121 |
| **UPDLB** | 1010-020 | 1 Flutes | | 2 | 0.5 | 40 | 4 | 434 |
| **UDCLBF** | 2010-0200 | 2 Flutes | | 2 | 0.7 | 50 | 4 | 83 |
| **UDCLB** | 2010-0200 | | | 2 | 0.7 | 50 | 4 | 98 |
| **CBN-LBSF** | 2010-020 | | | 2 | 0.7 | 50 | 4 | 115 |
| **CBN-LBF** | 2010-020 | | | 2 | 0.7 | 50 | 4 | 121 |
| **HSLB** | 2010-020S | | | 2 | 0.8 | 35 | 4 | 466 |
| **HGLB** | 2010-020 | | | 2 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-020 | | | 2 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-020 | | | 2 | 0.8 | 45 | 4 | 472 |
| **DLCLB** | 2010-020 | | | 2 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-020-6 | | | 2 | 0.8 | 50 | 6 | 438 |
| **UDCLBF** | 2010-0250 | | | 2.5 | 0.7 | 50 | 4 | 83 |
| **UDCLB** | 2010-0250 | | | 2.5 | 0.7 | 50 | 4 | 98 |
| **CBN-LBSF** | 2010-025 | | | 2.5 | 0.7 | 50 | 4 | 115 |
| **CBN-LBF** | 2010-025 | | | 2.5 | 0.7 | 50 | 4 | 121 |
| **HSLB** | 2010-025S | | | 2.5 | 0.8 | 35 | 4 | 466 |
| **HGLB** | 2010-025 | | | 2.5 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-025 | | | 2.5 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-025 | | | 2.5 | 0.8 | 45 | 4 | 472 |
| **CFLB** | 3010-025 | 3 Flutes | | 2.5 | 0.8 | 50 | 4 | 502 |
| **UDCLBF** | 2010-0300 | 2 Flutes | | 3 | 0.7 | 50 | 4 | 83 |
| **UDCLB** | 2010-0300 | | | 3 | 0.7 | 50 | 4 | 98 |
| **CBN-LBSF** | 2010-030 | | | 3 | 0.7 | 50 | 4 | 115 |
| **HSLB** | 2010-030S | | | 3 | 0.8 | 35 | 4 | 466 |
| **HGLB** | 2010-030 | | | 3 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-030 | | | 3 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-030 | | | 3 | 0.8 | 45 | 4 | 472 |
| **DCLB** | 2010-0030 | | | 3 | 0.8 | 45 | 4 | 485 |
| **DLCLB** | 2010-030 | | | 3 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-030-6 | | | 3 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-030-6 | | | 3 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-030-6 | | | 3 | 0.8 | 50 | 6 | 472 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CPRB** | 2010-3 | 2 Flutes | R0.5 | 3 | 1.2 | 45 | 4 | 499 |
| **CFLB** | 3010-030 | 3 Flutes | | 3 | 0.8 | 50 | 4 | 502 |
| **UDCLBF** | 2010-0400 | 2 Flutes | | 4 | 0.7 | 50 | 4 | 83 |
| **UDCLB** | 2010-0400 | | | 4 | 0.7 | 50 | 4 | 98 |
| **CBN-LBSF** | 2010-040 | | | 4 | 0.7 | 50 | 4 | 115 |
| **CBN-LBF** | 2010-040 | | | 4 | 0.7 | 50 | 4 | 121 |
| **HSLB** | 2010-040S | | | 4 | 0.8 | 35 | 4 | 466 |
| **HGLB** | 2010-040 | | | 4 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-040 | | | 4 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-040 | | | 4 | 0.8 | 45 | 4 | 472 |
| **DLCLB** | 2010-040 | | | 4 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-040-6 | | | 4 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-040-6 | | | 4 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-040-6 | | | 4 | 0.8 | 50 | 6 | 472 |
| **CPRB** | 2010-4 | | | 4 | 1.2 | 45 | 4 | 499 |
| **CFLB** | 3010-040 | 3 Flutes | | 4 | 0.8 | 50 | 4 | 502 |
| **UDCLB** | 2010-0500 | 2 Flutes | | 5 | 0.7 | 50 | 4 | 98 |
| **CBN-LBF** | 2010-050 | | | 5 | 0.7 | 50 | 4 | 121 |
| **HGLB** | 2010-050 | | | 5 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-050 | | | 5 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-050 | | | 5 | 0.8 | 45 | 4 | 472 |
| **DCLB** | 2010-0050 | | | 5 | 0.8 | 45 | 4 | 485 |
| **DLCLB** | 2010-050 | | | 5 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-050-6 | | | 5 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-050-6 | | | 5 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-050-6 | | | 5 | 0.8 | 50 | 6 | 472 |
| **CFLB** | 3010-050 | 3 Flutes | | 5 | 0.8 | 50 | 4 | 502 |
| **UDCLBF** | 2010-0600 | 2 Flutes | | 6 | 0.7 | 50 | 4 | 83 |
| **CBN-LBSF** | 2010-060 | | | 6 | 0.7 | 50 | 4 | 115 |
| **CBN-LBF** | 2010-060 | | | 6 | 0.7 | 50 | 4 | 121 |
| **HSLB** | 2010-060S | | | 6 | 0.8 | 40 | 4 | 466 |
| **HGLB** | 2010-060 | | | 6 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-060 | | | 6 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-060 | | | 6 | 0.8 | 45 | 4 | 472 |
| **DCLB** | 2010-0060 | | | 6 | 0.8 | 45 | 4 | 485 |
| **DLCLB** | 2010-060 | | | 6 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-060-6 | | | 6 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-060-6 | | | 6 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-060-6 | | | 6 | 0.8 | 50 | 6 | 472 |
| **CPRB** | 2010-6 | | | 6 | 1.2 | 45 | 4 | 499 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CFLB** | 3010-060 | 3 Flutes | R0.5 | 6 | 0.8 | 50 | 4 | 502 |
| **HGLB** | 2010-070 | 2 Flutes | | 7 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-070 | | | 7 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-070 | | | 7 | 0.8 | 45 | 4 | 472 |
| **HGLB** | 2010-070-6 | | | 7 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-070-6 | | | 7 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-070-6 | | | 7 | 0.8 | 50 | 6 | 472 |
| **UDCLBF** | 2010-0800 | | | 8 | 0.7 | 50 | 4 | 83 |
| **CBN-LBF** | 2010-080 | | | 8 | 0.7 | 50 | 4 | 121 |
| **HSLB** | 2010-080S | | | 8 | 0.8 | 40 | 4 | 466 |
| **HGLB** | 2010-080 | | | 8 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-080 | | | 8 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-080 | | | 8 | 0.8 | 45 | 4 | 472 |
| **DCLB** | 2010-0080 | | | 8 | 0.8 | 45 | 4 | 485 |
| **DLCLB** | 2010-080 | | | 8 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-080-6 | | | 8 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-080-6 | | | 8 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-080-6 | | | 8 | 0.8 | 50 | 6 | 472 |
| **CPRB** | 2010-8 | | | 8 | 1.2 | 45 | 4 | 499 |
| **CFLB** | 3010-080 | 3 Flutes | | 8 | 0.8 | 50 | 4 | 502 |
| **HSLB** | 2010-090 | 2 Flutes | | 9 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-090 | | | 9 | 0.8 | 45 | 4 | 472 |
| **UDCLBF** | 2010-1000 | | | 10 | 0.7 | 50 | 4 | 83 |
| **CBN-LBF** | 2010-100 | | | 10 | 0.7 | 50 | 4 | 121 |
| **HGLB** | 2010-100 | | | 10 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-100 | | | 10 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-100 | | | 10 | 0.8 | 45 | 4 | 472 |
| **DCLB** | 2010-0100-08 | | | 10 | 0.8 | 45 | 4 | 485 |
| **DLCLB** | 2010-100 | | | 10 | 0.8 | 45 | 4 | 490 |
| **HGLB** | 2010-100-6 | | | 10 | 0.8 | 50 | 6 | 438 |
| **HSLB** | 2010-100-6 | | | 10 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-100-6 | | | 10 | 0.8 | 50 | 6 | 472 |
| **CPRB** | 2010-10 | | | 10 | 1.2 | 45 | 4 | 499 |
| **DCLB** | 2010-0100 | | | 10 | 1.5 | 60 | 4 | 485 |
| **CFLB** | 3010-100 | 3 Flutes | | 10 | 0.8 | 50 | 4 | 502 |
| **HGLB** | 2010-120 | 2 Flutes | | 12 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-120 | | | 12 | 0.8 | 45 | 4 | 450 |
| **CSELB** | 2010-120 | | | 12 | 0.8 | 45 | 4 | 472 |
| **DLCLB** | 2010-120 | | | 12 | 0.8 | 45 | 4 | 490 |
| **DCLB** | 2010-0120 | | | 12 | 0.8 | 50 | 4 | 485 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2010-120-6 | 2 Flutes | R0.5 | 12 | 0.8 | 50 | 6 | 450 |
| **CSELB** | 2010-120-6 | | | 12 | 0.8 | 50 | 6 | 472 |
| **CPRB** | 2010-12 | | | 12 | 1.2 | 45 | 4 | 499 |
| **CFLB** | 3010-120 | 3 Flutes | | 12 | 0.8 | 50 | 4 | 502 |
| **HGLB** | 2010-140 | 2 Flutes | | 14 | 0.8 | 45 | 4 | 438 |
| **HSLB** | 2010-140 | | | 14 | 0.8 | 50 | 4 | 450 |
| **CSELB** | 2010-140 | | | 14 | 0.8 | 50 | 4 | 472 |
| **HSLB** | 2010-140-6 | | | 14 | 0.8 | 60 | 6 | 450 |
| **CSELB** | 2010-140-6 | | | 14 | 0.8 | 60 | 6 | 472 |
| **CPRB** | 2010-14 | | | 14 | 1.2 | 50 | 4 | 499 |
| **HGLB** | 2010-160 | | | 16 | 0.8 | 50 | 4 | 438 |
| **HSLB** | 2010-160 | | | 16 | 0.8 | 50 | 4 | 450 |
| **CSELB** | 2010-160 | | | 16 | 0.8 | 50 | 4 | 472 |
| **DCLB** | 2010-0160 | | | 16 | 0.8 | 50 | 4 | 485 |
| **HSLB** | 2010-160-6 | | | 16 | 0.8 | 60 | 6 | 450 |
| **CSELB** | 2010-160-6 | | | 16 | 0.8 | 60 | 6 | 472 |
| **CPRB** | 2010-16 | | | 16 | 1.2 | 50 | 4 | 499 |
| **HSLB** | 2010-180 | | | 18 | 0.8 | 55 | 4 | 450 |
| **CSELB** | 2010-180 | | | 18 | 0.8 | 55 | 4 | 472 |
| **HSLB** | 2010-200 | | | 20 | 0.8 | 55 | 4 | 450 |
| **CSELB** | 2010-200 | | | 20 | 0.8 | 55 | 4 | 472 |
| **HSLB** | 2010-200-6 | | | 20 | 0.8 | 70 | 6 | 450 |
| **CSELB** | 2010-200-6 | | | 20 | 0.8 | 70 | 6 | 472 |
| **CPRB** | 2010-20 | | | 20 | 1.2 | 55 | 4 | 499 |
| **DCLB** | 2010-0200 | | | 20 | 1.5 | 60 | 4 | 485 |
| **HSLB** | 2010-220-6 | | | 22 | 0.8 | 70 | 6 | 450 |
| **CSELB** | 2010-220-6 | | | 22 | 0.8 | 70 | 6 | 472 |
| **HSB** | 2011-0160 | 2 Flutes | R0.55 | — | 1.6 | 50 | 4 | 399 |
| **CSEB** | 2011-0160 | | | — | 1.6 | 50 | 4 | 407 |
| **UDCBF** | 2012-0084 | 2 Flutes | R0.6 | — | 0.84 | 50 | 4 | 80 |
| **HSB** | 2012-0180 | | | — | 1.8 | 50 | 4 | 399 |
| **CSEB** | 2012-0180 | | | — | 1.8 | 50 | 4 | 407 |
| **CBN-LBF** | 2012-024 | | | 2.4 | 0.8 | 50 | 4 | 121 |
| **HSLB** | 2012-025 | | | 2.5 | 0.96 | 45 | 4 | 450 |
| **CSELB** | 2012-025 | | | 2.5 | 0.96 | 45 | 4 | 472 |
| **CBN-LBF** | 2012-030 | | | 3 | 0.8 | 50 | 4 | 121 |
| **HSLB** | 2012-040 | | | 4 | 0.96 | 45 | 4 | 450 |
| **CSELB** | 2012-040 | | | 4 | 0.96 | 45 | 4 | 472 |
| **CBN-LBF** | 2012-060 | | | 6 | 0.8 | 50 | 4 | 121 |
| **HSLB** | 2012-060 | | | 6 | 0.96 | 45 | 4 | 450 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2012-060 | 2 Flutes | R0.6 | 6 | 0.96 | 45 | 4 | 472 |
| **HSLB** | 2012-060-6 | | | 6 | 0.96 | 50 | 6 | 450 |
| **CSELB** | 2012-060-6 | | | 6 | 0.96 | 50 | 6 | 472 |
| **HSLB** | 2012-080 | | | 8 | 0.96 | 45 | 4 | 450 |
| **CSELB** | 2012-080 | | | 8 | 0.96 | 45 | 4 | 472 |
| **HSLB** | 2012-080-6 | | | 8 | 0.96 | 50 | 6 | 450 |
| **CSELB** | 2012-080-6 | | | 8 | 0.96 | 50 | 6 | 472 |
| **CPRB** | 2012-8 | | | 8 | 1.3 | 45 | 4 | 499 |
| **HSLB** | 2012-100 | | | 10 | 0.96 | 45 | 4 | 450 |
| **CSELB** | 2012-100 | | | 10 | 0.96 | 45 | 4 | 472 |
| **HSLB** | 2012-100-6 | | | 10 | 0.96 | 50 | 6 | 450 |
| **CSELB** | 2012-100-6 | | | 10 | 0.96 | 50 | 6 | 472 |
| **HSLB** | 2012-120 | | | 12 | 0.96 | 45 | 4 | 450 |
| **CSELB** | 2012-120 | | | 12 | 0.96 | 45 | 4 | 472 |
| **HSLB** | 2012-120-6 | | | 12 | 0.96 | 50 | 6 | 450 |
| **CSELB** | 2012-120-6 | | | 12 | 0.96 | 50 | 6 | 472 |
| **CPRB** | 2012-12 | | | 12 | 1.3 | 45 | 4 | 499 |
| **HSLB** | 2012-140 | | | 14 | 0.96 | 50 | 4 | 450 |
| **CSELB** | 2012-140 | | | 14 | 0.96 | 50 | 4 | 472 |
| **HSLB** | 2012-160 | | | 16 | 0.96 | 50 | 4 | 450 |
| **CSELB** | 2012-160 | | | 16 | 0.96 | 50 | 4 | 472 |
| **HSLB** | 2012-160-6 | | | 16 | 0.96 | 60 | 6 | 450 |
| **CSELB** | 2012-160-6 | | | 16 | 0.96 | 60 | 6 | 472 |
| **HSLB** | 2012-180 | | | 18 | 0.96 | 55 | 4 | 450 |
| **CSELB** | 2012-180 | | | 18 | 0.96 | 55 | 4 | 472 |
| **HSLB** | 2012-200 | | | 20 | 0.96 | 60 | 4 | 450 |
| **CSELB** | 2012-200 | | | 20 | 0.96 | 60 | 4 | 472 |
| **HSB** | 2013-0190 | 2 Flutes | R0.65 | — | 1.9 | 50 | 4 | 399 |
| **CSEB** | 2013-0190 | | | — | 1.9 | 50 | 4 | 407 |
| **HSB** | 2014-0210 | 2 Flutes | R0.7 | — | 2.1 | 50 | 4 | 399 |
| **CSEB** | 2014-0210 | | | — | 2.1 | 50 | 4 | 407 |
| **HSLB** | 2014-060 | | | 6 | 1.12 | 45 | 4 | 450 |
| **CSELB** | 2014-060 | | | 6 | 1.12 | 45 | 4 | 473 |
| **HSLB** | 2014-080 | | | 8 | 1.12 | 45 | 4 | 450 |
| **CSELB** | 2014-080 | | | 8 | 1.12 | 45 | 4 | 473 |
| **CPRB** | 2014-8 | | | 8 | 1.4 | 45 | 4 | 499 |
| **HSLB** | 2014-120 | | | 12 | 1.12 | 45 | 4 | 450 |
| **CSELB** | 2014-120 | | | 12 | 1.12 | 45 | 4 | 473 |
| **CPRB** | 2014-12 | | | 12 | 1.4 | 45 | 4 | 499 |
| **HSLB** | 2014-160 | | | 16 | 1.12 | 50 | 4 | 450 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2014-160 | 2 Flutes | R0.7 | 16 | 1.12 | 50 | 4 | 473 |
| **CPRB** | 2014-16 | | | 16 | 1.4 | 50 | 4 | 499 |
| **UDCBH** | 2015-0105 | 2 Flutes | R0.75 | — | 1.05 | 50 | 4 | 78 |
| **UDCBF** | 2015-0105 | | | — | 1.05 | 50 | 4 | 80 |
| **HSB** | 2015-0150S | | | — | 1.5 | 35 | 4 | 403 |
| **HSB** | 2015-0150 | | | — | 1.5 | 50 | 4 | 399 |
| **CSEB** | 2015-0150 | | | — | 1.5 | 50 | 4 | 407 |
| **HSB** | 2015-0150-6 | | | — | 1.5 | 50 | 6 | 399 |
| **CSEB** | 2015-0150-6 | | | — | 1.5 | 50 | 6 | 407 |
| **HSB** | 2015-0200 | | | — | 2 | 50 | 4 | 399 |
| **CSEB** | 2015-0200 | | | — | 2 | 50 | 4 | 407 |
| **HGB** | 2015-0225 | | | — | 2.25 | 50 | 4 | 396 |
| **HSB** | 2015-0225 | | | — | 2.25 | 50 | 4 | 399 |
| **CSEB** | 2015-0225 | | | — | 2.25 | 50 | 4 | 407 |
| **HSB** | 2015-0400 | | | — | 4 | 50 | 4 | 399 |
| **CSEB** | 2015-0400 | | | — | 4 | 50 | 4 | 407 |
| **CGB** | 2015 | | | — | 5 | 60 | 4 | 414 |
| **CFB** | 3015-0225 | 3 Flutes | | — | 2.25 | 50 | 4 | 416 |
| **DLC-CFB** | 3015-0225 | | | — | 2.25 | 50 | 4 | 422 |
| **UDCLBF** | 2015-0200 | 2 Flutes | | 2 | 1.05 | 50 | 4 | 83 |
| **CBN-LBSF** | 2015-025 | | | 2.5 | 0.9 | 50 | 4 | 115 |
| **CBN-LBSF** | 2015-030 | | | 3 | 0.9 | 50 | 4 | 115 |
| **CBN-LBF** | 2015-030 | | | 3 | 0.9 | 50 | 4 | 121 |
| **HSLB** | 2015-030S | | | 3 | 1.2 | 35 | 4 | 466 |
| **HGLB** | 2015-030 | | | 3 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-030 | | | 3 | 1.2 | 45 | 4 | 451 |
| **CSELB** | 2015-030 | | | 3 | 1.2 | 45 | 4 | 473 |
| **HGLB** | 2015-030-6 | | | 3 | 1.2 | 50 | 6 | 439 |
| **CBN-LBSF** | 2015-038 | | | 3.8 | 0.9 | 50 | 4 | 115 |
| **CBN-LBF** | 2015-040 | | | 4 | 0.9 | 50 | 4 | 121 |
| **UDCLBF** | 2015-0400 | | | 4 | 1.05 | 50 | 4 | 83 |
| **HSLB** | 2015-040S | | | 4 | 1.2 | 35 | 4 | 466 |
| **HGLB** | 2015-040 | | | 4 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-040 | | | 4 | 1.2 | 45 | 4 | 451 |
| **CSELB** | 2015-040 | | | 4 | 1.2 | 45 | 4 | 473 |
| **DLCLB** | 2015-040 | | | 4 | 1.2 | 45 | 4 | 490 |
| **CFLB** | 3015-040 | 3 Flutes | | 4 | 1.2 | 50 | 4 | 503 |
| **CBN-LBSF** | 2015-060 | 2 Flutes | | 6 | 0.9 | 50 | 4 | 115 |
| **CBN-LBF** | 2015-060 | | | 6 | 0.9 | 50 | 4 | 121 |
| **UDCLBF** | 2015-0600 | | | 6 | 1.05 | 50 | 4 | 83 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2015-060S | 2 Flutes | R0.75 | 6 | 1.2 | 40 | 4 | 466 |
| **HGLB** | 2015-060 | | | 6 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-060 | | | 6 | 1.2 | 45 | 4 | 451 |
| **CSELB** | 2015-060 | | | 6 | 1.2 | 45 | 4 | 473 |
| **DCLB** | 2015-0060 | | | 6 | 1.2 | 45 | 4 | 485 |
| **DLCLB** | 2015-060 | | | 6 | 1.2 | 45 | 4 | 490 |
| **HGLB** | 2015-060-6 | | | 6 | 1.2 | 50 | 6 | 439 |
| **HSLB** | 2015-060-6 | | | 6 | 1.2 | 50 | 6 | 451 |
| **CSELB** | 2015-060-6 | | | 6 | 1.2 | 50 | 6 | 473 |
| **CPRB** | 2015-6 | | | 6 | 1.45 | 45 | 4 | 499 |
| **CFLB** | 3015-060 | 3 Flutes | | 6 | 1.2 | 50 | 4 | 503 |
| **CBN-LBSF** | 2015-080 | 2 Flutes | | 8 | 0.9 | 50 | 4 | 115 |
| **CBN-LBF** | 2015-080 | | | 8 | 0.9 | 50 | 4 | 121 |
| **UDCLBF** | 2015-0800 | | | 8 | 1.05 | 50 | 4 | 83 |
| **HSLB** | 2015-080S | | | 8 | 1.2 | 40 | 4 | 466 |
| **HGLB** | 2015-080 | | | 8 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-080 | | | 8 | 1.2 | 45 | 4 | 451 |
| **CSELB** | 2015-080 | | | 8 | 1.2 | 45 | 4 | 473 |
| **HGLB** | 2015-080-6 | | | 8 | 1.2 | 50 | 6 | 439 |
| **HSLB** | 2015-080-6 | | | 8 | 1.2 | 50 | 6 | 451 |
| **CSELB** | 2015-080-6 | | | 8 | 1.2 | 50 | 6 | 473 |
| **CPRB** | 2015-8 | | | 8 | 1.45 | 45 | 4 | 499 |
| **CFLB** | 3015-080 | 3 Flutes | | 8 | 1.2 | 50 | 4 | 503 |
| **CBN-LBF** | 2015-100 | 2 Flutes | | 10 | 0.9 | 50 | 4 | 121 |
| **UDCLBF** | 2015-1000 | | | 10 | 1.05 | 50 | 4 | 83 |
| **HSLB** | 2015-100S | | | 10 | 1.2 | 40 | 4 | 466 |
| **HGLB** | 2015-100 | | | 10 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-100 | | | 10 | 1.2 | 45 | 4 | 451 |
| **CSELB** | 2015-100 | | | 10 | 1.2 | 45 | 4 | 473 |
| **DCLB** | 2015-0100 | | | 10 | 1.2 | 45 | 4 | 485 |
| **HGLB** | 2015-100-6 | | | 10 | 1.2 | 50 | 6 | 439 |
| **HSLB** | 2015-100-6 | | | 10 | 1.2 | 50 | 6 | 451 |
| **CSELB** | 2015-100-6 | | | 10 | 1.2 | 50 | 6 | 473 |
| **CPRB** | 2015-10 | | | 10 | 1.45 | 45 | 4 | 499 |
| **CFLB** | 3015-100 | 3 Flutes | | 10 | 1.2 | 50 | 4 | 503 |
| **CBN-LBF** | 2015-120 | 2 Flutes | | 12 | 0.9 | 50 | 4 | 121 |
| **UDCLBF** | 2015-1200 | | | 12 | 1.05 | 50 | 4 | 83 |
| **HGLB** | 2015-120 | | | 12 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-120 | | | 12 | 1.2 | 45 | 4 | 451 |
| **CSELB** | 2015-120 | | | 12 | 1.2 | 45 | 4 | 473 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **DLCLB** | 2015-120 | 2 Flutes | R0.75 | 12 | 1.2 | 50 | 4 | 490 |
| **HGLB** | 2015-120-6 | | | 12 | 1.2 | 50 | 6 | 439 |
| **HSLB** | 2015-120-6 | | | 12 | 1.2 | 50 | 6 | 451 |
| **CSELB** | 2015-120-6 | | | 12 | 1.2 | 50 | 6 | 473 |
| **CPRB** | 2015-12 | | | 12 | 1.45 | 45 | 4 | 499 |
| **CFLB** | 3015-120 | 3 Flutes | | 12 | 1.2 | 50 | 4 | 503 |
| **HGLB** | 2015-140 | 2 Flutes | | 14 | 1.2 | 45 | 4 | 439 |
| **HSLB** | 2015-140 | | | 14 | 1.2 | 50 | 4 | 451 |
| **CSELB** | 2015-140 | | | 14 | 1.2 | 50 | 4 | 473 |
| **CBN-LBF** | 2015-150 | | | 15 | 0.9 | 50 | 4 | 121 |
| **HGLB** | 2015-160 | | | 16 | 1.2 | 50 | 4 | 439 |
| **HSLB** | 2015-160 | | | 16 | 1.2 | 50 | 4 | 451 |
| **CSELB** | 2015-160 | | | 16 | 1.2 | 50 | 4 | 473 |
| **DCLB** | 2015-0160 | | | 16 | 1.2 | 50 | 4 | 485 |
| **HSLB** | 2015-160-6 | | | 16 | 1.2 | 60 | 6 | 451 |
| **CSELB** | 2015-160-6 | | | 16 | 1.2 | 60 | 6 | 473 |
| **CPRB** | 2015-16 | | | 16 | 1.45 | 50 | 4 | 499 |
| **CFLB** | 3015-160 | 3 Flutes | | 16 | 1.2 | 50 | 4 | 503 |
| **HSLB** | 2015-180 | 2 Flutes | | 18 | 1.2 | 55 | 4 | 451 |
| **CSELB** | 2015-180 | | | 18 | 1.2 | 55 | 4 | 473 |
| **DLCLB** | 2015-180 | | | 18 | 1.2 | 55 | 4 | 490 |
| **HSLB** | 2015-200 | | | 20 | 1.2 | 55 | 4 | 451 |
| **CSELB** | 2015-200 | | | 20 | 1.2 | 55 | 4 | 473 |
| **HGLB** | 2015-200 | | | 20 | 1.2 | 60 | 4 | 439 |
| **HSLB** | 2015-200-6 | | | 20 | 1.2 | 60 | 6 | 451 |
| **CSELB** | 2015-200-6 | | | 20 | 1.2 | 60 | 6 | 473 |
| **CPRB** | 2015-20 | | | 20 | 1.45 | 55 | 4 | 499 |
| **HSLB** | 2015-220 | | | 22 | 1.2 | 55 | 4 | 451 |
| **CSELB** | 2015-220 | | | 22 | 1.2 | 55 | 4 | 473 |
| **HSLB** | 2015-250 | | | 25 | 1.2 | 65 | 4 | 451 |
| **CSELB** | 2015-250 | | | 25 | 1.2 | 65 | 4 | 473 |
| **HSLB** | 2015-300 | | | 30 | 1.2 | 70 | 4 | 451 |
| **CSELB** | 2015-300 | | | 30 | 1.2 | 70 | 4 | 473 |
| **HSB** | 2016-0240 | 2 Flutes | R0.8 | — | 2.4 | 50 | 4 | 399 |
| **CSEB** | 2016-0240 | | | — | 2.4 | 50 | 4 | 407 |
| **HSLB** | 2016-040 | | | 4 | 1.28 | 45 | 4 | 451 |
| **CSELB** | 2016-040 | | | 4 | 1.28 | 45 | 4 | 473 |
| **HSLB** | 2016-080 | | | 8 | 1.28 | 45 | 4 | 451 |
| **CSELB** | 2016-080 | | | 8 | 1.28 | 45 | 4 | 473 |
| **CPRB** | 2016-8 | | | 8 | 1.5 | 45 | 4 | 499 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2016-120 | 2 Flutes | R0.8 | 12 | 1.28 | 45 | 4 | 451 |
| **CSELB** | 2016-120 | | | 12 | 1.28 | 45 | 4 | 473 |
| **CPRB** | 2016-12 | | | 12 | 1.5 | 45 | 4 | 499 |
| **HSLB** | 2016-160 | | | 16 | 1.28 | 50 | 4 | 451 |
| **CSELB** | 2016-160 | | | 16 | 1.28 | 50 | 4 | 473 |
| **CPRB** | 2016-16 | | | 16 | 1.5 | 50 | 4 | 499 |
| **HSLB** | 2016-200 | | | 20 | 1.28 | 55 | 4 | 451 |
| **CSELB** | 2016-200 | | | 20 | 1.28 | 55 | 4 | 473 |
| **CPRB** | 2016-20 | | | 20 | 1.5 | 55 | 4 | 499 |
| **HSB** | 2017-0250 | 2 Flutes | R0.85 | — | 2.5 | 50 | 4 | 399 |
| **CSEB** | 2017-0250 | | | — | 2.5 | 50 | 4 | 407 |
| **HSB** | 2018-0270 | 2 Flutes | R0.9 | — | 2.7 | 50 | 4 | 399 |
| **CSEB** | 2018-0270 | | | — | 2.7 | 50 | 4 | 407 |
| **HSLB** | 2018-040 | | | 4 | 1.44 | 45 | 4 | 451 |
| **CSELB** | 2018-040 | | | 4 | 1.44 | 45 | 4 | 473 |
| **HSLB** | 2018-060 | | | 6 | 1.44 | 45 | 4 | 451 |
| **CSELB** | 2018-060 | | | 6 | 1.44 | 45 | 4 | 473 |
| **HSLB** | 2018-080 | | | 8 | 1.44 | 45 | 4 | 451 |
| **CSELB** | 2018-080 | | | 8 | 1.44 | 45 | 4 | 473 |
| **CPRB** | 2018-8 | | | 8 | 1.6 | 45 | 4 | 499 |
| **HSLB** | 2018-100 | | | 10 | 1.44 | 45 | 4 | 451 |
| **CSELB** | 2018-100 | | | 10 | 1.44 | 45 | 4 | 473 |
| **HSLB** | 2018-120 | | | 12 | 1.44 | 45 | 4 | 451 |
| **CSELB** | 2018-120 | | | 12 | 1.44 | 45 | 4 | 473 |
| **CPRB** | 2018-12 | | | 12 | 1.6 | 45 | 4 | 499 |
| **HSLB** | 2018-160 | | | 16 | 1.44 | 50 | 4 | 451 |
| **CSELB** | 2018-160 | | | 16 | 1.44 | 50 | 4 | 473 |
| **CPRB** | 2018-16 | | | 16 | 1.6 | 50 | 4 | 499 |
| **HSLB** | 2018-180 | | | 18 | 1.44 | 55 | 4 | 451 |
| **CSELB** | 2018-180 | | | 18 | 1.44 | 55 | 4 | 473 |
| **HSLB** | 2018-200 | | | 20 | 1.44 | 55 | 4 | 451 |
| **CSELB** | 2018-200 | | | 20 | 1.44 | 55 | 4 | 473 |
| **CPRB** | 2018-20 | | | 20 | 1.6 | 55 | 4 | 499 |
| **HSLB** | 2018-220 | | | 22 | 1.44 | 60 | 4 | 451 |
| **CSELB** | 2018-220 | | | 22 | 1.44 | 60 | 4 | 473 |
| **HSLB** | 2018-250 | | | 25 | 1.44 | 65 | 4 | 451 |
| **CSELB** | 2018-250 | | | 25 | 1.44 | 65 | 4 | 473 |
| **HSLB** | 2018-300 | | | 30 | 1.44 | 70 | 4 | 451 |
| **CSELB** | 2018-300 | | | 30 | 1.44 | 70 | 4 | 473 |
| **HSB** | 2019-0280 | 2 Flutes | R0.95 | — | 2.8 | 50 | 4 | 399 |
| **CSEB** | 2019-0280 | 2 Flutes | R0.95 | — | 2.8 | 50 | 4 | 407 |
| **UDCBH** | 2020-0140 | 2 Flutes | R1 | — | 1.4 | 50 | 4 | 78 |
| **UDCBF** | 2020-0140 | | | — | 1.4 | 50 | 4 | 80 |
| **UDCB** | 2020-0140 | | | — | 1.4 | 50 | 4 | 94 |
| **HSB** | 2020-0200S | | | — | 2 | 35 | 4 | 403 |
| **HSB** | 2020-0200 | | | — | 2 | 50 | 4 | 399 |
| **CSEB** | 2020-0200 | | | — | 2 | 50 | 4 | 407 |
| **HSB** | 2020-0200-6 | | | — | 2 | 60 | 6 | 399 |
| **CSEB** | 2020-0200-6 | | | — | 2 | 60 | 6 | 407 |
| **HGB** | 2020-0300 | | | — | 3 | 50 | 4 | 396 |
| **HSB** | 2020-0300 | | | — | 3 | 50 | 4 | 399 |
| **CSEB** | 2020-0300 | | | — | 3 | 60 | 4 | 407 |
| **HSB** | 2020-0600 | | | — | 6 | 60 | 4 | 399 |
| **CSEB** | 2020-0600 | | | — | 6 | 60 | 4 | 407 |
| **DCB** | 2020 | | | — | 10 | 70 | 4 | 412 |
| **CGB** | 2020 | | | — | 10 | 70 | 4 | 414 |
| **CFB** | 3020-0300 | 3 Flutes | | — | 3 | 50 | 4 | 416 |
| **DLC-CFB** | 3020-0300 | | | — | 3 | 50 | 4 | 422 |
| **HFB** | 4020-0300S | 4 Flutes | | — | 3 | 40 | 4 | 427 |
| **HFB** | 4020-0300 | | | — | 3 | 50 | 4 | 426 |
| **HFB** | 4020-0300-6 | | | — | 3 | 50 | 6 | 426 |
| **UPDLB** | 1020-030 | 1 Flutes | | 3 | 1 | 40 | 4 | 434 |
| **CBN-LBSF** | 2020-030 | 2 Flutes | | 3 | 1.2 | 50 | 4 | 115 |
| **UDCLBF** | 2020-0300 | | | 3 | 1.4 | 50 | 4 | 83 |
| **UDCLB** | 2020-0300 | | | 3 | 1.4 | 50 | 4 | 98 |
| **HSLB** | 2020-030S | | | 3 | 1.6 | 35 | 4 | 466 |
| **HGLB** | 2020-030 | | | 3 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-030 | | | 3 | 1.6 | 45 | 4 | 452 |
| **CSELB** | 2020-030 | | | 3 | 1.6 | 45 | 4 | 474 |
| **HGLB** | 2020-030-6 | | | 3 | 1.6 | 50 | 6 | 439 |
| **CBN-LBSF** | 2020-040 | | | 4 | 1.2 | 50 | 4 | 115 |
| **CBN-LBF** | 2020-040 | | | 4 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-0400 | | | 4 | 1.4 | 50 | 4 | 83 |
| **UDCLB** | 2020-0400 | | | 4 | 1.4 | 50 | 4 | 98 |
| **HSLB** | 2020-040S | | | 4 | 1.6 | 35 | 4 | 466 |
| **HGLB** | 2020-040 | | | 4 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-040 | | | 4 | 1.6 | 45 | 4 | 452 |
| **CSELB** | 2020-040 | | | 4 | 1.6 | 45 | 4 | 474 |
| **DCLB** | 2020-0040 | | | 4 | 1.6 | 45 | 4 | 485 |
| **DLCLB** | 2020-040 | | | 4 | 1.6 | 45 | 4 | 490 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HGLB** | 2020-040-6 | 2 Flutes | R1 | 4 | 1.6 | 50 | 6 | 439 |
| **HSLB** | 2020-040-6 | | | 4 | 1.6 | 50 | 6 | 452 |
| **CSELB** | 2020-040-6 | | | 4 | 1.6 | 50 | 6 | 474 |
| **CPRB** | 2020-4 | | | 4 | 1.7 | 45 | 4 | 499 |
| **CFLB** | 3020-040 | 3 Flutes | | 4 | 1.6 | 50 | 4 | 503 |
| **CBN-LBSF** | 2020-050 | 2 Flutes | | 5 | 1.2 | 50 | 4 | 115 |
| **CBN-LBF** | 2020-050 | | | 5 | 1.2 | 50 | 4 | 121 |
| **CBN-LBSF** | 2020-060 | | | 6 | 1.2 | 50 | 4 | 115 |
| **CBN-LBF** | 2020-060 | | | 6 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-0600 | | | 6 | 1.4 | 50 | 4 | 83 |
| **UDCLB** | 2020-0600 | | | 6 | 1.4 | 50 | 4 | 98 |
| **HSLB** | 2020-060S | | | 6 | 1.6 | 35 | 4 | 466 |
| **HGLB** | 2020-060 | | | 6 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-060 | | | 6 | 1.6 | 45 | 4 | 452 |
| **CSELB** | 2020-060 | | | 6 | 1.6 | 45 | 4 | 474 |
| **DCLB** | 2020-0060 | | | 6 | 1.6 | 45 | 4 | 485 |
| **DLCLB** | 2020-060 | | | 6 | 1.6 | 45 | 4 | 490 |
| **HGLB** | 2020-060-6 | | | 6 | 1.6 | 50 | 6 | 439 |
| **HSLB** | 2020-060-6 | | | 6 | 1.6 | 50 | 6 | 452 |
| **CSELB** | 2020-060-6 | | | 6 | 1.6 | 50 | 6 | 474 |
| **CPRB** | 2020-6 | | | 6 | 1.7 | 45 | 4 | 499 |
| **CFLB** | 3020-060 | 3 Flutes | | 6 | 1.6 | 50 | 4 | 503 |
| **CBN-LBSF** | 2020-080 | 2 Flutes | | 8 | 1.2 | 50 | 4 | 115 |
| **CBN-LBF** | 2020-080 | | | 8 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-0800 | | | 8 | 1.4 | 50 | 4 | 83 |
| **UDCLB** | 2020-0800 | | | 8 | 1.4 | 50 | 4 | 98 |
| **HSLB** | 2020-080S | | | 8 | 1.6 | 40 | 4 | 466 |
| **HGLB** | 2020-080 | | | 8 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-080 | | | 8 | 1.6 | 45 | 4 | 452 |
| **CSELB** | 2020-080 | | | 8 | 1.6 | 45 | 4 | 474 |
| **DCLB** | 2020-0080 | | | 8 | 1.6 | 45 | 4 | 485 |
| **DLCLB** | 2020-080 | | | 8 | 1.6 | 45 | 4 | 490 |
| **HGLB** | 2020-080-6 | | | 8 | 1.6 | 50 | 6 | 439 |
| **HSLB** | 2020-080-6 | | | 8 | 1.6 | 50 | 6 | 452 |
| **CSELB** | 2020-080-6 | | | 8 | 1.6 | 50 | 6 | 474 |
| **CPRB** | 2020-8 | | | 8 | 1.7 | 45 | 4 | 499 |
| **CFLB** | 3020-080 | 3 Flutes | | 8 | 1.6 | 50 | 4 | 503 |
| **CBN-LBSF** | 2020-100 | 2 Flutes | | 10 | 1.2 | 50 | 4 | 115 |
| **CBN-LBF** | 2020-100 | | | 10 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-1000 | | | 10 | 1.4 | 50 | 4 | 83 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **UDCLB** | 2020-1000 | 2 Flutes | R1 | 10 | 1.4 | 50 | 4 | 98 |
| **HSLB** | 2020-100S | | | 10 | 1.6 | 40 | 4 | 466 |
| **HGLB** | 2020-100 | | | 10 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-100 | | | 10 | 1.6 | 45 | 4 | 452 |
| **CSELB** | 2020-100 | | | 10 | 1.6 | 45 | 4 | 474 |
| **DCLB** | 2020-0100 | | | 10 | 1.6 | 45 | 4 | 485 |
| **DLCLB** | 2020-100 | | | 10 | 1.6 | 45 | 4 | 490 |
| **HGLB** | 2020-100-6 | | | 10 | 1.6 | 50 | 6 | 439 |
| **HSLB** | 2020-100-6 | | | 10 | 1.6 | 50 | 6 | 452 |
| **CSELB** | 2020-100-6 | | | 10 | 1.6 | 50 | 6 | 474 |
| **CPRB** | 2020-10 | | | 10 | 1.7 | 45 | 4 | 499 |
| **CFLB** | 3020-100 | 3 Flutes | | 10 | 1.6 | 50 | 4 | 503 |
| **CBN-LBF** | 2020-120 | 2 Flutes | | 12 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-1200 | | | 12 | 1.4 | 50 | 4 | 83 |
| **HGLB** | 2020-120 | | | 12 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-120 | | | 12 | 1.6 | 45 | 4 | 452 |
| **HSLB** | 2020-120S | | | 12 | 1.6 | 45 | 4 | 466 |
| **CSELB** | 2020-120 | | | 12 | 1.6 | 45 | 4 | 474 |
| **DCLB** | 2020-0120 | | | 12 | 1.6 | 45 | 4 | 485 |
| **DLCLB** | 2020-120 | | | 12 | 1.6 | 50 | 4 | 490 |
| **HGLB** | 2020-120-6 | | | 12 | 1.6 | 50 | 6 | 439 |
| **HSLB** | 2020-120-6 | | | 12 | 1.6 | 50 | 6 | 452 |
| **CSELB** | 2020-120-6 | | | 12 | 1.6 | 50 | 6 | 474 |
| **CPRB** | 2020-12 | | | 12 | 1.7 | 45 | 4 | 499 |
| **CFLB** | 3020-120 | 3 Flutes | | 12 | 1.6 | 50 | 4 | 503 |
| **HSLB** | 2020-130 | 2 Flutes | | 13 | 1.6 | 45 | 4 | 452 |
| **CSELB** | 2020-130 | | | 13 | 1.6 | 45 | 4 | 474 |
| **CBN-LBF** | 2020-140 | | | 14 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-1400 | | | 14 | 1.4 | 50 | 4 | 83 |
| **HGLB** | 2020-140 | | | 14 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-140S | | | 14 | 1.6 | 45 | 4 | 466 |
| **HSLB** | 2020-140 | | | 14 | 1.6 | 50 | 4 | 452 |
| **CSELB** | 2020-140 | | | 14 | 1.6 | 50 | 4 | 474 |
| **DLCLB** | 2020-140 | | | 14 | 1.6 | 50 | 4 | 490 |
| **CPRB** | 2020-14 | | | 14 | 1.7 | 50 | 4 | 499 |
| **CFLB** | 3020-140 | 3 Flutes | | 14 | 1.6 | 50 | 4 | 503 |
| **CBN-LBF** | 2020-160 | 2 Flutes | | 16 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-1600 | | | 16 | 1.4 | 50 | 4 | 83 |
| **HGLB** | 2020-160 | | | 16 | 1.6 | 45 | 4 | 439 |
| **HSLB** | 2020-160 | | | 16 | 1.6 | 50 | 4 | 452 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2020-160S | 2 Flutes | R1 | 16 | 1.6 | 50 | 4 | 466 |
| **CSELB** | 2020-160 | | | 16 | 1.6 | 50 | 4 | 474 |
| **DCLB** | 2020-0160 | | | 16 | 1.6 | 50 | 4 | 485 |
| **DLCLB** | 2020-160 | | | 16 | 1.6 | 50 | 4 | 490 |
| **HSLB** | 2020-160-6 | | | 16 | 1.6 | 60 | 6 | 452 |
| **CSELB** | 2020-160-6 | | | 16 | 1.6 | 60 | 6 | 474 |
| **CPRB** | 2020-16 | | | 16 | 1.7 | 50 | 4 | 499 |
| **CFLB** | 3020-160 | 3 Flutes | | 16 | 1.6 | 50 | 4 | 503 |
| **CBN-LBF** | 2020-180 | 2 Flutes | | 18 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-1800 | | | 18 | 1.4 | 60 | 4 | 83 |
| **HSLB** | 2020-180 | | | 18 | 1.6 | 55 | 4 | 452 |
| **CSELB** | 2020-180 | | | 18 | 1.6 | 55 | 4 | 474 |
| **CFLB** | 3020-180 | 3 Flutes | | 18 | 1.6 | 55 | 4 | 503 |
| **CBN-LBF** | 2020-200 | 2 Flutes | | 20 | 1.2 | 50 | 4 | 121 |
| **UDCLBF** | 2020-2000 | | | 20 | 1.4 | 60 | 4 | 83 |
| **HSLB** | 2020-200S | | | 20 | 1.6 | 50 | 4 | 466 |
| **HSLB** | 2020-200 | | | 20 | 1.6 | 55 | 4 | 452 |
| **CSELB** | 2020-200 | | | 20 | 1.6 | 55 | 4 | 474 |
| **DLCLB** | 2020-200 | | | 20 | 1.6 | 55 | 4 | 490 |
| **HGLB** | 2020-200 | | | 20 | 1.6 | 60 | 4 | 439 |
| **DCLB** | 2020-0200-16 | | | 20 | 1.6 | 60 | 4 | 485 |
| **HSLB** | 2020-200-6 | | | 20 | 1.6 | 70 | 6 | 452 |
| **CSELB** | 2020-200-6 | | | 20 | 1.6 | 70 | 6 | 474 |
| **CPRB** | 2020-20 | | | 20 | 1.7 | 55 | 4 | 499 |
| **DCLB** | 2020-0200 | | | 20 | 3 | 70 | 4 | 485 |
| **CFLB** | 3020-200 | 3 Flutes | | 20 | 1.6 | 55 | 4 | 503 |
| **HSLB** | 2020-220 | 2 Flutes | | 22 | 1.6 | 60 | 4 | 452 |
| **CSELB** | 2020-220 | | | 22 | 1.6 | 60 | 4 | 474 |
| **CPRB** | 2020-22 | | | 22 | 1.7 | 60 | 4 | 499 |
| **HGLB** | 2020-250 | | | 25 | 1.6 | 60 | 4 | 439 |
| **HSLB** | 2020-250 | | | 25 | 1.6 | 65 | 4 | 452 |
| **CSELB** | 2020-250 | | | 25 | 1.6 | 65 | 4 | 474 |
| **DCLB** | 2020-0250 | | | 25 | 1.6 | 65 | 4 | 485 |
| **DLCLB** | 2020-250 | | | 25 | 1.6 | 65 | 4 | 490 |
| **HSLB** | 2020-250-6 | | | 25 | 1.6 | 80 | 6 | 452 |
| **CSELB** | 2020-250-6 | | | 25 | 1.6 | 80 | 6 | 474 |
| **CPRB** | 2020-25 | | | 25 | 1.7 | 65 | 4 | 499 |
| **DCLB** | 2020-0250-30 | | | 25 | 3 | 65 | 4 | 485 |
| **HSLB** | 2020-270 | | | 27 | 1.6 | 65 | 4 | 452 |
| **CSELB** | 2020-270 | | | 27 | 1.6 | 65 | 4 | 474 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HGLB** | 2020-300 | 2 Flutes | R1 | 30 | 1.6 | 70 | 4 | 439 |
| **HSLB** | 2020-300 | | | 30 | 1.6 | 70 | 4 | 452 |
| **CSELB** | 2020-300 | | | 30 | 1.6 | 70 | 4 | 474 |
| **DCLB** | 2020-0300-16 | | | 30 | 1.6 | 70 | 4 | 485 |
| **HSLB** | 2020-300-6 | | | 30 | 1.6 | 80 | 6 | 452 |
| **CSELB** | 2020-300-6 | | | 30 | 1.6 | 80 | 6 | 474 |
| **CPRB** | 2020-30 | | | 30 | 1.7 | 70 | 4 | 499 |
| **DCLB** | 2020-0300 | | | 30 | 3 | 70 | 4 | 485 |
| **HSLB** | 2020-320 | | | 32 | 1.6 | 70 | 4 | 452 |
| **CSELB** | 2020-320 | | | 32 | 1.6 | 70 | 4 | 474 |
| **HSLB** | 2020-350 | | | 35 | 1.6 | 80 | 4 | 452 |
| **CSELB** | 2020-350 | | | 35 | 1.6 | 80 | 4 | 474 |
| **HSLB** | 2020-350-6 | | | 35 | 1.6 | 80 | 6 | 452 |
| **CSELB** | 2020-350-6 | | | 35 | 1.6 | 80 | 6 | 474 |
| **DCLB** | 2020-0350 | | | 35 | 3 | 70 | 4 | 485 |
| **HSLB** | 2020-400 | | | 40 | 1.6 | 80 | 4 | 452 |
| **CSELB** | 2020-400 | | | 40 | 1.6 | 80 | 4 | 474 |
| **DCLB** | 2020-0400 | | | 40 | 1.6 | 80 | 4 | 485 |
| **HSLB** | 2020-400-6 | | | 40 | 1.6 | 90 | 6 | 452 |
| **CSELB** | 2020-400-6 | | | 40 | 1.6 | 90 | 6 | 474 |
| **HSB** | 2025-0250 | 2 Flutes | R1.25 | — | 2.5 | 50 | 4 | 399 |
| **CSEB** | 2025-0250 | | | — | 2.5 | 50 | 4 | 407 |
| **HSB** | 2025-0250-6 | | | — | 2.5 | 60 | 6 | 399 |
| **CSEB** | 2025-0250-6 | | | — | 2.5 | 60 | 6 | 407 |
| **HGB** | 2025-0375 | | | — | 3.75 | 50 | 4 | 396 |
| **HSB** | 2025-0375 | | | — | 3.75 | 50 | 4 | 399 |
| **CSEB** | 2025-0375 | | | — | 3.75 | 50 | 4 | 407 |
| **HSB** | 2025-0600 | | | — | 6 | 60 | 4 | 399 |
| **CSEB** | 2025-0600 | | | — | 6 | 60 | 4 | 407 |
| **CGB** | 2025 | | | — | 10 | 70 | 4 | 414 |
| **HSLB** | 2025-060 | | | 6 | 2 | 45 | 4 | 452 |
| **CSELB** | 2025-060 | | | 6 | 2 | 45 | 4 | 474 |
| **HSLB** | 2025-080 | | | 8 | 2 | 45 | 4 | 452 |
| **CSELB** | 2025-080 | | | 8 | 2 | 45 | 4 | 474 |
| **HSLB** | 2025-100 | | | 10 | 2 | 45 | 4 | 452 |
| **CSELB** | 2025-100 | | | 10 | 2 | 45 | 4 | 474 |
| **HSLB** | 2025-150 | | | 15 | 2 | 50 | 4 | 452 |
| **CSELB** | 2025-150 | | | 15 | 2 | 50 | 4 | 474 |
| **HSLB** | 2025-200 | | | 20 | 2 | 55 | 4 | 452 |
| **CSELB** | 2025-200 | | | 20 | 2 | 55 | 4 | 474 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2025-250 | 2 Flutes | R1.25 | 25 | 2 | 65 | 4 | 452 |
| **CSELB** | 2025-250 | | | 25 | 2 | 65 | 4 | 474 |
| **HSLB** | 2025-300 | | | 30 | 2 | 70 | 4 | 452 |
| **CSELB** | 2025-300 | | | 30 | 2 | 70 | 4 | 474 |
| **HSLB** | 2025-350 | | | 35 | 2 | 70 | 4 | 452 |
| **CSELB** | 2025-350 | | | 35 | 2 | 70 | 4 | 474 |
| **UDCBF** | 2030-0210 | 2 Flutes | R1.5 | — | 2.1 | 60 | 6 | 80 |
| **UDCB** | 2030-0210 | | | — | 2.1 | 60 | 6 | 94 |
| **HSB** | 2030-0300S | | | — | 3 | 40 | 6 | 403 |
| **HSB** | 2030-0300 | | | — | 3 | 50 | 6 | 399 |
| **CSEB** | 2030-0300 | | | — | 3 | 50 | 6 | 407 |
| **HGB** | 2030-0450 | | | — | 4.5 | 50 | 6 | 396 |
| **HSB** | 2030-0450 | | | — | 4.5 | 70 | 6 | 399 |
| **CSEB** | 2030-0450 | | | — | 4.5 | 70 | 6 | 407 |
| **HBL** | 2030-0800 | | | — | 4.5 | 80 | 3 | 404 |
| **HSB** | 2030-0800 | | | — | 8 | 70 | 6 | 399 |
| **CSEB** | 2030-0800 | | | — | 8 | 70 | 6 | 407 |
| **DCB** | 2030 | | | — | 15 | 80 | 4 | 412 |
| **CGB** | 2030 | | | — | 15 | 80 | 4 | 414 |
| **CFB** | 3030-0450 | 3 Flutes | | — | 4.5 | 60 | 6 | 416 |
| **DLC-CFB** | 3030-0450 | | | — | 4.5 | 60 | 6 | 422 |
| **HFB** | 4030-0450S | 4 Flutes | | — | 4.5 | 40 | 4 | 427 |
| **HFB** | 4030-0450 | | | — | 4.5 | 60 | 6 | 426 |
| **UDCLBF** | 2030-0600 | 2 Flutes | | 6 | 2.1 | 60 | 6 | 83 |
| **UDCLB** | 2030-0600 | | | 6 | 2.1 | 60 | 6 | 98 |
| **HSLB** | 2030-060-4S | | | 6 | 2.4 | 35 | 4 | 466 |
| **HSLB** | 2030-060-3 | | | 6 | 2.4 | 60 | 3 | 453 |
| **CSELB** | 2030-060-3 | | | 6 | 2.4 | 60 | 3 | 475 |
| **HSLB** | 2030-060-4 | | | 6 | 2.4 | 60 | 4 | 453 |
| **CSELB** | 2030-060-4 | | | 6 | 2.4 | 60 | 4 | 475 |
| **HGLB** | 2030-060 | | | 6 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-060 | | | 6 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-060 | | | 6 | 2.4 | 60 | 6 | 475 |
| **UDCLBF** | 2030-0800 | | | 8 | 2.1 | 60 | 6 | 83 |
| **UDCLB** | 2030-0800 | | | 8 | 2.1 | 60 | 6 | 98 |
| **HSLB** | 2030-080-4S | | | 8 | 2.4 | 40 | 4 | 466 |
| **HGLB** | 2030-080 | | | 8 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-080 | | | 8 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-080 | | | 8 | 2.4 | 60 | 6 | 475 |
| **CPRB** | 2030-8 | | | 8 | 2.5 | 60 | 6 | 500 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CFLB** | 3030-080 | 3 Flutes | R1.5 | 8 | 2.4 | 60 | 6 | 503 |
| **UDCLBF** | 2030-1000 | 2 Flutes | | 10 | 2.1 | 60 | 6 | 83 |
| **UDCLB** | 2030-1000 | | | 10 | 2.1 | 60 | 6 | 98 |
| **HSLB** | 2030-100-4S | | | 10 | 2.4 | 40 | 4 | 466 |
| **HGLB** | 2030-100 | | | 10 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-100 | | | 10 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-100 | | | 10 | 2.4 | 60 | 6 | 475 |
| **DLCLB** | 2030-100 | | | 10 | 2.4 | 60 | 6 | 492 |
| **CPRB** | 2030-10 | | | 10 | 2.5 | 60 | 6 | 500 |
| **CFLB** | 3030-100 | 3 Flutes | | 10 | 2.4 | 60 | 6 | 503 |
| **UDCLBF** | 2030-1200 | 2 Flutes | | 12 | 2.1 | 60 | 6 | 83 |
| **UDCLB** | 2030-1200 | | | 12 | 2.1 | 60 | 6 | 98 |
| **HSLB** | 2030-120-4S | | | 12 | 2.4 | 40 | 4 | 466 |
| **HGLB** | 2030-120 | | | 12 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-120 | | | 12 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-120 | | | 12 | 2.4 | 60 | 6 | 475 |
| **DLCLB** | 2030-120 | | | 12 | 2.4 | 60 | 6 | 492 |
| **CPRB** | 2030-12 | | | 12 | 2.5 | 60 | 6 | 500 |
| **CFLB** | 3030-120 | 3 Flutes | | 12 | 2.4 | 60 | 6 | 503 |
| **UDCLBF** | 2030-1400 | 2 Flutes | | 14 | 2.1 | 60 | 6 | 83 |
| **UDCLB** | 2030-1400 | | | 14 | 2.1 | 60 | 6 | 98 |
| **HGLB** | 2030-140 | | | 14 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-140 | | | 14 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-140 | | | 14 | 2.4 | 60 | 6 | 475 |
| **DLCLB** | 2030-140 | | | 14 | 2.4 | 60 | 6 | 492 |
| **HSLB** | 2030-150 | | | 15 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-150 | | | 15 | 2.4 | 60 | 6 | 475 |
| **HSLB** | 2030-160-4S | | | 16 | 2.4 | 45 | 4 | 466 |
| **HGLB** | 2030-160 | | | 16 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-160 | | | 16 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-160 | | | 16 | 2.4 | 60 | 6 | 475 |
| **DCLB** | 2030-0160 | | | 16 | 2.4 | 60 | 6 | 485 |
| **DLCLB** | 2030-160 | | | 16 | 2.4 | 60 | 6 | 492 |
| **CPRB** | 2030-16 | | | 16 | 2.5 | 60 | 6 | 500 |
| **CFLB** | 3030-160 | 3 Flutes | | 16 | 2.4 | 60 | 6 | 503 |
| **HGLB** | 2030-180 | 2 Flutes | | 18 | 2.4 | 60 | 6 | 439 |
| **HSLB** | 2030-180 | | | 18 | 2.4 | 60 | 6 | 453 |
| **CSELB** | 2030-180 | | | 18 | 2.4 | 60 | 6 | 475 |
| **HSLB** | 2030-200-4S | | | 20 | 2.4 | 50 | 4 | 466 |
| **DCLB** | 2030-0200 | | | 20 | 2.4 | 60 | 6 | 485 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HGLB** | 2030-200 | 2 Flutes | R1.5 | 20 | 2.4 | 70 | 6 | 439 |
| **HSLB** | 2030-200 | | | 20 | 2.4 | 70 | 6 | 453 |
| **CSELB** | 2030-200 | | | 20 | 2.4 | 70 | 6 | 475 |
| **DLCLB** | 2030-200 | | | 20 | 2.4 | 70 | 6 | 492 |
| **CPRB** | 2030-20 | | | 20 | 2.5 | 70 | 6 | 500 |
| **CFLB** | 3030-200 | 3 Flutes | | 20 | 2.4 | 70 | 6 | 503 |
| **HGLB** | 2030-220 | 2 Flutes | | 22 | 2.4 | 70 | 6 | 439 |
| **HSLB** | 2030-220 | | | 22 | 2.4 | 70 | 6 | 453 |
| **CSELB** | 2030-220 | | | 22 | 2.4 | 70 | 6 | 475 |
| **HGLB** | 2030-250 | | | 25 | 2.4 | 70 | 6 | 439 |
| **HSLB** | 2030-250 | | | 25 | 2.4 | 70 | 6 | 453 |
| **CSELB** | 2030-250 | | | 25 | 2.4 | 70 | 6 | 475 |
| **DCLB** | 2030-0250 | | | 25 | 2.4 | 70 | 6 | 485 |
| **DLCLB** | 2030-250 | | | 25 | 2.4 | 70 | 6 | 492 |
| **CPRB** | 2030-25 | | | 25 | 2.5 | 70 | 6 | 500 |
| **CFLB** | 3030-250 | 3 Flutes | | 25 | 2.4 | 70 | 6 | 503 |
| **HGLB** | 2030-270 | 2 Flutes | | 27 | 2.4 | 70 | 6 | 439 |
| **HSLB** | 2030-270 | | | 27 | 2.4 | 70 | 6 | 453 |
| **CSELB** | 2030-270 | | | 27 | 2.4 | 70 | 6 | 475 |
| **HGLB** | 2030-300 | | | 30 | 2.4 | 70 | 6 | 439 |
| **HSLB** | 2030-300 | | | 30 | 2.4 | 70 | 6 | 453 |
| **CSELB** | 2030-300 | | | 30 | 2.4 | 70 | 6 | 475 |
| **DLCLB** | 2030-300 | | | 30 | 2.4 | 70 | 6 | 492 |
| **DCLB** | 2030-0300-S6 | | | 30 | 2.4 | 80 | 6 | 485 |
| **CPRB** | 2030-30 | | | 30 | 2.5 | 70 | 6 | 500 |
| **DCLB** | 2030-0300 | | | 30 | 4.5 | 80 | 4 | 485 |
| **HSLB** | 2030-320 | | | 32 | 2.4 | 80 | 6 | 453 |
| **CSELB** | 2030-320 | | | 32 | 2.4 | 80 | 6 | 475 |
| **HSLB** | 2030-350 | | | 35 | 2.4 | 80 | 6 | 453 |
| **CSELB** | 2030-350 | | | 35 | 2.4 | 80 | 6 | 475 |
| **CPRB** | 2030-35 | | | 35 | 2.5 | 80 | 6 | 500 |
| **HSLB** | 2030-400 | | | 40 | 2.4 | 80 | 6 | 453 |
| **CSELB** | 2030-400 | | | 40 | 2.4 | 80 | 6 | 475 |
| **DCLB** | 2030-0400-S6 | | | 40 | 2.4 | 80 | 6 | 485 |
| **DCLB** | 2030-0400 | | | 40 | 4.5 | 80 | 4 | 485 |
| **CSEB** | 2035-0520 | 2 Flutes | R1.75 | — | 5.2 | 70 | 6 | 407 |
| **HSLB** | 2035-100 | | | 10 | 2.8 | 60 | 6 | 453 |
| **CSELB** | 2035-100 | | | 10 | 2.8 | 60 | 6 | 475 |
| **HSLB** | 2035-150 | | | 15 | 2.8 | 60 | 6 | 453 |
| **CSELB** | 2035-150 | | | 15 | 2.8 | 60 | 6 | 475 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2035-200 | 2 Flutes | R1.75 | 20 | 2.8 | 65 | 6 | 453 |
| **CSELB** | 2035-200 | | | 20 | 2.8 | 65 | 6 | 475 |
| **HSLB** | 2035-250 | | | 25 | 2.8 | 70 | 6 | 453 |
| **CSELB** | 2035-250 | | | 25 | 2.8 | 70 | 6 | 475 |
| **HSLB** | 2035-300 | | | 30 | 2.8 | 70 | 6 | 453 |
| **CSELB** | 2035-300 | | | 30 | 2.8 | 70 | 6 | 475 |
| **HSLB** | 2035-400 | | | 40 | 2.8 | 90 | 6 | 453 |
| **CSELB** | 2035-400 | | | 40 | 2.8 | 90 | 6 | 475 |
| **HSLB** | 2035-450 | | | 45 | 2.8 | 90 | 6 | 453 |
| **CSELB** | 2035-450 | | | 45 | 2.8 | 90 | 6 | 475 |
| **UDCBF** | 2040-0280 | 2 Flutes | R2 | — | 2.8 | 60 | 6 | 80 |
| **UDCB** | 2040-0280 | | | — | 2.8 | 60 | 6 | 94 |
| **HSB** | 2040-0400S | | | — | 4 | 40 | 6 | 403 |
| **HSB** | 2040-0400 | | | — | 4 | 50 | 6 | 399 |
| **CSEB** | 2040-0400 | | | — | 4 | 50 | 6 | 407 |
| **HGB** | 2040-0600 | | | — | 6 | 50 | 6 | 396 |
| **HSB** | 2040-0600-4 | | | — | 6 | 70 | 4 | 399 |
| **CSEB** | 2040-0600-4 | | | — | 6 | 70 | 4 | 407 |
| **HSB** | 2040-0600 | | | — | 6 | 70 | 6 | 399 |
| **CSEB** | 2040-0600 | | | — | 6 | 70 | 6 | 407 |
| **HBL** | 2040-1000 | | | — | 6 | 100 | 4 | 404 |
| **HSB** | 2040-0800 | | | — | 8 | 70 | 6 | 399 |
| **CSEB** | 2040-0800 | | | — | 8 | 70 | 6 | 407 |
| **DCB** | 2040 | | | — | 20 | 100 | 4 | 412 |
| **CGB** | 2040 | | | — | 20 | 100 | 4 | 414 |
| **CFB** | 3040-0600-4 | 3 Flutes | | — | 6 | 70 | 4 | 416 |
| **DLC-CFB** | 3040-0600-4 | | | — | 6 | 70 | 4 | 422 |
| **CFB** | 3040-0600 | | | — | 6 | 70 | 6 | 416 |
| **DLC-CFB** | 3040-0600 | | | — | 6 | 70 | 6 | 422 |
| **HFB** | 4040-0600S | 4 Flutes | | — | 6 | 45 | 6 | 427 |
| **HFB** | 4040-0600 | | | — | 6 | 70 | 6 | 426 |
| **CGB** | 4040 | | | — | 20 | 100 | 4 | 432 |
| **UDCLBF** | 2040-0800 | 2 Flutes | | 8 | 2.8 | 60 | 6 | 83 |
| **UDCLB** | 2040-0800 | | | 8 | 2.8 | 60 | 6 | 98 |
| **HSLB** | 2040-080-4S | | | 8 | 3.2 | 35 | 4 | 466 |
| **HSLB** | 2040-080-4 | | | 8 | 3.2 | 70 | 4 | 453 |
| **CSELB** | 2040-080-4 | | | 8 | 3.2 | 70 | 4 | 475 |
| **HGLB** | 2040-080 | | | 8 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-080 | | | 8 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-080 | | | 8 | 3.2 | 70 | 6 | 475 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **UDCLBF** | 2040-1000 | 2 Flutes | R2 | 10 | 2.8 | 60 | 6 | 83 |
| **UDCLB** | 2040-1000 | | | 10 | 2.8 | 60 | 6 | 98 |
| **CPRB** | 2040-10 | | | 10 | 3 | 70 | 6 | 500 |
| **HSLB** | 2040-100-4S | | | 10 | 3.2 | 40 | 4 | 466 |
| **HGLB** | 2040-100 | | | 10 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-100 | | | 10 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-100 | | | 10 | 3.2 | 70 | 6 | 475 |
| **DLCLB** | 2040-100 | | | 10 | 3.2 | 70 | 6 | 492 |
| **CFLB** | 3040-100 | 3 Flutes | | 10 | 3.2 | 70 | 6 | 503 |
| **CPRB** | 2040-12 | 2 Flutes | | 12 | 3 | 70 | 6 | 500 |
| **HSLB** | 2040-120-4S | | | 12 | 3.2 | 40 | 4 | 466 |
| **HGLB** | 2040-120 | | | 12 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-120 | | | 12 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-120 | | | 12 | 3.2 | 70 | 6 | 475 |
| **CFLB** | 3040-120 | 3 Flutes | | 12 | 3.2 | 70 | 6 | 503 |
| **HGLB** | 2040-140 | 2 Flutes | | 14 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-140 | | | 14 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-140 | | | 14 | 3.2 | 70 | 6 | 475 |
| **UDCLBF** | 2040-1500 | | | 15 | 2.8 | 60 | 6 | 83 |
| **UDCLB** | 2040-1500 | | | 15 | 2.8 | 60 | 6 | 98 |
| **HSLB** | 2040-150 | | | 15 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-150 | | | 15 | 3.2 | 70 | 6 | 475 |
| **DLCLB** | 2040-150 | | | 15 | 3.2 | 70 | 6 | 492 |
| **CPRB** | 2040-16 | | | 16 | 3 | 70 | 6 | 500 |
| **HSLB** | 2040-160-4S | | | 16 | 3.2 | 45 | 4 | 466 |
| **HGLB** | 2040-160 | | | 16 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-160 | | | 16 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-160 | | | 16 | 3.2 | 70 | 6 | 475 |
| **DCLB** | 2040-0160 | | | 16 | 3.2 | 70 | 6 | 485 |
| **CFLB** | 3040-160 | 3 Flutes | | 16 | 3.2 | 70 | 6 | 503 |
| **HGLB** | 2040-180 | 2 Flutes | | 18 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-180 | | | 18 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-180 | | | 18 | 3.2 | 70 | 6 | 475 |
| **CPRB** | 2040-20 | | | 20 | 3 | 70 | 6 | 500 |
| **HSLB** | 2040-200-4S | | | 20 | 3.2 | 50 | 4 | 466 |
| **HGLB** | 2040-200 | | | 20 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-200 | | | 20 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-200 | | | 20 | 3.2 | 70 | 6 | 475 |
| **DCLB** | 2040-0200 | | | 20 | 3.2 | 70 | 6 | 485 |
| **DLCLB** | 2040-200 | | | 20 | 3.2 | 70 | 6 | 492 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CFLB** | 3040-200 | 3 Flutes | R2 | 20 | 3.2 | 70 | 6 | 503 |
| **HGLB** | 2040-220 | 2 Flutes | | 22 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-220 | | | 22 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-220 | | | 22 | 3.2 | 70 | 6 | 475 |
| **CPRB** | 2040-25 | | | 25 | 3 | 70 | 6 | 500 |
| **HGLB** | 2040-250 | | | 25 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-250 | | | 25 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-250 | | | 25 | 3.2 | 70 | 6 | 475 |
| **DCLB** | 2040-0250 | | | 25 | 3.2 | 70 | 6 | 485 |
| **DLCLB** | 2040-250 | | | 25 | 3.2 | 70 | 6 | 492 |
| **CFLB** | 3040-250 | 3 Flutes | | 25 | 3.2 | 70 | 6 | 503 |
| **HGLB** | 2040-270 | 2 Flutes | | 27 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-270 | | | 27 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-270 | | | 27 | 3.2 | 70 | 6 | 475 |
| **CPRB** | 2040-30 | | | 30 | 3 | 70 | 6 | 500 |
| **HGLB** | 2040-300 | | | 30 | 3.2 | 70 | 6 | 440 |
| **HSLB** | 2040-300 | | | 30 | 3.2 | 70 | 6 | 453 |
| **CSELB** | 2040-300 | | | 30 | 3.2 | 70 | 6 | 475 |
| **DCLB** | 2040-0300 | | | 30 | 3.2 | 70 | 6 | 485 |
| **DLCLB** | 2040-300 | | | 30 | 3.2 | 70 | 6 | 492 |
| **DCLB** | 2040-0300-60 | | | 30 | 6 | 100 | 4 | 485 |
| **CFLB** | 3040-300 | 3 Flutes | | 30 | 3.2 | 70 | 6 | 503 |
| **HSLB** | 2040-320 | 2 Flutes | | 32 | 3.2 | 80 | 6 | 453 |
| **CSELB** | 2040-320 | | | 32 | 3.2 | 80 | 6 | 475 |
| **CPRB** | 2040-35 | | | 35 | 3 | 80 | 6 | 500 |
| **HGLB** | 2040-350 | | | 35 | 3.2 | 80 | 6 | 440 |
| **HSLB** | 2040-350 | | | 35 | 3.2 | 80 | 6 | 453 |
| **CSELB** | 2040-350 | | | 35 | 3.2 | 80 | 6 | 475 |
| **CPRB** | 2040-40 | | | 40 | 3 | 90 | 6 | 500 |
| **DLCLB** | 2040-400 | | | 40 | 3.2 | 80 | 6 | 492 |
| **HGLB** | 2040-400 | | | 40 | 3.2 | 90 | 6 | 440 |
| **HSLB** | 2040-400 | | | 40 | 3.2 | 90 | 6 | 453 |
| **CSELB** | 2040-400 | | | 40 | 3.2 | 90 | 6 | 475 |
| **DCLB** | 2040-0400-S6 | | | 40 | 3.2 | 90 | 6 | 485 |
| **DCLB** | 2040-0400 | | | 40 | 6 | 100 | 4 | 485 |
| **CPRB** | 2040-45 | | | 45 | 3 | 90 | 6 | 500 |
| **HSLB** | 2040-450 | | | 45 | 3.2 | 90 | 6 | 453 |
| **CSELB** | 2040-450 | | | 45 | 3.2 | 90 | 6 | 475 |
| **CPRB** | 2040-50 | | | 50 | 3 | 100 | 6 | 500 |
| **HSLB** | 2040-500 | | | 50 | 3.2 | 100 | 6 | 453 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2040-500 | 2 Flutes | R2 | 50 | 3.2 | 100 | 6 | 475 |
| **DCLB** | 2040-0500-S6 | | | 50 | 3.2 | 100 | 6 | 485 |
| **DCLB** | 2040-0500 | | | 50 | 6 | 100 | 4 | 485 |
| **HSLB** | 2040-600 | | | 60 | 3.2 | 120 | 6 | 453 |
| **CSELB** | 2040-600 | | | 60 | 3.2 | 120 | 6 | 475 |
| **DCLB** | 2040-0600 | | | 60 | 6 | 100 | 4 | 485 |
| **CSEB** | 2045-0670 | 2 Flutes | R2.25 | — | 6.7 | 70 | 6 | 407 |
| **UDCBF** | 2050-0350 | 2 Flutes | R2.5 | — | 3.5 | 60 | 6 | 80 |
| **UDCB** | 2050-0350 | | | — | 3.5 | 60 | 6 | 94 |
| **HSB** | 2050-0500 | | | — | 5 | 50 | 6 | 399 |
| **CSEB** | 2050-0500 | | | — | 5 | 50 | 6 | 407 |
| **HGB** | 2050-0750 | | | — | 7.5 | 50 | 6 | 396 |
| **HSB** | 2050-0750 | | | — | 7.5 | 80 | 6 | 399 |
| **CSEB** | 2050-0750 | | | — | 7.5 | 80 | 6 | 407 |
| **HSB** | 2050-0800 | | | — | 8 | 80 | 6 | 399 |
| **CSEB** | 2050-0800 | | | — | 8 | 80 | 6 | 407 |
| **HSB** | 2050-1200 | | | — | 12 | 80 | 6 | 399 |
| **CSEB** | 2050-1200 | | | — | 12 | 80 | 6 | 407 |
| **DCB** | 2050 | | | — | 20 | 100 | 5 | 412 |
| **CGB** | 2050 | | | — | 20 | 100 | 5 | 414 |
| **CFB** | 3050-0750 | 3 Flutes | | — | 7.5 | 80 | 6 | 416 |
| **DLC-CFB** | 3050-0750 | | | — | 7.5 | 80 | 6 | 422 |
| **CGB** | 4050 | 4 Flutes | | — | 20 | 100 | 5 | 432 |
| **UDCLBF** | 2050-1000 | 2 Flutes | | 10 | 3.5 | 60 | 6 | 83 |
| **UDCLB** | 2050-1000 | | | 10 | 3.5 | 60 | 6 | 98 |
| **HSLB** | 2050-100 | | | 10 | 4 | 70 | 6 | 454 |
| **CSELB** | 2050-100 | | | 10 | 4 | 70 | 6 | 476 |
| **UDCLBF** | 2050-1500 | | | 15 | 3.5 | 60 | 6 | 83 |
| **UDCLB** | 2050-1500 | | | 15 | 3.5 | 60 | 6 | 98 |
| **HSLB** | 2050-150 | | | 15 | 4 | 70 | 6 | 454 |
| **CSELB** | 2050-150 | | | 15 | 4 | 70 | 6 | 476 |
| **CPRB** | 2050-20 | | | 20 | 3.5 | 70 | 6 | 500 |
| **HSLB** | 2050-200 | | | 20 | 4 | 70 | 6 | 454 |
| **CSELB** | 2050-200 | | | 20 | 4 | 70 | 6 | 476 |
| **DCLB** | 2050-0200 | | | 20 | 4 | 70 | 6 | 485 |
| **CPRB** | 2050-25 | | | 25 | 3.5 | 70 | 6 | 500 |
| **HSLB** | 2050-250 | | | 25 | 4 | 70 | 6 | 454 |
| **CSELB** | 2050-250 | | | 25 | 4 | 70 | 6 | 476 |
| **CPRB** | 2050-30 | | | 30 | 3.5 | 80 | 6 | 500 |
| **HSLB** | 2050-300 | | | 30 | 4 | 80 | 6 | 454 |
| **CSELB** | 2050-300 | 2 Flutes | R2.5 | 30 | 4 | 80 | 6 | 476 |
| **DCLB** | 2050-0300 | | | 30 | 4 | 80 | 6 | 485 |
| **CPRB** | 2050-35 | | | 35 | 3.5 | 80 | 6 | 500 |
| **HSLB** | 2050-350 | | | 35 | 4 | 80 | 6 | 454 |
| **CSELB** | 2050-350 | | | 35 | 4 | 80 | 6 | 476 |
| **HSLB** | 2050-400 | | | 40 | 4 | 90 | 6 | 454 |
| **CSELB** | 2050-400 | | | 40 | 4 | 90 | 6 | 476 |
| **HSLB** | 2050-450 | | | 45 | 4 | 100 | 6 | 454 |
| **CSELB** | 2050-450 | | | 45 | 4 | 100 | 6 | 476 |
| **HSLB** | 2050-500 | | | 50 | 4 | 100 | 6 | 454 |
| **CSELB** | 2050-500 | | | 50 | 4 | 100 | 6 | 476 |
| **CSEB** | 2055-0820 | 2 Flutes | R2.75 | — | 8.2 | 80 | 6 | 407 |
| **UDCBF** | 2060-0420 | 2 Flutes | R3 | — | 4.2 | 60 | 6 | 80 |
| **UDCB** | 2060-0420 | | | — | 4.2 | 60 | 6 | 94 |
| **HSB** | 2060-0600 | | | — | 6 | 50 | 6 | 399 |
| **CSEB** | 2060-0600 | | | — | 6 | 50 | 6 | 407 |
| **HGB** | 2060-0900 | | | — | 9 | 50 | 6 | 396 |
| **HSB** | 2060-0900 | | | — | 9 | 80 | 6 | 399 |
| **CSEB** | 2060-0900 | | | — | 9 | 80 | 6 | 407 |
| **HSB** | 2060-1200 | | | — | 12 | 80 | 6 | 399 |
| **CSEB** | 2060-1200 | | | — | 12 | 80 | 6 | 407 |
| **HBL** | 2060-1400 | | | — | 18 | 140 | 6 | 404 |
| **DCB** | 2060 | | | — | 30 | 150 | 6 | 412 |
| **CGB** | 2060 | | | — | 30 | 150 | 6 | 414 |
| **CFB** | 3060-0900 | 3 Flutes | | — | 9 | 80 | 6 | 416 |
| **DLC-CFB** | 3060-0900 | | | — | 9 | 80 | 6 | 422 |
| **HFB** | 4060-0900S | 4 Flutes | | — | 9 | 50 | 6 | 427 |
| **HFB** | 4060-0900 | | | — | 9 | 80 | 6 | 426 |
| **CGB** | 4060 | | | — | 30 | 150 | 6 | 432 |
| **UDCLBF** | 2060-1000 | 2 Flutes | | 10 | 4.2 | 60 | 6 | 83 |
| **UDCLB** | 2060-1000 | | | 10 | 4.2 | 60 | 6 | 98 |
| **HGLB** | 2060-100 | | | 10 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-100 | | | 10 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-100 | | | 10 | 4.8 | 80 | 6 | 476 |
| **DLCLB** | 2060-100 | | | 10 | 4.8 | 80 | 6 | 492 |
| **UDCLBF** | 2060-1500 | | | 15 | 4.2 | 60 | 6 | 83 |
| **UDCLB** | 2060-1500 | | | 15 | 4.2 | 60 | 6 | 98 |
| **HSLB** | 2060-150S | | | 15 | 4.8 | 45 | 6 | 466 |
| **HGLB** | 2060-150 | | | 15 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-150 | | | 15 | 4.8 | 80 | 6 | 454 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CSELB** | 2060-150 | 2 Flutes | R3 | 15 | 4.8 | 80 | 6 | 476 |
| **DLCLB** | 2060-150 | | | 15 | 4.8 | 80 | 6 | 492 |
| **HGLB** | 2060-180 | | | 18 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-180 | | | 18 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-180 | | | 18 | 4.8 | 80 | 6 | 476 |
| **HSLB** | 2060-200S | | | 20 | 4.8 | 50 | 6 | 466 |
| **HGLB** | 2060-200 | | | 20 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-200 | | | 20 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-200 | | | 20 | 4.8 | 80 | 6 | 476 |
| **DLCLB** | 2060-200 | | | 20 | 4.8 | 80 | 6 | 492 |
| **CFLB** | 3060-200 | 3 Flutes | | 20 | 4.8 | 80 | 6 | 503 |
| **HSLB** | 2060-220 | 2 Flutes | | 22 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-220 | | | 22 | 4.8 | 80 | 6 | 476 |
| **HGLB** | 2060-250 | | | 25 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-250 | | | 25 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-250 | | | 25 | 4.8 | 80 | 6 | 476 |
| **CFLB** | 3060-250 | 3 Flutes | | 25 | 4.8 | 80 | 6 | 503 |
| **HSLB** | 2060-270 | 2 Flutes | | 27 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-270 | | | 27 | 4.8 | 80 | 6 | 476 |
| **HGLB** | 2060-300 | | | 30 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-300 | | | 30 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-300 | | | 30 | 4.8 | 80 | 6 | 476 |
| **DCLB** | 2060-0300 | | | 30 | 4.8 | 80 | 6 | 485 |
| **DLCLB** | 2060-300 | | | 30 | 4.8 | 80 | 6 | 492 |
| **CPRB** | 2060-30 | | | 30 | 6 | 80 | 6 | 500 |
| **CFLB** | 3060-300 | 3 Flutes | | 30 | 4.8 | 80 | 6 | 503 |
| **HSLB** | 2060-320 | 2 Flutes | | 32 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-320 | | | 32 | 4.8 | 80 | 6 | 476 |
| **HGLB** | 2060-350 | | | 35 | 4.8 | 80 | 6 | 440 |
| **HSLB** | 2060-350 | | | 35 | 4.8 | 80 | 6 | 454 |
| **CSELB** | 2060-350 | | | 35 | 4.8 | 80 | 6 | 476 |
| **CFLB** | 3060-350 | 3 Flutes | | 35 | 4.8 | 80 | 6 | 503 |
| **HGLB** | 2060-400 | 2 Flutes | | 40 | 4.8 | 90 | 6 | 440 |
| **HSLB** | 2060-400 | | | 40 | 4.8 | 90 | 6 | 454 |
| **CSELB** | 2060-400 | | | 40 | 4.8 | 90 | 6 | 476 |
| **DCLB** | 2060-0400 | | | 40 | 4.8 | 100 | 6 | 485 |
| **CFLB** | 3060-400 | 3 Flutes | | 40 | 4.8 | 90 | 6 | 503 |
| **HSLB** | 2060-450 | 2 Flutes | | 45 | 4.8 | 100 | 6 | 454 |
| **CSELB** | 2060-450 | | | 45 | 4.8 | 100 | 6 | 476 |
| **HGLB** | 2060-500 | | | 50 | 4.8 | 120 | 6 | 440 |

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **HSLB** | 2060-500 | 2 Flutes | R3 | 50 | 4.8 | 120 | 6 | 454 |
| **CSELB** | 2060-500 | | | 50 | 4.8 | 120 | 6 | 476 |
| **DCLB** | 2060-0500 | | | 50 | 4.8 | 120 | 6 | 485 |
| **CPRB** | 2060-50 | | | 50 | 6 | 120 | 6 | 500 |
| **HSLB** | 2060-600 | | | 60 | 4.8 | 120 | 6 | 454 |
| **CSELB** | 2060-600 | | | 60 | 4.8 | 120 | 6 | 476 |
| **DCLB** | 2060-0600 | | | 60 | 4.8 | 120 | 6 | 485 |
| **DCLB** | 2060-0700 | | | 70 | 4.8 | 120 | 6 | 485 |
| **DCLB** | 2060-0800 | | | 80 | 4.8 | 120 | 6 | 485 |
| **CSEB** | 2065-0970 | 2 Flutes | R3.25 | — | 9.7 | 90 | 8 | 407 |
| **CSEB** | 2070-1050 | 2 Flutes | R3.5 | — | 10.5 | 90 | 8 | 407 |
| **CGB** | 2070 | | | — | 30 | 150 | 6 | 414 |
| **CGB** | 4070 | 4 Flutes | | — | 30 | 150 | 6 | 432 |
| **CSEB** | 2075-1120 | 2 Flutes | R3.75 | — | 11.2 | 90 | 8 | 407 |
| **HSB** | 2080-0800 | 2 Flutes | R4 | — | 8 | 60 | 8 | 399 |
| **CSEB** | 2080-0800 | | | — | 8 | 60 | 8 | 407 |
| **HSB** | 2080-1200 | | | — | 12 | 90 | 8 | 399 |
| **CSEB** | 2080-1200 | | | — | 12 | 90 | 8 | 407 |
| **HSB** | 2080-1400 | | | — | 14 | 90 | 8 | 399 |
| **CSEB** | 2080-1400 | | | — | 14 | 90 | 8 | 407 |
| **HBL** | 2080-1600 | | | — | 20 | 160 | 8 | 404 |
| **DCB** | 2080 | | | — | 40 | 150 | 8 | 412 |
| **CGB** | 2080 | | | — | 40 | 150 | 8 | 414 |
| **CFB** | 3080-1200 | 3 Flutes | | — | 12 | 90 | 8 | 416 |
| **DLC-CFB** | 3080-1200 | | | — | 12 | 90 | 8 | 422 |
| **CFB** | 3080-1200LS | | | — | 12 | 120 | 8 | 416 |
| **DLC-CFB** | 3080-1200LS | | | — | 12 | 120 | 8 | 422 |
| **HFB** | 4080-1200S | 4 Flutes | | — | 12 | 60 | 8 | 427 |
| **HFB** | 4080-1200 | | | — | 12 | 90 | 8 | 426 |
| **CGB** | 4080 | | | — | 40 | 150 | 8 | 432 |
| **CSEB** | 2085-1270 | 2 Flutes | R4.25 | — | 12.7 | 100 | 10 | 407 |
| **CSEB** | 2090-1350 | 2 Flutes | R4.5 | — | 13.5 | 100 | 10 | 407 |
| **HSB** | 2100-1000 | 2 Flutes | R5 | — | 10 | 70 | 10 | 399 |
| **CSEB** | 2100-1000 | | | — | 10 | 70 | 10 | 407 |
| **HSB** | 2100-1500 | | | — | 15 | 100 | 10 | 399 |
| **CSEB** | 2100-1500 | | | — | 15 | 100 | 10 | 407 |
| **HSB** | 2100-1800 | | | — | 18 | 100 | 10 | 399 |
| **CSEB** | 2100-1800 | | | — | 18 | 100 | 10 | 407 |
| **HBL** | 2100-1800 | | | — | 25 | 180 | 10 | 404 |
| **DCB** | 2100 | | | — | 50 | 180 | 10 | 412 |

# Simplified Table

## Ball

| Model Number | | Number of Flutes | Radius of Ball Nose | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|
| **CGB** | 2100 | 2 Flutes | R5 | — | 50 | 180 | 10 | 414 |
| **CFB** | 3100-1500 | 3 Flutes | | — | 15 | 100 | 10 | 416 |
| **DLC-CFB** | 3100-1500 | | | — | 15 | 100 | 10 | 422 |
| **HFB** | 4100-1500S | 4 Flutes | | — | 15 | 60 | 10 | 427 |
| **HFB** | 4100-1500 | | | — | 15 | 100 | 10 | 426 |
| **CGB** | 4100 | | | — | 50 | 180 | 10 | 432 |
| **CSEB** | 2110-1650 | 2 Flutes | R5.5 | — | 16.5 | 110 | 12 | 407 |
| **CGB** | 2110 | | | — | 50 | 180 | 10 | 414 |
| **HSB** | 2120-1200 | 2 Flutes | R6 | — | 12 | 75 | 12 | 399 |
| **CSEB** | 2120-1200 | | | — | 12 | 75 | 12 | 407 |
| **HSB** | 2120-1800 | | | — | 18 | 110 | 12 | 399 |
| **CSEB** | 2120-1800 | | | — | 18 | 110 | 12 | 407 |
| **HSB** | 2120-2200 | | | — | 22 | 110 | 12 | 399 |
| **CSEB** | 2120-2200 | | | — | 22 | 110 | 12 | 407 |
| **HBL** | 2120-2000 | | | — | 25 | 200 | 12 | 404 |
| **DCB** | 2120 | | | — | 55 | 180 | 12 | 412 |
| **CGB** | 2120 | | | — | 55 | 200 | 12 | 414 |
| **CFB** | 3120-1800 | 3 Flutes | | — | 18 | 110 | 12 | 416 |
| **DLC-CFB** | 3120-1800 | | | — | 18 | 110 | 12 | 422 |
| **HFB** | 4120-1800S | 4 Flutes | | — | 18 | 60 | 12 | 427 |
| **HFB** | 4120-1800 | | | — | 18 | 110 | 12 | 426 |
| **CGB** | 4120 | | | — | 55 | 200 | 12 | 432 |
| **CGB** | 4160 | 4 Flutes | R8 | — | 60 | 200 | 16 | 432 |
| **CGB** | 4200 | 4 Flutes | R10 | — | 60 | 250 | 20 | 432 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CBN-LRF | 2001-002002 | 2 Flutes | 0.1 | R0.02 | 0.2 | 0.04 | 50 | 4 | 132 |
| CBN-LRF | 2001-002003 | | | R0.02 | 0.3 | 0.04 | 50 | 4 | 132 |
| CBN-LRF | 2001-002005 | | | R0.02 | 0.5 | 0.04 | 50 | 4 | 132 |
| CBN-LRF | 2001-003002 | | | R0.03 | 0.2 | 0.04 | 50 | 4 | 132 |
| CBN-LRF | 2001-003003 | | | R0.03 | 0.3 | 0.04 | 50 | 4 | 132 |
| CBN-LRF | 2001-003005 | | | R0.03 | 0.5 | 0.04 | 50 | 4 | 132 |
| CBN-LRF | 20015-002X2 | 2 Flutes | 0.15 | R0.02 | 0.2 | 0.06 | 50 | 4 | 132 |
| CBN-LRF | 20015-002X3 | | | R0.02 | 0.3 | 0.06 | 50 | 4 | 132 |
| CBN-LRF | 20015-002X5 | | | R0.02 | 0.5 | 0.06 | 50 | 4 | 132 |
| CBN-LRF | 20015-003X2 | | | R0.03 | 0.2 | 0.06 | 50 | 4 | 132 |
| CBN-LRF | 20015-003X3 | | | R0.03 | 0.3 | 0.06 | 50 | 4 | 132 |
| CBN-LRF | 20015-003X5 | | | R0.03 | 0.5 | 0.06 | 50 | 4 | 132 |
| CBN-RSF | 1002-002003 | 1 Flutes | 0.2 | R0.02 | 0.3 | 0.08 | 50 | 4 | 126 |
| HLRS | 4002-002-003 | 4 Flutes | | R0.02 | 0.3 | 0.12 | 50 | 4 | 338 |
| CBN-RSF | 1002-002005 | 1 Flutes | | R0.02 | 0.5 | 0.08 | 50 | 4 | 126 |
| CBN-LRF | 2002-002005 | 2 Flutes | | R0.02 | 0.5 | 0.08 | 50 | 4 | 133 |
| HLRS | 4002-002-005 | 4 Flutes | | R0.02 | 0.5 | 0.12 | 50 | 4 | 338 |
| UPDLRS | 1002-002-006 | 1 Flutes | | R0.02 | 0.6 | 0.1 | 40 | 4 | 316 |
| CBN-LRF | 2002-002X75 | 2 Flutes | | R0.02 | 0.75 | 0.08 | 50 | 4 | 133 |
| CBN-LRF | 2002-002010 | | | R0.02 | 1 | 0.08 | 50 | 4 | 133 |
| HLRS | 4002-002-010 | 4 Flutes | | R0.02 | 1 | 0.12 | 50 | 4 | 338 |
| HLRS | 4002-002-015 | | | R0.02 | 1.5 | 0.12 | 50 | 4 | 338 |
| HLRS | 4002-002-020 | | | R0.02 | 2 | 0.12 | 50 | 4 | 338 |
| CBN-LRF | 2002-003005 | 2 Flutes | | R0.03 | 0.5 | 0.08 | 50 | 4 | 133 |
| CBN-LRF | 2002-003X75 | | | R0.03 | 0.75 | 0.08 | 50 | 4 | 133 |
| CBN-LRF | 2002-003010 | | | R0.03 | 1 | 0.08 | 50 | 4 | 133 |
| CBN-RSF | 1002-005003 | 1 Flutes | | R0.05 | 0.3 | 0.08 | 50 | 4 | 126 |
| HLRS | 4002-005-003 | 4 Flutes | | R0.05 | 0.3 | 0.12 | 50 | 4 | 338 |
| CBN-RSF | 1002-005005 | 1 Flutes | | R0.05 | 0.5 | 0.08 | 50 | 4 | 126 |
| CBN-LRF | 2002-005005 | 2 Flutes | | R0.05 | 0.5 | 0.08 | 50 | 4 | 133 |
| HLRS | 2002-005-005E | | | R0.05 | 0.5 | 0.2 | 50 | 4 | 318 |
| UPDLRS | 1002-005-006 | 1 Flutes | | R0.05 | 0.6 | 0.1 | 40 | 4 | 316 |
| CBN-LRF | 2002-005X75 | 2 Flutes | | R0.05 | 0.75 | 0.08 | 50 | 4 | 133 |
| CBN-LRF | 2002-005010 | | | R0.05 | 1 | 0.08 | 50 | 4 | 133 |
| HLRS | 2002-005-010E | | | R0.05 | 1 | 0.2 | 50 | 4 | 318 |
| HLRS | 2002-005-015E | | | R0.05 | 1.5 | 0.2 | 50 | 4 | 318 |
| HLRS | 2002-005-020E | | | R0.05 | 2 | 0.2 | 50 | 4 | 318 |
| CBN-LRF | 20025-005X5 | 2 Flutes | 0.25 | R0.05 | 0.5 | 0.1 | 50 | 4 | 133 |
| CBN-LRF | 20025-X5X75 | | | R0.05 | 0.75 | 0.1 | 50 | 4 | 133 |
| CBN-LRF | 20025-X5010 | | | R0.05 | 1 | 0.1 | 50 | 4 | 133 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CBN-LRF | 2003-001010 | 2 Flutes | 0.3 | R0.01 | 1 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-002-003 | 4 Flutes | | R0.02 | 0.3 | 0.18 | 50 | 4 | 338 |
| CBN-RSF | 1003-002005 | 1 Flutes | | R0.02 | 0.5 | 0.13 | 50 | 4 | 126 |
| CBN-LRF | 2003-002005 | 2 Flutes | | R0.02 | 0.5 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-002-005 | 4 Flutes | | R0.02 | 0.5 | 0.18 | 50 | 4 | 338 |
| CBN-LRF | 2003-002X75 | 2 Flutes | | R0.02 | 0.75 | 0.13 | 50 | 4 | 133 |
| UPDLRS | 1003-002-010 | 1 Flutes | | R0.02 | 1 | 0.15 | 40 | 4 | 316 |
| CBN-RSF | 1003-002010 | | | R0.02 | 1 | 0.13 | 50 | 4 | 126 |
| CBN-LRF | 2003-002010 | 2 Flutes | | R0.02 | 1 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-002-010 | 4 Flutes | | R0.02 | 1 | 0.18 | 50 | 4 | 338 |
| CBN-LRF | 2003-002015 | 2 Flutes | | R0.02 | 1.5 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-002-015 | 4 Flutes | | R0.02 | 1.5 | 0.18 | 50 | 4 | 338 |
| CBN-LRF | 2003-002020 | 2 Flutes | | R0.02 | 2 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-002-020 | 4 Flutes | | R0.02 | 2 | 0.18 | 50 | 4 | 338 |
| CBN-LRF | 2003-003005 | 2 Flutes | | R0.03 | 0.5 | 0.13 | 50 | 4 | 133 |
| UDCLRSF | 2003-003006 | | | R0.03 | 0.6 | 0.15 | 50 | 4 | 86 |
| UDCLRS | 2003-003-006 | | | R0.03 | 0.6 | 0.15 | 50 | 4 | 102 |
| CBN-LRF | 2003-003X75 | | | R0.03 | 0.75 | 0.13 | 50 | 4 | 133 |
| CBN-LRF | 2003-003010 | | | R0.03 | 1 | 0.13 | 50 | 4 | 133 |
| CBN-LRF | 2003-003015 | | | R0.03 | 1.5 | 0.13 | 50 | 4 | 133 |
| CBN-LRF | 2003-003020 | | | R0.03 | 2 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-005-003 | 4 Flutes | | R0.05 | 0.3 | 0.18 | 50 | 4 | 338 |
| CBN-RSF | 1003-005005 | 1 Flutes | | R0.05 | 0.5 | 0.13 | 50 | 4 | 126 |
| CBN-LRF | 2003-005005 | 2 Flutes | | R0.05 | 0.5 | 0.13 | 50 | 4 | 133 |
| HLRS | 4003-005-005 | 4 Flutes | | R0.05 | 0.5 | 0.18 | 50 | 4 | 338 |
| UDCLRSF | 2003-005006 | 2 Flutes | | R0.05 | 0.6 | 0.15 | 50 | 4 | 86 |
| UDCLRS | 2003-005-006 | | | R0.05 | 0.6 | 0.15 | 50 | 4 | 102 |
| CBN-LRF | 2003-005X75 | | | R0.05 | 0.75 | 0.13 | 50 | 4 | 133 |
| UPDLRS | 1003-005-010 | 1 Flutes | | R0.05 | 1 | 0.15 | 40 | 4 | 316 |
| CBN-RSF | 1003-005010 | | | R0.05 | 1 | 0.13 | 50 | 4 | 126 |
| CBN-LRF | 2003-005010 | 2 Flutes | | R0.05 | 1 | 0.13 | 50 | 4 | 133 |
| HLRS | 2003-005-010E | | | R0.05 | 1 | 0.3 | 50 | 4 | 318 |
| CBN-LRF | 2003-005015 | | | R0.05 | 1.5 | 0.13 | 50 | 4 | 133 |
| HLRS | 2003-005-015E | | | R0.05 | 1.5 | 0.3 | 50 | 4 | 318 |
| CBN-LRF | 2003-005020 | | | R0.05 | 2 | 0.13 | 50 | 4 | 133 |
| HLRS | 2003-005-020E | | | R0.05 | 2 | 0.3 | 50 | 4 | 318 |
| HLRS | 2003-005-025E | | | R0.05 | 2.5 | 0.3 | 50 | 4 | 318 |
| HLRS | 2003-005-030E | | | R0.05 | 3 | 0.3 | 50 | 4 | 318 |
| CBN-RSF | 1004-002005 | 1 Flutes | 0.4 | R0.02 | 0.5 | 0.24 | 50 | 4 | 127 |
| CBN-LRF | 2004-002005 | 2 Flutes | | R0.02 | 0.5 | 0.24 | 50 | 4 | 133 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4004-002-005 | 4 Flutes | 0.4 | R0.02 | 0.5 | 0.24 | 50 | 4 | 338 |
| CBN-LRF | 2004-002010 | 2 Flutes | | R0.02 | 1 | 0.24 | 50 | 4 | 133 |
| HLRS | 4004-002-010 | 4 Flutes | | R0.02 | 1 | 0.24 | 50 | 4 | 338 |
| CBN-RSF | 1004-002015 | 1 Flutes | | R0.02 | 1.5 | 0.24 | 50 | 4 | 127 |
| CBN-LRF | 2004-002015 | 2 Flutes | | R0.02 | 1.5 | 0.24 | 50 | 4 | 133 |
| CBN-LRF | 2004-002020 | | | R0.02 | 2 | 0.24 | 50 | 4 | 133 |
| HLRS | 4004-002-020 | 4 Flutes | | R0.02 | 2 | 0.24 | 50 | 4 | 338 |
| CBN-LRF | 2004-003005 | 2 Flutes | | R0.03 | 0.5 | 0.24 | 50 | 4 | 133 |
| CBN-LRF | 2004-003010 | | | R0.03 | 1 | 0.24 | 50 | 4 | 133 |
| CBN-LRF | 2004-003015 | | | R0.03 | 1.5 | 0.24 | 50 | 4 | 133 |
| CBN-RSF | 1004-005005 | 1 Flutes | | R0.05 | 0.5 | 0.24 | 50 | 4 | 127 |
| CBN-LRF | 2004-005005 | 2 Flutes | | R0.05 | 0.5 | 0.24 | 50 | 4 | 133 |
| HLRS | 4004-005-005 | 4 Flutes | | R0.05 | 0.5 | 0.24 | 50 | 4 | 338 |
| CBN-LRF | 2004-005010 | 2 Flutes | | R0.05 | 1 | 0.24 | 50 | 4 | 133 |
| HLRS | 2004-005-010E | | | R0.05 | 1 | 0.4 | 50 | 4 | 318 |
| HLRS | 4004-005-010 | 4 Flutes | | R0.05 | 1 | 0.24 | 50 | 4 | 338 |
| CBN-RSF | 1004-005015 | 1 Flutes | | R0.05 | 1.5 | 0.24 | 50 | 4 | 127 |
| CBN-LRF | 2004-005015 | 2 Flutes | | R0.05 | 1.5 | 0.24 | 50 | 4 | 133 |
| HLRS | 2004-005-015E | | | R0.05 | 1.5 | 0.4 | 50 | 4 | 318 |
| HLRS | 4004-005-015 | 4 Flutes | | R0.05 | 1.5 | 0.24 | 50 | 4 | 338 |
| CBN-LRF | 2004-005020 | 2 Flutes | | R0.05 | 2 | 0.24 | 50 | 4 | 133 |
| HLRS | 2004-005-020E | | | R0.05 | 2 | 0.4 | 50 | 4 | 318 |
| HLRS | 4004-005-020 | 4 Flutes | | R0.05 | 2 | 0.24 | 50 | 4 | 338 |
| HLRS | 2004-005-030E | 2 Flutes | | R0.05 | 3 | 0.4 | 50 | 4 | 318 |
| CBN-LRF | 2004-005040 | | | R0.05 | 4 | 0.24 | 50 | 4 | 133 |
| HLRS | 2004-005-040E | | | R0.05 | 4 | 0.4 | 50 | 4 | 318 |
| CBN-LRF | 2004-010005 | | | R0.1 | 0.5 | 0.24 | 50 | 4 | 133 |
| CBN-LRF | 2004-010010 | | | R0.1 | 1 | 0.24 | 50 | 4 | 133 |
| HLRS | 2004-01-010 | | | R0.1 | 1 | 0.4 | 50 | 4 | 318 |
| HLRS | 4004-01-010 | 4 Flutes | | R0.1 | 1 | 0.24 | 50 | 4 | 338 |
| CBN-LRF | 2004-010015 | 2 Flutes | | R0.1 | 1.5 | 0.24 | 50 | 4 | 133 |
| HLRS | 2004-01-015 | | | R0.1 | 1.5 | 0.4 | 50 | 4 | 318 |
| HLRS | 2004-01-020 | | | R0.1 | 2 | 0.4 | 50 | 4 | 318 |
| HLRS | 4004-01-020 | 4 Flutes | | R0.1 | 2 | 0.24 | 50 | 4 | 338 |
| HLRS | 2004-01-030 | 2 Flutes | | R0.1 | 3 | 0.4 | 50 | 4 | 318 |
| HLRS | 2004-01-040 | | | R0.1 | 4 | 0.4 | 50 | 4 | 318 |
| CBN-LRF | 2005-001010 | 2 Flutes | 0.5 | R0.01 | 1 | 0.3 | 50 | 4 | 134 |
| CBN-RSF | 1005-002005 | 1 Flutes | | R0.02 | 0.5 | 0.3 | 50 | 4 | 127 |
| CBN-LRF | 2005-002005 | 2 Flutes | | R0.02 | 0.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2005-002010 | | | R0.02 | 1 | 0.3 | 50 | 4 | 134 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4005-002-010 | 4 Flutes | 0.5 | R0.02 | 1 | 0.3 | 50 | 4 | 340 |
| CBN-RSF | 1005-002015 | 1 Flutes | | R0.02 | 1.5 | 0.3 | 50 | 4 | 127 |
| CBN-LRF | 2005-002015 | 2 Flutes | | R0.02 | 1.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2005-002020 | | | R0.02 | 2 | 0.3 | 50 | 4 | 134 |
| HLRS | 4005-002-020 | 4 Flutes | | R0.02 | 2 | 0.3 | 50 | 4 | 340 |
| UDCLRSF | 2005-003005 | 2 Flutes | | R0.03 | 0.5 | 0.25 | 50 | 4 | 86 |
| UDCLRS | 2005-003-005 | | | R0.03 | 0.5 | 0.25 | 50 | 4 | 102 |
| CBN-LRF | 2005-003005 | | | R0.03 | 0.5 | 0.3 | 50 | 4 | 134 |
| UDCLRSF | 2005-003010 | | | R0.03 | 1 | 0.25 | 50 | 4 | 86 |
| UDCLRS | 2005-003-010 | | | R0.03 | 1 | 0.25 | 50 | 4 | 102 |
| CBN-LRF | 2005-003010 | | | R0.03 | 1 | 0.3 | 50 | 4 | 134 |
| UDCLRSF | 2005-003015 | | | R0.03 | 1.5 | 0.25 | 50 | 4 | 86 |
| CBN-LRF | 2005-003015 | | | R0.03 | 1.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2005-003020 | | | R0.03 | 2 | 0.3 | 50 | 4 | 134 |
| CBN-RSF | 1005-005005 | 1 Flutes | | R0.05 | 0.5 | 0.3 | 50 | 4 | 127 |
| UDCLRSF | 2005-005005 | 2 Flutes | | R0.05 | 0.5 | 0.25 | 50 | 4 | 86 |
| UDCLRS | 2005-005-005 | | | R0.05 | 0.5 | 0.25 | 50 | 4 | 102 |
| CBN-LRF | 2005-005005 | | | R0.05 | 0.5 | 0.3 | 50 | 4 | 134 |
| UDCLRSF | 2005-005010 | | | R0.05 | 1 | 0.25 | 50 | 4 | 86 |
| UDCLRS | 2005-005-010 | | | R0.05 | 1 | 0.25 | 50 | 4 | 102 |
| CBN-LRF | 2005-005010 | | | R0.05 | 1 | 0.3 | 50 | 4 | 134 |
| HLRS | 2005-005-010 | | | R0.05 | 1 | 0.5 | 50 | 4 | 318 |
| HLRS | 4005-005-010 | 4 Flutes | | R0.05 | 1 | 0.3 | 50 | 4 | 340 |
| UPDLRS | 1005-005-015 | 1 Flutes | | R0.05 | 1.5 | 0.25 | 40 | 4 | 316 |
| CBN-RSF | 1005-005015 | | | R0.05 | 1.5 | 0.3 | 50 | 4 | 127 |
| UDCLRSF | 2005-005015 | 2 Flutes | | R0.05 | 1.5 | 0.25 | 50 | 4 | 86 |
| CBN-LRF | 2005-005015 | | | R0.05 | 1.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2005-005020 | | | R0.05 | 2 | 0.3 | 50 | 4 | 134 |
| HLRS | 2005-005-020 | | | R0.05 | 2 | 0.5 | 50 | 4 | 318 |
| HLRS | 4005-005-020 | 4 Flutes | | R0.05 | 2 | 0.3 | 50 | 4 | 340 |
| HLRS | 2005-005-030 | 2 Flutes | | R0.05 | 3 | 0.5 | 50 | 4 | 318 |
| HLRS | 2005-005-040 | | | R0.05 | 4 | 0.5 | 50 | 4 | 318 |
| HLRS | 2005-005-050 | | | R0.05 | 5 | 0.5 | 50 | 4 | 318 |
| CBN-LRF | 2005-010005 | | | R0.1 | 0.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2005-010010 | | | R0.1 | 1 | 0.3 | 50 | 4 | 134 |
| HLRS | 2005-01-010 | | | R0.1 | 1 | 0.5 | 50 | 4 | 318 |
| HLRS | 4005-01-010 | 4 Flutes | | R0.1 | 1 | 0.3 | 50 | 4 | 340 |
| UPDLRS | 1005-010-015 | 1 Flutes | | R0.1 | 1.5 | 0.25 | 40 | 4 | 316 |
| CBN-LRF | 2005-010015 | 2 Flutes | | R0.1 | 1.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2005-010020 | | | R0.1 | 2 | 0.3 | 50 | 4 | 134 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2005-01-020 | 2 Flutes | 0.5 | R0.1 | 2 | 0.5 | 50 | 4 | 318 |
| HLRS | 4005-01-020 | 4 Flutes | | R0.1 | 2 | 0.3 | 50 | 4 | 340 |
| HLRS | 2005-01-030 | 2 Flutes | | R0.1 | 3 | 0.5 | 50 | 4 | 318 |
| HLRS | 2005-01-040 | | | R0.1 | 4 | 0.5 | 50 | 4 | 318 |
| HLRS | 2005-01-050 | | | R0.1 | 5 | 0.5 | 50 | 4 | 318 |
| HLRS | 2005-01-060 | | | R0.1 | 6 | 0.5 | 50 | 4 | 318 |
| CBN-LRF | 2006-002005 | 2 Flutes | 0.6 | R0.02 | 0.5 | 0.3 | 50 | 4 | 134 |
| CBN-RSF | 1006-002010 | 1 Flutes | | R0.02 | 1 | 0.3 | 50 | 4 | 127 |
| CBN-LRF | 2006-002010 | 2 Flutes | | R0.02 | 1 | 0.3 | 50 | 4 | 134 |
| CBN-RSF | 1006-002015 | 1 Flutes | | R0.02 | 1.5 | 0.3 | 50 | 4 | 127 |
| CBN-LRF | 2006-002015 | 2 Flutes | | R0.02 | 1.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2006-005005 | | | R0.05 | 0.5 | 0.3 | 50 | 4 | 134 |
| CBN-RSF | 1006-005010 | 1 Flutes | | R0.05 | 1 | 0.3 | 50 | 4 | 127 |
| CBN-LRF | 2006-005010 | 2 Flutes | | R0.05 | 1 | 0.3 | 50 | 4 | 134 |
| CBN-RSF | 1006-005015 | 1 Flutes | | R0.05 | 1.5 | 0.3 | 50 | 4 | 127 |
| CBN-LRF | 2006-005015 | 2 Flutes | | R0.05 | 1.5 | 0.3 | 50 | 4 | 134 |
| HLRS | 2006-005-020 | | | R0.05 | 2 | 0.6 | 50 | 4 | 320 |
| HLRS | 4006-005-020 | 4 Flutes | | R0.05 | 2 | 0.36 | 50 | 4 | 340 |
| CBN-LRF | 2006-005030 | 2 Flutes | | R0.05 | 3 | 0.3 | 50 | 4 | 134 |
| HLRS | 2006-005-030 | | | R0.05 | 3 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-005-040 | | | R0.05 | 4 | 0.6 | 50 | 4 | 320 |
| HLRS | 4006-005-040 | 4 Flutes | | R0.05 | 4 | 0.36 | 50 | 4 | 340 |
| HLRS | 2006-005-060 | 2 Flutes | | R0.05 | 6 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-005-080 | | | R0.05 | 8 | 0.6 | 50 | 4 | 320 |
| CBN-LRF | 2006-010005 | | | R0.1 | 0.5 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2006-010010 | | | R0.1 | 1 | 0.3 | 50 | 4 | 134 |
| CBN-LRF | 2006-010015 | | | R0.1 | 1.5 | 0.3 | 50 | 4 | 134 |
| HLRS | 2006-01-020 | | | R0.1 | 2 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-01-020E | | | R0.1 | 2 | 0.6 | 50 | 4 | 320 |
| HLRS | 4006-01-020 | 4 Flutes | | R0.1 | 2 | 0.36 | 50 | 4 | 340 |
| HLRS | 2006-01-030 | 2 Flutes | | R0.1 | 3 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-01-030E | | | R0.1 | 3 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-01-040 | | | R0.1 | 4 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-01-040E | | | R0.1 | 4 | 0.6 | 50 | 4 | 320 |
| HLRS | 4006-01-040 | 4 Flutes | | R0.1 | 4 | 0.36 | 50 | 4 | 340 |
| HLRS | 2006-01-060 | 2 Flutes | | R0.1 | 6 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-01-080 | | | R0.1 | 8 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-02-020 | | | R0.2 | 2 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-02-030 | | | R0.2 | 3 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-02-040 | | | R0.2 | 4 | 0.6 | 50 | 4 | 320 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2006-02-060 | 2 Flutes | 0.6 | R0.2 | 6 | 0.6 | 50 | 4 | 320 |
| HLRS | 2006-02-080 | | | R0.2 | 8 | 0.6 | 50 | 4 | 320 |
| HLRS | 2007-01-040 | 2 Flutes | 0.7 | R0.1 | 4 | 0.7 | 50 | 4 | 320 |
| HLRS | 2007-01-060 | | | R0.1 | 6 | 0.7 | 50 | 4 | 320 |
| HLRS | 2007-02-040 | | | R0.2 | 4 | 0.7 | 50 | 4 | 320 |
| HLRS | 2007-02-060 | | | R0.2 | 6 | 0.7 | 50 | 4 | 320 |
| CBN-RSF | 1008-002010 | 1 Flutes | 0.8 | R0.02 | 1 | 0.56 | 50 | 4 | 127 |
| CBN-LRF | 2008-002010 | 2 Flutes | | R0.02 | 1 | 0.56 | 50 | 4 | 134 |
| CBN-LRF | 2008-002015 | | | R0.02 | 1.5 | 0.56 | 50 | 4 | 134 |
| CBN-RSF | 1008-002020 | 1 Flutes | | R0.02 | 2 | 0.56 | 50 | 4 | 127 |
| CBN-LRF | 2008-002020 | 2 Flutes | | R0.02 | 2 | 0.56 | 50 | 4 | 134 |
| HLRS | 4008-002-020 | 4 Flutes | | R0.02 | 2 | 0.48 | 50 | 4 | 340 |
| HLRS | 4008-002-030 | | | R0.02 | 3 | 0.48 | 50 | 4 | 340 |
| HLRS | 4008-002-040 | | | R0.02 | 4 | 0.48 | 50 | 4 | 340 |
| CBN-LRF | 2008-002050 | 2 Flutes | | R0.02 | 5 | 0.56 | 50 | 4 | 134 |
| HLRS | 4008-002-060 | 4 Flutes | | R0.02 | 6 | 0.48 | 50 | 4 | 340 |
| HLRS | 4008-002-080 | | | R0.02 | 8 | 0.48 | 50 | 4 | 340 |
| UDCLRSF | 2008-003008 | 2 Flutes | | R0.03 | 0.8 | 0.4 | 50 | 4 | 86 |
| UDCLRS | 2008-003-008 | | | R0.03 | 0.8 | 0.4 | 50 | 4 | 102 |
| UDCLRSF | 2008-003016 | | | R0.03 | 1.6 | 0.4 | 50 | 4 | 86 |
| UDCLRS | 2008-003-016 | | | R0.03 | 1.6 | 0.4 | 50 | 4 | 102 |
| UDCLRSF | 2008-003024 | | | R0.03 | 2.4 | 0.4 | 50 | 4 | 86 |
| UDCLRSF | 2008-005008 | | | R0.05 | 0.8 | 0.4 | 50 | 4 | 86 |
| UDCLRS | 2008-005-008 | | | R0.05 | 0.8 | 0.4 | 50 | 4 | 102 |
| CBN-RSF | 1008-005010 | 1 Flutes | | R0.05 | 1 | 0.56 | 50 | 4 | 127 |
| CBN-LRF | 2008-005010 | 2 Flutes | | R0.05 | 1 | 0.56 | 50 | 4 | 134 |
| CBN-LRF | 2008-005015 | | | R0.05 | 1.5 | 0.56 | 50 | 4 | 134 |
| UDCLRSF | 2008-005016 | | | R0.05 | 1.6 | 0.4 | 50 | 4 | 86 |
| UDCLRS | 2008-005-016 | | | R0.05 | 1.6 | 0.4 | 50 | 4 | 102 |
| CBN-RSF | 1008-005020 | 1 Flutes | | R0.05 | 2 | 0.56 | 50 | 4 | 127 |
| CBN-LRF | 2008-005020 | 2 Flutes | | R0.05 | 2 | 0.56 | 50 | 4 | 134 |
| HLRS | 4008-005-020 | 4 Flutes | | R0.05 | 2 | 0.48 | 50 | 4 | 340 |
| UDCLRSF | 2008-005024 | 2 Flutes | | R0.05 | 2.4 | 0.4 | 50 | 4 | 86 |
| HLRS | 4008-005-030 | 4 Flutes | | R0.05 | 3 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-005-040 | 2 Flutes | | R0.05 | 4 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-005-040 | 4 Flutes | | R0.05 | 4 | 0.48 | 50 | 4 | 340 |
| CBN-LRF | 2008-005050 | 2 Flutes | | R0.05 | 5 | 0.56 | 50 | 4 | 134 |
| HLRS | 2008-005-060 | | | R0.05 | 6 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-005-060 | 4 Flutes | | R0.05 | 6 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-005-080 | 2 Flutes | | R0.05 | 8 | 0.8 | 50 | 4 | 320 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| UDCLRSF | 2008-010008 | 2 Flutes | 0.8 | R0.1 | 0.8 | 0.4 | 50 | 4 | 86 |
| UDCLRS | 2008-010-008 | | | R0.1 | 0.8 | 0.4 | 50 | 4 | 102 |
| CBN-LRF | 2008-010010 | | | R0.1 | 1 | 0.56 | 50 | 4 | 134 |
| CBN-LRF | 2008-010015 | | | R0.1 | 1.5 | 0.56 | 50 | 4 | 134 |
| UDCLRSF | 2008-010016 | | | R0.1 | 1.6 | 0.4 | 50 | 4 | 86 |
| UDCLRS | 2008-010-016 | | | R0.1 | 1.6 | 0.4 | 50 | 4 | 102 |
| CBN-LRF | 2008-010020 | | | R0.1 | 2 | 0.56 | 50 | 4 | 134 |
| HLRS | 4008-01-020 | 4 Flutes | | R0.1 | 2 | 0.48 | 50 | 4 | 340 |
| UDCLRSF | 2008-010024 | 2 Flutes | | R0.1 | 2.4 | 0.4 | 50 | 4 | 86 |
| HLRS | 4008-01-030 | 4 Flutes | | R0.1 | 3 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-01-040 | 2 Flutes | | R0.1 | 4 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-01-040 | 4 Flutes | | R0.1 | 4 | 0.48 | 50 | 4 | 340 |
| CBN-LRF | 2008-010050 | 2 Flutes | | R0.1 | 5 | 0.56 | 50 | 4 | 134 |
| HLRS | 2008-01-060 | | | R0.1 | 6 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-01-060 | 4 Flutes | | R0.1 | 6 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-01-080 | 2 Flutes | | R0.1 | 8 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-02-020 | 4 Flutes | | R0.2 | 2 | 0.48 | 50 | 4 | 340 |
| HLRS | 4008-02-030 | | | R0.2 | 3 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-02-040 | 2 Flutes | | R0.2 | 4 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-02-040 | 4 Flutes | | R0.2 | 4 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-02-060 | 2 Flutes | | R0.2 | 6 | 0.8 | 50 | 4 | 320 |
| HLRS | 4008-02-060 | 4 Flutes | | R0.2 | 6 | 0.48 | 50 | 4 | 340 |
| HLRS | 2008-02-080 | 2 Flutes | | R0.2 | 8 | 0.8 | 50 | 4 | 320 |
| CBN-RSF | 1010-002010 | 1 Flutes | 1 | R0.02 | 1 | 0.7 | 50 | 4 | 127 |
| CBN-LRF | 2010-002010 | 2 Flutes | | R0.02 | 1 | 0.7 | 50 | 4 | 135 |
| CBN-RSF | 1010-002020 | 1 Flutes | | R0.02 | 2 | 0.7 | 50 | 4 | 127 |
| CBN-LRF | 2010-002020 | 2 Flutes | | R0.02 | 2 | 0.7 | 50 | 4 | 135 |
| HLRS | 4010-002-020 | 4 Flutes | | R0.02 | 2 | 0.8 | 50 | 4 | 340 |
| CBN-RSF | 1010-002030 | 1 Flutes | | R0.02 | 3 | 0.7 | 50 | 4 | 127 |
| CBN-LRF | 2010-002030 | 2 Flutes | | R0.02 | 3 | 0.7 | 50 | 4 | 135 |
| HLRS | 4010-002-030 | 4 Flutes | | R0.02 | 3 | 0.8 | 50 | 4 | 340 |
| HLRS | 4010-002-040 | | | R0.02 | 4 | 0.8 | 50 | 4 | 340 |
| CBN-LRF | 2010-002050 | 2 Flutes | | R0.02 | 5 | 0.7 | 50 | 4 | 135 |
| HLRS | 4010-002-050 | 4 Flutes | | R0.02 | 5 | 0.8 | 50 | 4 | 340 |
| HLRS | 4010-002-060 | | | R0.02 | 6 | 0.8 | 50 | 4 | 340 |
| DCLRS | 4010-002-060 | | | R0.02 | 6 | 2 | 50 | 4 | 376 |
| HLRS | 4010-002-080 | | | R0.02 | 8 | 0.8 | 50 | 4 | 340 |
| HLRS | 4010-002-100 | | | R0.02 | 10 | 0.8 | 50 | 4 | 340 |
| DCLRS | 4010-002-100 | | | R0.02 | 10 | 2 | 50 | 4 | 376 |
| HLRS | 4010-002-120 | | | R0.02 | 12 | 0.8 | 55 | 4 | 340 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| DCLRS | 4010-002-200 | 4 Flutes | 1 | R0.02 | 20 | 2 | 60 | 4 | 376 |
| UDCLRSF | 2010-003010 | 2 Flutes | | R0.03 | 1 | 0.5 | 50 | 4 | 88 |
| UDCLRS | 2010-003-010 | | | R0.03 | 1 | 0.5 | 50 | 4 | 102 |
| UDCLRSF | 2010-003020 | | | R0.03 | 2 | 0.5 | 50 | 4 | 88 |
| UDCLRS | 2010-003-020 | | | R0.03 | 2 | 0.5 | 50 | 4 | 102 |
| UDCLRSF | 2010-003040 | | | R0.03 | 4 | 0.5 | 50 | 4 | 88 |
| UDCLRSF | 2010-003060 | | | R0.03 | 6 | 0.5 | 50 | 4 | 88 |
| CBN-RSF | 1010-005010 | 1 Flutes | | R0.05 | 1 | 0.7 | 50 | 4 | 127 |
| UDCLRSF | 2010-005010 | 2 Flutes | | R0.05 | 1 | 0.5 | 50 | 4 | 88 |
| UDCLRS | 2010-005-010 | | | R0.05 | 1 | 0.5 | 50 | 4 | 102 |
| CBN-LRF | 2010-005010 | | | R0.05 | 1 | 0.7 | 50 | 4 | 135 |
| CBN-RSF | 1010-005020 | 1 Flutes | | R0.05 | 2 | 0.7 | 50 | 4 | 127 |
| UDCLRSF | 2010-005020 | 2 Flutes | | R0.05 | 2 | 0.5 | 50 | 4 | 88 |
| UDCLRS | 2010-005-020 | | | R0.05 | 2 | 0.5 | 50 | 4 | 102 |
| CBN-LRF | 2010-005020 | | | R0.05 | 2 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-005-020 | | | R0.05 | 2 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-020 | 4 Flutes | | R0.05 | 2 | 0.8 | 50 | 4 | 340 |
| UPDLRS | 1010-005-030 | 1 Flutes | | R0.05 | 3 | 0.55 | 40 | 4 | 316 |
| CBN-RSF | 1010-005030 | | | R0.05 | 3 | 0.7 | 50 | 4 | 127 |
| CBN-LRF | 2010-005030 | 2 Flutes | | R0.05 | 3 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-005-030 | | | R0.05 | 3 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-030 | 4 Flutes | | R0.05 | 3 | 0.8 | 50 | 4 | 340 |
| UDCLRSF | 2010-005040 | 2 Flutes | | R0.05 | 4 | 0.5 | 50 | 4 | 88 |
| HLRS | 2010-005-040 | | | R0.05 | 4 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-040 | 4 Flutes | | R0.05 | 4 | 0.8 | 50 | 4 | 340 |
| CBN-LRF | 2010-005050 | 2 Flutes | | R0.05 | 5 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-005-050 | | | R0.05 | 5 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-050 | 4 Flutes | | R0.05 | 5 | 0.8 | 50 | 4 | 342 |
| UDCLRSF | 2010-005060 | 2 Flutes | | R0.05 | 6 | 0.5 | 50 | 4 | 88 |
| HLRS | 2010-005-060 | | | R0.05 | 6 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-060 | 4 Flutes | | R0.05 | 6 | 0.8 | 50 | 4 | 342 |
| DCLRS | 4010-005-060 | | | R0.05 | 6 | 2 | 50 | 4 | 376 |
| HLRS | 2010-005-080 | 2 Flutes | | R0.05 | 8 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-080 | 4 Flutes | | R0.05 | 8 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-005-100 | 2 Flutes | | R0.05 | 10 | 1 | 50 | 4 | 320 |
| HLRS | 4010-005-100 | 4 Flutes | | R0.05 | 10 | 0.8 | 50 | 4 | 342 |
| DCLRS | 4010-005-100 | | | R0.05 | 10 | 2 | 50 | 4 | 376 |
| HLRS | 2010-005-120 | 2 Flutes | | R0.05 | 12 | 1 | 55 | 4 | 320 |
| HLRS | 4010-005-120 | 4 Flutes | | R0.05 | 12 | 0.8 | 55 | 4 | 342 |
| HLRS | 2010-005-160 | 2 Flutes | | R0.05 | 16 | 1 | 60 | 4 | 320 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2010-005-200 | 2 Flutes | 1 | R0.05 | 20 | 1 | 60 | 4 | 320 |
| DCLRS | 4010-005-200 | 4 Flutes | | R0.05 | 20 | 2 | 60 | 4 | 376 |
| CXERS | 4010-01-025 | | | R0.1 | — | 2.5 | 50 | 4 | 298 |
| CBN-RSF | 1010-010010 | 1 Flutes | | R0.1 | 1 | 0.7 | 50 | 4 | 127 |
| UDCLRSF | 2010-010010 | 2 Flutes | | R0.1 | 1 | 0.5 | 50 | 4 | 88 |
| UDCLRS | 2010-010-010 | | | R0.1 | 1 | 0.5 | 50 | 4 | 102 |
| CBN-LRF | 2010-010010 | | | R0.1 | 1 | 0.7 | 50 | 4 | 135 |
| CBN-RSF | 1010-010020 | 1 Flutes | | R0.1 | 2 | 0.7 | 50 | 4 | 127 |
| UDCLRSF | 2010-010020 | 2 Flutes | | R0.1 | 2 | 0.5 | 50 | 4 | 88 |
| UDCLRS | 2010-010-020 | | | R0.1 | 2 | 0.5 | 50 | 4 | 102 |
| CBN-LRF | 2010-010020 | | | R0.1 | 2 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-01-020 | | | R0.1 | 2 | 1 | 50 | 4 | 320 |
| HLRS | 2010-01-020E | | | R0.1 | 2 | 1 | 50 | 4 | 320 |
| HLRS | 4010-01-020 | 4 Flutes | | R0.1 | 2 | 0.8 | 50 | 4 | 342 |
| UPDLRS | 1010-010-030 | 1 Flutes | | R0.1 | 3 | 0.55 | 40 | 4 | 316 |
| CBN-RSF | 1010-010030 | | | R0.1 | 3 | 0.7 | 50 | 4 | 127 |
| CBN-LRF | 2010-010030 | 2 Flutes | | R0.1 | 3 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-01-030 | | | R0.1 | 3 | 1 | 50 | 4 | 320 |
| HLRS | 4010-01-030 | 4 Flutes | | R0.1 | 3 | 0.8 | 50 | 4 | 342 |
| UDCLRSF | 2010-010040 | 2 Flutes | | R0.1 | 4 | 0.5 | 50 | 4 | 88 |
| HLRS | 2010-01-040 | | | R0.1 | 4 | 1 | 50 | 4 | 320 |
| HLRS | 2010-01-040E | | | R0.1 | 4 | 1 | 50 | 4 | 320 |
| HLRS | 4010-01-040 | 4 Flutes | | R0.1 | 4 | 0.8 | 50 | 4 | 342 |
| CBN-LRF | 2010-010050 | 2 Flutes | | R0.1 | 5 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-01-050 | | | R0.1 | 5 | 1 | 50 | 4 | 320 |
| HLRS | 4010-01-050 | 4 Flutes | | R0.1 | 5 | 0.8 | 50 | 4 | 342 |
| UDCLRSF | 2010-010060 | 2 Flutes | | R0.1 | 6 | 0.5 | 50 | 4 | 88 |
| HLRS | 2010-01-060 | | | R0.1 | 6 | 1 | 50 | 4 | 320 |
| HLRS | 2010-01-060E | | | R0.1 | 6 | 1 | 50 | 4 | 320 |
| HLRS | 4010-01-060 | 4 Flutes | | R0.1 | 6 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-01-080 | 2 Flutes | | R0.1 | 8 | 1 | 50 | 4 | 322 |
| HLRS | 4010-01-080 | 4 Flutes | | R0.1 | 8 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-01-100 | 2 Flutes | | R0.1 | 10 | 1 | 50 | 4 | 322 |
| HLRS | 4010-01-100 | 4 Flutes | | R0.1 | 10 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-01-120 | 2 Flutes | | R0.1 | 12 | 1 | 55 | 4 | 322 |
| HLRS | 4010-01-120 | 4 Flutes | | R0.1 | 12 | 0.8 | 55 | 4 | 342 |
| HLRS | 2010-01-160 | 2 Flutes | | R0.1 | 16 | 1 | 60 | 4 | 322 |
| HLRS | 2010-01-200 | | | R0.1 | 20 | 1 | 60 | 4 | 322 |
| C-CRS | 2010-02 | | | R0.2 | — | 2 | 45 | 4 | 290 |
| CXERS | 4010-02-025 | 4 Flutes | | R0.2 | — | 2.5 | 50 | 4 | 298 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CBN-LRF | 2010-020010 | 2 Flutes | 1 | R0.2 | 1 | 0.7 | 50 | 4 | 135 |
| CBN-LRF | 2010-020020 | | | R0.2 | 2 | 0.7 | 50 | 4 | 135 |
| HLRS | 2010-02-020 | | | R0.2 | 2 | 1 | 50 | 4 | 322 |
| HLRS | 2010-02-020E | | | R0.2 | 2 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-020 | 4 Flutes | | R0.2 | 2 | 0.8 | 50 | 4 | 342 |
| UPDLRS | 1010-020-030 | 1 Flutes | | R0.2 | 3 | 0.55 | 40 | 4 | 316 |
| HLRS | 2010-02-030 | 2 Flutes | | R0.2 | 3 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-030 | 4 Flutes | | R0.2 | 3 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-02-040 | 2 Flutes | | R0.2 | 4 | 1 | 50 | 4 | 322 |
| HLRS | 2010-02-040E | | | R0.2 | 4 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-040 | 4 Flutes | | R0.2 | 4 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-02-050 | 2 Flutes | | R0.2 | 5 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-050 | 4 Flutes | | R0.2 | 5 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-02-060 | 2 Flutes | | R0.2 | 6 | 1 | 50 | 4 | 322 |
| HLRS | 2010-02-060E | | | R0.2 | 6 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-060 | 4 Flutes | | R0.2 | 6 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-02-080 | 2 Flutes | | R0.2 | 8 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-080 | 4 Flutes | | R0.2 | 8 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-02-100 | 2 Flutes | | R0.2 | 10 | 1 | 50 | 4 | 322 |
| HLRS | 4010-02-100 | 4 Flutes | | R0.2 | 10 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-02-120 | 2 Flutes | | R0.2 | 12 | 1 | 55 | 4 | 322 |
| HLRS | 4010-02-120 | 4 Flutes | | R0.2 | 12 | 0.8 | 55 | 4 | 342 |
| HLRS | 2010-02-160 | 2 Flutes | | R0.2 | 16 | 1 | 60 | 4 | 322 |
| HLRS | 2010-02-200 | | | R0.2 | 20 | 1 | 60 | 4 | 322 |
| C-CRS | 2010-03 | | | R0.3 | — | 2 | 45 | 4 | 290 |
| CXERS | 4010-03-025 | 4 Flutes | | R0.3 | — | 2.5 | 50 | 4 | 298 |
| HLRS | 2010-03-020 | 2 Flutes | | R0.3 | 2 | 1 | 50 | 4 | 322 |
| HLRS | 2010-03-020E | | | R0.3 | 2 | 1 | 50 | 4 | 322 |
| HLRS | 4010-03-020 | 4 Flutes | | R0.3 | 2 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-030 | 2 Flutes | | R0.3 | 3 | 1 | 50 | 4 | 322 |
| HLRS | 4010-03-030 | 4 Flutes | | R0.3 | 3 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-040 | 2 Flutes | | R0.3 | 4 | 1 | 50 | 4 | 322 |
| HLRS | 2010-03-040E | | | R0.3 | 4 | 1 | 50 | 4 | 322 |
| HLRS | 4010-03-040 | 4 Flutes | | R0.3 | 4 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-050 | 2 Flutes | | R0.3 | 5 | 1 | 50 | 4 | 322 |
| HLRS | 4010-03-050 | 4 Flutes | | R0.3 | 5 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-060 | 2 Flutes | | R0.3 | 6 | 1 | 50 | 4 | 322 |
| HLRS | 2010-03-060E | | | R0.3 | 6 | 1 | 50 | 4 | 322 |
| HLRS | 4010-03-060 | 4 Flutes | | R0.3 | 6 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-080 | 2 Flutes | | R0.3 | 8 | 1 | 50 | 4 | 322 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4010-03-080 | 4 Flutes | 1 | R0.3 | 8 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-100 | 2 Flutes | | R0.3 | 10 | 1 | 50 | 4 | 322 |
| HLRS | 4010-03-100 | 4 Flutes | | R0.3 | 10 | 0.8 | 50 | 4 | 342 |
| HLRS | 2010-03-120 | 2 Flutes | | R0.3 | 12 | 1 | 55 | 4 | 322 |
| HLRS | 4010-03-120 | 4 Flutes | | R0.3 | 12 | 0.8 | 55 | 4 | 342 |
| HLRS | 2010-03-160 | 2 Flutes | | R0.3 | 16 | 1 | 60 | 4 | 322 |
| HLRS | 4010-03-160 | 4 Flutes | | R0.3 | 16 | 0.8 | 60 | 4 | 342 |
| HLRS | 2010-03-200 | 2 Flutes | | R0.3 | 20 | 1 | 60 | 4 | 322 |
| HLRS | 4012-01-040 | 4 Flutes | 1.2 | R0.1 | 4 | 0.96 | 50 | 4 | 342 |
| HLRS | 4012-01-060 | | | R0.1 | 6 | 0.96 | 50 | 4 | 342 |
| HLRS | 4012-01-100 | | | R0.1 | 10 | 0.96 | 50 | 4 | 342 |
| HLRS | 4012-02-040 | | | R0.2 | 4 | 0.96 | 50 | 4 | 342 |
| HLRS | 2012-02-060 | 2 Flutes | | R0.2 | 6 | 1.2 | 50 | 4 | 322 |
| HLRS | 4012-02-060 | 4 Flutes | | R0.2 | 6 | 0.96 | 50 | 4 | 342 |
| HLRS | 4012-02-100 | | | R0.2 | 10 | 0.96 | 50 | 4 | 342 |
| HLRS | 2012-02-120 | 2 Flutes | | R0.2 | 12 | 1.2 | 55 | 4 | 322 |
| HLRS | 2012-02-200 | | | R0.2 | 20 | 1.2 | 60 | 4 | 322 |
| HLRS | 4012-03-040 | 4 Flutes | | R0.3 | 4 | 0.96 | 50 | 4 | 342 |
| HLRS | 2012-03-060 | 2 Flutes | | R0.3 | 6 | 1.2 | 50 | 4 | 322 |
| HLRS | 4012-03-060 | 4 Flutes | | R0.3 | 6 | 0.96 | 50 | 4 | 342 |
| HLRS | 4012-03-100 | | | R0.3 | 10 | 0.96 | 50 | 4 | 342 |
| HLRS | 2012-03-120 | 2 Flutes | | R0.3 | 12 | 1.2 | 55 | 4 | 322 |
| HLRS | 2012-03-200 | | | R0.3 | 20 | 1.2 | 60 | 4 | 322 |
| CBN-RSF | 1015-002030 | 1 Flutes | 1.5 | R0.02 | 3 | 1 | 50 | 4 | 127 |
| CBN-LRF | 2015-002030 | 2 Flutes | | R0.02 | 3 | 1 | 50 | 4 | 135 |
| CBN-LRF | 2015-002040 | | | R0.02 | 4 | 1 | 50 | 4 | 135 |
| CBN-LRF | 2015-002060 | | | R0.02 | 6 | 1 | 50 | 4 | 135 |
| DCLRS | 4015-002-120 | 4 Flutes | | R0.02 | 12 | 3 | 55 | 4 | 376 |
| DCLRS | 4015-002-200 | | | R0.02 | 20 | 3 | 60 | 4 | 376 |
| DCLRS | 4015-002-300 | | | R0.02 | 30 | 3 | 80 | 4 | 376 |
| UDCLRSF | 2015-003015 | 2 Flutes | | R0.03 | 1.5 | 0.75 | 50 | 4 | 88 |
| UDCLRS | 2015-003-015 | | | R0.03 | 1.5 | 0.75 | 50 | 4 | 102 |
| UDCLRSF | 2015-003030 | | | R0.03 | 3 | 0.75 | 50 | 4 | 88 |
| UDCLRS | 2015-003-030 | | | R0.03 | 3 | 0.75 | 50 | 4 | 102 |
| UDCLRSF | 2015-005015 | | | R0.05 | 1.5 | 0.75 | 50 | 4 | 88 |
| UDCLRS | 2015-005-015 | | | R0.05 | 1.5 | 0.75 | 50 | 4 | 102 |
| CBN-RSF | 1015-005030 | 1 Flutes | | R0.05 | 3 | 1 | 50 | 4 | 127 |
| UDCLRSF | 2015-005030 | 2 Flutes | | R0.05 | 3 | 0.75 | 50 | 4 | 88 |
| UDCLRS | 2015-005-030 | | | R0.05 | 3 | 0.75 | 50 | 4 | 102 |
| CBN-LRF | 2015-005030 | | | R0.05 | 3 | 1 | 50 | 4 | 135 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4015-005-030 | 4 Flutes | 1.5 | R0.05 | 3 | 1.2 | 50 | 4 | 344 |
| CBN-LRF | 2015-005040 | 2 Flutes | | R0.05 | 4 | 1 | 50 | 4 | 135 |
| HLRS | 2015-005-040 | | | R0.05 | 4 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-005-040 | 4 Flutes | | R0.05 | 4 | 1.2 | 50 | 4 | 344 |
| CBN-LRF | 2015-005060 | 2 Flutes | | R0.05 | 6 | 1 | 50 | 4 | 135 |
| HLRS | 2015-005-060 | | | R0.05 | 6 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-005-060 | 4 Flutes | | R0.05 | 6 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-005-080 | 2 Flutes | | R0.05 | 8 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-005-080 | 4 Flutes | | R0.05 | 8 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-005-100 | 2 Flutes | | R0.05 | 10 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-005-120 | 4 Flutes | | R0.05 | 12 | 1.2 | 55 | 4 | 344 |
| DCLRS | 4015-005-120 | | | R0.05 | 12 | 3 | 55 | 4 | 376 |
| HLRS | 4015-005-160 | | | R0.05 | 16 | 1.2 | 60 | 4 | 344 |
| DCLRS | 4015-005-200 | | | R0.05 | 20 | 3 | 60 | 4 | 376 |
| DCLRS | 4015-005-300 | | | R0.05 | 30 | 3 | 80 | 4 | 376 |
| CXERS | 4015-01-0375 | | | R0.1 | — | 3.75 | 50 | 4 | 298 |
| UDCLRSF | 2015-010015 | 2 Flutes | | R0.1 | 1.5 | 0.75 | 50 | 4 | 88 |
| UDCLRS | 2015-010-015 | | | R0.1 | 1.5 | 0.75 | 50 | 4 | 102 |
| CBN-RSF | 1015-010030 | 1 Flutes | | R0.1 | 3 | 1 | 50 | 4 | 127 |
| UDCLRSF | 2015-010030 | 2 Flutes | | R0.1 | 3 | 0.75 | 50 | 4 | 88 |
| UDCLRS | 2015-010-030 | | | R0.1 | 3 | 0.75 | 50 | 4 | 102 |
| CBN-LRF | 2015-010030 | | | R0.1 | 3 | 1 | 50 | 4 | 135 |
| HLRS | 4015-01-030 | 4 Flutes | | R0.1 | 3 | 1.2 | 50 | 4 | 344 |
| UDCLRSF | 2015-010040 | 2 Flutes | | R0.1 | 4 | 0.75 | 50 | 4 | 88 |
| CBN-LRF | 2015-010040 | | | R0.1 | 4 | 1 | 50 | 4 | 135 |
| HLRS | 2015-01-040 | | | R0.1 | 4 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-01-040 | 4 Flutes | | R0.1 | 4 | 1.2 | 50 | 4 | 344 |
| UDCLRSF | 2015-010060 | 2 Flutes | | R0.1 | 6 | 0.75 | 50 | 4 | 88 |
| CBN-LRF | 2015-010060 | | | R0.1 | 6 | 1 | 50 | 4 | 135 |
| HLRS | 2015-01-060 | | | R0.1 | 6 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-01-060 | 4 Flutes | | R0.1 | 6 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-01-080 | 2 Flutes | | R0.1 | 8 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-01-080 | 4 Flutes | | R0.1 | 8 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-01-100 | 2 Flutes | | R0.1 | 10 | 1.5 | 50 | 4 | 322 |
| HLRS | 4015-01-100 | 4 Flutes | | R0.1 | 10 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-01-120 | 2 Flutes | | R0.1 | 12 | 1.5 | 55 | 4 | 322 |
| HLRS | 4015-01-120 | 4 Flutes | | R0.1 | 12 | 1.2 | 55 | 4 | 344 |
| HLRS | 2015-01-160 | 2 Flutes | | R0.1 | 16 | 1.5 | 55 | 4 | 322 |
| HLRS | 4015-01-160 | 4 Flutes | | R0.1 | 16 | 1.2 | 60 | 4 | 344 |
| HLRS | 4015-01-180 | | | R0.1 | 18 | 1.2 | 60 | 4 | 344 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2015-01-200 | 2 Flutes | 1.5 | R0.1 | 20 | 1.5 | 60 | 4 | 322 |
| C-CRS | 2015-02 | | | R0.2 | — | 3 | 45 | 4 | 290 |
| CXERS | 4015-02-0375 | 4 Flutes | | R0.2 | — | 3.75 | 50 | 4 | 298 |
| HLRS | 4015-02-030 | | | R0.2 | 3 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-02-040 | 2 Flutes | | R0.2 | 4 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-02-040 | 4 Flutes | | R0.2 | 4 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-02-060 | 2 Flutes | | R0.2 | 6 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-02-060 | 4 Flutes | | R0.2 | 6 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-02-080 | 2 Flutes | | R0.2 | 8 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-02-080 | 4 Flutes | | R0.2 | 8 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-02-100 | 2 Flutes | | R0.2 | 10 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-02-100 | 4 Flutes | | R0.2 | 10 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-02-120 | 2 Flutes | | R0.2 | 12 | 1.5 | 55 | 4 | 324 |
| HLRS | 4015-02-120 | 4 Flutes | | R0.2 | 12 | 1.2 | 55 | 4 | 344 |
| HLRS | 2015-02-160 | 2 Flutes | | R0.2 | 16 | 1.5 | 55 | 4 | 324 |
| HLRS | 4015-02-160 | 4 Flutes | | R0.2 | 16 | 1.2 | 60 | 4 | 344 |
| HLRS | 4015-02-180 | | | R0.2 | 18 | 1.2 | 60 | 4 | 344 |
| HLRS | 2015-02-200 | 2 Flutes | | R0.2 | 20 | 1.5 | 60 | 4 | 324 |
| C-CRS | 2015-03 | | | R0.3 | — | 3 | 45 | 4 | 290 |
| CXERS | 4015-03-0375 | 4 Flutes | | R0.3 | — | 3.75 | 50 | 4 | 298 |
| HLRS | 4015-03-030 | | | R0.3 | 3 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-03-040 | 2 Flutes | | R0.3 | 4 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-03-040 | 4 Flutes | | R0.3 | 4 | 1.2 | 50 | 4 | 344 |
| CBN-LRF | 2015-030045 | 2 Flutes | | R0.3 | 4.5 | 1 | 50 | 4 | 135 |
| HLRS | 2015-03-060 | | | R0.3 | 6 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-03-060 | 4 Flutes | | R0.3 | 6 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-03-080 | 2 Flutes | | R0.3 | 8 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-03-080 | 4 Flutes | | R0.3 | 8 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-03-100 | 2 Flutes | | R0.3 | 10 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-03-100 | 4 Flutes | | R0.3 | 10 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-03-120 | 2 Flutes | | R0.3 | 12 | 1.5 | 55 | 4 | 324 |
| HLRS | 4015-03-120 | 4 Flutes | | R0.3 | 12 | 1.2 | 55 | 4 | 344 |
| HLRS | 2015-03-160 | 2 Flutes | | R0.3 | 16 | 1.5 | 55 | 4 | 324 |
| HLRS | 4015-03-160 | 4 Flutes | | R0.3 | 16 | 1.2 | 60 | 4 | 344 |
| HLRS | 4015-03-180 | | | R0.3 | 18 | 1.2 | 60 | 4 | 344 |
| HLRS | 2015-03-200 | 2 Flutes | | R0.3 | 20 | 1.5 | 60 | 4 | 324 |
| C-CRS | 2015-05 | | | R0.5 | — | 3 | 45 | 4 | 290 |
| HLRS | 4015-05-030 | 4 Flutes | | R0.5 | 3 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-05-040 | 2 Flutes | | R0.5 | 4 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-05-040 | 4 Flutes | | R0.5 | 4 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-05-060 | 2 Flutes | 1.5 | R0.5 | 6 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-05-060 | 4 Flutes | | R0.5 | 6 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-05-080 | 2 Flutes | | R0.5 | 8 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-05-080 | 4 Flutes | | R0.5 | 8 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-05-100 | 2 Flutes | | R0.5 | 10 | 1.5 | 50 | 4 | 324 |
| HLRS | 4015-05-100 | 4 Flutes | | R0.5 | 10 | 1.2 | 50 | 4 | 344 |
| HLRS | 2015-05-120 | 2 Flutes | | R0.5 | 12 | 1.5 | 55 | 4 | 324 |
| HLRS | 4015-05-120 | 4 Flutes | | R0.5 | 12 | 1.2 | 55 | 4 | 344 |
| HLRS | 2015-05-160 | 2 Flutes | | R0.5 | 16 | 1.5 | 55 | 4 | 324 |
| HLRS | 4015-05-160 | 4 Flutes | | R0.5 | 16 | 1.2 | 60 | 4 | 344 |
| HLRS | 4015-05-180 | | | R0.5 | 18 | 1.2 | 60 | 4 | 344 |
| HLRS | 2015-05-200 | 2 Flutes | | R0.5 | 20 | 1.5 | 60 | 4 | 324 |
| HLRS | 4018-02-080 | 4 Flutes | 1.8 | R0.2 | 8 | 1.44 | 50 | 4 | 346 |
| HLRS | 4018-02-100 | | | R0.2 | 10 | 1.44 | 50 | 4 | 346 |
| HLRS | 4018-02-120 | | | R0.2 | 12 | 1.44 | 55 | 4 | 346 |
| HLRS | 4018-02-140 | | | R0.2 | 14 | 1.44 | 55 | 4 | 346 |
| HLRS | 4018-02-160 | | | R0.2 | 16 | 1.44 | 60 | 4 | 346 |
| CBN-RSF | 1020-002040 | 1 Flutes | 2 | R0.02 | 4 | 1.2 | 50 | 4 | 127 |
| CBN-LRF | 2020-002040 | 2 Flutes | | R0.02 | 4 | 1.2 | 50 | 4 | 135 |
| HLRS | 4020-002-040 | 4 Flutes | | R0.02 | 4 | 1.6 | 50 | 4 | 346 |
| CBN-RSF | 1020-002060 | 1 Flutes | | R0.02 | 6 | 1.2 | 50 | 4 | 127 |
| CBN-LRF | 2020-002060 | 2 Flutes | | R0.02 | 6 | 1.2 | 50 | 4 | 135 |
| HLRS | 4020-002-060 | 4 Flutes | | R0.02 | 6 | 1.6 | 50 | 4 | 346 |
| CBN-LRF | 2020-002080 | 2 Flutes | | R0.02 | 8 | 1.2 | 50 | 4 | 135 |
| HLRS | 4020-002-080 | 4 Flutes | | R0.02 | 8 | 1.6 | 50 | 4 | 346 |
| CBN-LRF | 2020-002100 | 2 Flutes | | R0.02 | 10 | 1.2 | 50 | 4 | 135 |
| HLRS | 4020-002-100 | 4 Flutes | | R0.02 | 10 | 1.6 | 50 | 4 | 346 |
| HLRS | 4020-002-120 | | | R0.02 | 12 | 1.6 | 55 | 4 | 346 |
| HLRS | 4020-002-160 | | | R0.02 | 16 | 1.6 | 60 | 4 | 346 |
| HLRS | 4020-002-200 | | | R0.02 | 20 | 1.6 | 60 | 4 | 346 |
| UDCLRSF | 2020-003020 | 2 Flutes | | R0.03 | 2 | 1 | 50 | 4 | 88 |
| UDCLRS | 2020-003-020 | | | R0.03 | 2 | 1 | 50 | 4 | 102 |
| CBN-LRF | 2020-003030 | | | R0.03 | 3 | 1.2 | 50 | 4 | 135 |
| UDCLRSF | 2020-003040 | | | R0.03 | 4 | 1 | 50 | 4 | 88 |
| UDCLRS | 2020-003-040 | | | R0.03 | 4 | 1 | 50 | 4 | 102 |
| UDCLRSF | 2020-003060 | | | R0.03 | 6 | 1 | 50 | 4 | 88 |
| UDCLRSF | 2020-003080 | | | R0.03 | 8 | 1 | 50 | 4 | 88 |
| UDCLRSF | 2020-003100 | | | R0.03 | 10 | 1 | 50 | 4 | 88 |
| UDCLRSF | 2020-005020 | | | R0.05 | 2 | 1 | 50 | 4 | 88 |
| UDCLRS | 2020-005-020 | | | R0.05 | 2 | 1 | 50 | 4 | 102 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| UPDLRS | 1020-005-040 | 1 Flutes | 2 | R0.05 | 4 | 0.55 | 40 | 4 | 316 |
| CBN-RSF | 1020-005040 | | | R0.05 | 4 | 1.2 | 50 | 4 | 127 |
| UDCLRSF | 2020-005040 | 2 Flutes | | R0.05 | 4 | 1 | 50 | 4 | 88 |
| UDCLRS | 2020-005-040 | | | R0.05 | 4 | 1 | 50 | 4 | 102 |
| CBN-LRF | 2020-005040 | | | R0.05 | 4 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-005-040 | | | R0.05 | 4 | 2 | 50 | 4 | 324 |
| HLRS | 4020-005-040 | 4 Flutes | | R0.05 | 4 | 1.6 | 50 | 4 | 346 |
| CBN-RSF | 1020-005060 | 1 Flutes | | R0.05 | 6 | 1.2 | 50 | 4 | 127 |
| UDCLRSF | 2020-005060 | 2 Flutes | | R0.05 | 6 | 1 | 50 | 4 | 88 |
| CBN-LRF | 2020-005060 | | | R0.05 | 6 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-005-060 | | | R0.05 | 6 | 2 | 50 | 4 | 324 |
| HLRS | 4020-005-060 | 4 Flutes | | R0.05 | 6 | 1.6 | 50 | 4 | 346 |
| CBN-LRF | 2020-005080 | 2 Flutes | | R0.05 | 8 | 1.2 | 50 | 4 | 135 |
| UDCLRSF | 2020-005080 | | | R0.05 | 8 | 1 | 50 | 4 | 88 |
| HLRS | 2020-005-080 | | | R0.05 | 8 | 2 | 50 | 4 | 324 |
| HLRS | 4020-005-080 | 4 Flutes | | R0.05 | 8 | 1.6 | 50 | 4 | 346 |
| UDCLRSF | 2020-005100 | 2 Flutes | | R0.05 | 10 | 1 | 50 | 4 | 88 |
| CBN-LRF | 2020-005100 | | | R0.05 | 10 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-005-100 | | | R0.05 | 10 | 2 | 50 | 4 | 324 |
| HLRS | 4020-005-100 | 4 Flutes | | R0.05 | 10 | 1.6 | 50 | 4 | 346 |
| DCLRS | 4020-005-100 | | | R0.05 | 10 | 4 | 50 | 4 | 377 |
| HLRS | 4020-005-120 | | | R0.05 | 12 | 1.6 | 55 | 4 | 346 |
| HLRS | 4020-005-160 | | | R0.05 | 16 | 1.6 | 60 | 4 | 346 |
| HLRS | 4020-005-200 | | | R0.05 | 20 | 1.6 | 60 | 4 | 346 |
| DCLRS | 4020-005-200 | | | R0.05 | 20 | 4 | 60 | 4 | 377 |
| CXERS | 4020-01-050 | | | R0.1 | — | 5 | 50 | 4 | 298 |
| UDCLRSF | 2020-010020 | 2 Flutes | | R0.1 | 2 | 1 | 50 | 4 | 88 |
| UDCLRS | 2020-010-020 | | | R0.1 | 2 | 1 | 50 | 4 | 102 |
| UPDLRS | 1020-010-040 | 1 Flutes | | R0.1 | 4 | 0.55 | 40 | 4 | 316 |
| CBN-RSF | 1020-010040 | | | R0.1 | 4 | 1.2 | 50 | 4 | 127 |
| UDCLRSF | 2020-010040 | 2 Flutes | | R0.1 | 4 | 1 | 50 | 4 | 88 |
| UDCLRS | 2020-010-040 | | | R0.1 | 4 | 1 | 50 | 4 | 102 |
| CBN-LRF | 2020-010040 | | | R0.1 | 4 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-01-040 | | | R0.1 | 4 | 2 | 50 | 4 | 324 |
| HLRS | 2020-01-040E | | | R0.1 | 4 | 2 | 50 | 4 | 324 |
| HLRS | 4020-01-040 | 4 Flutes | | R0.1 | 4 | 1.6 | 50 | 4 | 346 |
| CBN-RSF | 1020-010060 | 1 Flutes | | R0.1 | 6 | 1.2 | 50 | 4 | 127 |
| CPRS25NSP | 2020-010-06 | 2 Flutes | | R0.1 | 6 | 3 | 38 | 3 | 564 |
| UDCLRSF | 2020-010060 | | | R0.1 | 6 | 1 | 50 | 4 | 88 |
| CBN-LRF | 2020-010060 | | | R0.1 | 6 | 1.2 | 50 | 4 | 135 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2020-01-060 | 2 Flutes | 2 | R0.1 | 6 | 2 | 50 | 4 | 324 |
| HLRS | 2020-01-060E | | | R0.1 | 6 | 2 | 50 | 4 | 324 |
| HLRS | 4020-01-060 | 4 Flutes | | R0.1 | 6 | 1.6 | 50 | 4 | 346 |
| CBN-LRF | 2020-010080 | 2 Flutes | | R0.1 | 8 | 1.2 | 50 | 4 | 135 |
| UDCLRSF | 2020-010080 | | | R0.1 | 8 | 1 | 50 | 4 | 88 |
| HLRS | 2020-01-080 | | | R0.1 | 8 | 2 | 50 | 4 | 324 |
| HLRS | 2020-01-080E | | | R0.1 | 8 | 2 | 50 | 4 | 324 |
| HLRS | 4020-01-080 | 4 Flutes | | R0.1 | 8 | 1.6 | 50 | 4 | 346 |
| UDCLRSF | 2020-010100 | 2 Flutes | | R0.1 | 10 | 1 | 50 | 4 | 88 |
| CBN-LRF | 2020-010100 | | | R0.1 | 10 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-01-100 | | | R0.1 | 10 | 2 | 50 | 4 | 324 |
| HLRS | 2020-01-100E | | | R0.1 | 10 | 2 | 50 | 4 | 324 |
| HLRS | 4020-01-100 | 4 Flutes | | R0.1 | 10 | 1.6 | 50 | 4 | 346 |
| HLRS | 2020-01-120 | 2 Flutes | | R0.1 | 12 | 2 | 55 | 4 | 324 |
| HLRS | 2020-01-120E | | | R0.1 | 12 | 2 | 55 | 4 | 324 |
| HLRS | 4020-01-120 | 4 Flutes | | R0.1 | 12 | 1.6 | 55 | 4 | 346 |
| HLRS | 2020-01-160 | 2 Flutes | | R0.1 | 16 | 2 | 60 | 4 | 324 |
| HLRS | 4020-01-160 | 4 Flutes | | R0.1 | 16 | 1.6 | 60 | 4 | 346 |
| HLRS | 2020-01-200 | 2 Flutes | | R0.1 | 20 | 2 | 60 | 4 | 324 |
| HLRS | 4020-01-200 | 4 Flutes | | R0.1 | 20 | 1.6 | 60 | 4 | 346 |
| HLRS | 4020-01-240 | | | R0.1 | 24 | 1.6 | 70 | 4 | 346 |
| HLRS | 2020-01-260 | 2 Flutes | | R0.1 | 26 | 2 | 70 | 4 | 324 |
| HLRS | 2020-01-300 | | | R0.1 | 30 | 2 | 70 | 4 | 324 |
| C-CRS | 2020-02 | | | R0.2 | — | 4 | 45 | 4 | 290 |
| CXERS | 4020-02-050 | 4 Flutes | | R0.2 | — | 5 | 50 | 4 | 298 |
| UPDLRS | 1020-020-040 | 1 Flutes | | R0.2 | 4 | 0.55 | 40 | 4 | 316 |
| CBN-LRF | 2020-020040 | 2 Flutes | | R0.2 | 4 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-02-040 | | | R0.2 | 4 | 2 | 50 | 4 | 324 |
| HLRS | 2020-02-040E | | | R0.2 | 4 | 2 | 50 | 4 | 324 |
| HLRS | 4020-02-040 | 4 Flutes | | R0.2 | 4 | 1.6 | 50 | 4 | 346 |
| CRS20HSP | 4020-020-05 | | | R0.2 | 5 | 2.5 | 50 | 6 | 570 |
| CBN-LRF | 2020-020060 | 2 Flutes | | R0.2 | 6 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-02-060 | | | R0.2 | 6 | 2 | 50 | 4 | 324 |
| HLRS | 2020-02-060E | | | R0.2 | 6 | 2 | 50 | 4 | 324 |
| CRS40HSP | 3020-020-06 | 3 Flutes | | R0.2 | 6 | 3 | 38 | 3 | 568 |
| HLRS | 4020-02-060 | 4 Flutes | | R0.2 | 6 | 1.6 | 50 | 4 | 346 |
| CBN-LRF | 2020-020080 | 2 Flutes | | R0.2 | 8 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-02-080 | | | R0.2 | 8 | 2 | 50 | 4 | 324 |
| HLRS | 2020-02-080E | | | R0.2 | 8 | 2 | 50 | 4 | 324 |
| HLRS | 4020-02-080 | 4 Flutes | | R0.2 | 8 | 1.6 | 50 | 4 | 346 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CBN-LRF | 2020-020100 | 2 Flutes | 2 | R0.2 | 10 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-02-100 | | | R0.2 | 10 | 2 | 50 | 4 | 324 |
| HLRS | 2020-02-100E | | | R0.2 | 10 | 2 | 50 | 4 | 324 |
| CRS40HSP | 3020-020-10 | 3 Flutes | | R0.2 | 10 | 3 | 60 | 3 | 568 |
| HLRS | 4020-02-100 | 4 Flutes | | R0.2 | 10 | 1.6 | 50 | 4 | 346 |
| DCLRS | 4020-02-100 | | | R0.2 | 10 | 4 | 50 | 4 | 377 |
| HLRS | 2020-02-120 | 2 Flutes | | R0.2 | 12 | 2 | 55 | 4 | 326 |
| HLRS | 2020-02-120E | | | R0.2 | 12 | 2 | 55 | 4 | 326 |
| HLRS | 4020-02-120 | 4 Flutes | | R0.2 | 12 | 1.6 | 55 | 4 | 346 |
| HLRS | 2020-02-160 | 2 Flutes | | R0.2 | 16 | 2 | 60 | 4 | 326 |
| HLRS | 4020-02-160 | 4 Flutes | | R0.2 | 16 | 1.6 | 60 | 4 | 346 |
| HLRS | 2020-02-200 | 2 Flutes | | R0.2 | 20 | 2 | 60 | 4 | 326 |
| HLRS | 4020-02-200 | 4 Flutes | | R0.2 | 20 | 1.6 | 60 | 4 | 346 |
| DCLRS | 4020-02-200 | | | R0.2 | 20 | 4 | 60 | 4 | 377 |
| HLRS | 4020-02-240 | | | R0.2 | 24 | 1.6 | 70 | 4 | 346 |
| HLRS | 2020-02-260 | 2 Flutes | | R0.2 | 26 | 2 | 70 | 4 | 326 |
| HLRS | 2020-02-300 | | | R0.2 | 30 | 2 | 70 | 4 | 326 |
| DCLRS | 4020-02-300 | 4 Flutes | | R0.2 | 30 | 4 | 80 | 4 | 377 |
| C-CRS | 2020-03 | 2 Flutes | | R0.3 | — | 4 | 45 | 4 | 290 |
| CXERS | 4020-03-050 | 4 Flutes | | R0.3 | — | 5 | 50 | 4 | 298 |
| HLRS | 2020-03-040 | 2 Flutes | | R0.3 | 4 | 2 | 50 | 4 | 326 |
| HLRS | 2020-03-040E | | | R0.3 | 4 | 2 | 50 | 4 | 326 |
| HLRS | 4020-03-040 | 4 Flutes | | R0.3 | 4 | 1.6 | 50 | 4 | 346 |
| HLRS | 2020-03-060 | 2 Flutes | | R0.3 | 6 | 2 | 50 | 4 | 326 |
| HLRS | 2020-03-060E | | | R0.3 | 6 | 2 | 50 | 4 | 326 |
| HRRS | 4020-03-06S | 4 Flutes | | R0.3 | 6 | 2 | 45 | 4 | 368 |
| HLRS | 4020-03-060 | | | R0.3 | 6 | 1.6 | 50 | 4 | 346 |
| HRRS | 4020-03-06 | | | R0.3 | 6 | 2 | 70 | 4 | 362 |
| HLRS | 2020-03-080 | 2 Flutes | | R0.3 | 8 | 2 | 50 | 4 | 326 |
| HLRS | 2020-03-080E | | | R0.3 | 8 | 2 | 50 | 4 | 326 |
| HLRS | 4020-03-080 | 4 Flutes | | R0.3 | 8 | 1.6 | 50 | 4 | 346 |
| HLRS | 2020-03-100 | 2 Flutes | | R0.3 | 10 | 2 | 50 | 4 | 326 |
| HLRS | 2020-03-100E | | | R0.3 | 10 | 2 | 50 | 4 | 326 |
| HLRS | 4020-03-100 | 4 Flutes | | R0.3 | 10 | 1.6 | 50 | 4 | 346 |
| HLRS | 2020-03-120 | 2 Flutes | | R0.3 | 12 | 2 | 55 | 4 | 326 |
| HLRS | 2020-03-120E | | | R0.3 | 12 | 2 | 55 | 4 | 326 |
| HLRS | 4020-03-120 | 4 Flutes | | R0.3 | 12 | 1.6 | 55 | 4 | 346 |
| HLRS | 2020-03-160 | 2 Flutes | | R0.3 | 16 | 2 | 60 | 4 | 326 |
| HLRS | 4020-03-160 | 4 Flutes | | R0.3 | 16 | 1.6 | 60 | 4 | 346 |
| HLRS | 2020-03-200 | 2 Flutes | | R0.3 | 20 | 2 | 60 | 4 | 326 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4020-03-200 | 4 Flutes | 2 | R0.3 | 20 | 1.6 | 60 | 4 | 346 |
| HLRS | 4020-03-240 | | | R0.3 | 24 | 1.6 | 70 | 4 | 346 |
| HLRS | 2020-03-260 | 2 Flutes | | R0.3 | 26 | 2 | 70 | 4 | 326 |
| HLRS | 2020-03-300 | | | R0.3 | 30 | 2 | 70 | 4 | 326 |
| C-CRS | 2020-05 | | | R0.5 | — | 4 | 45 | 4 | 290 |
| CXERS | 4020-05-050 | 4 Flutes | | R0.5 | — | 5 | 50 | 4 | 298 |
| CBN-LRF | 2020-050040 | 2 Flutes | | R0.5 | 4 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-05-040 | | | R0.5 | 4 | 2 | 50 | 4 | 326 |
| HLRS | 2020-05-040E | | | R0.5 | 4 | 2 | 50 | 4 | 326 |
| HLRS | 4020-05-040 | 4 Flutes | | R0.5 | 4 | 1.6 | 50 | 4 | 348 |
| CBN-LRF | 2020-050060 | 2 Flutes | | R0.5 | 6 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-05-060 | | | R0.5 | 6 | 2 | 50 | 4 | 326 |
| HLRS | 2020-05-060E | | | R0.5 | 6 | 2 | 50 | 4 | 326 |
| HRRS | 4020-05-06S | 4 Flutes | | R0.5 | 6 | 2 | 45 | 4 | 368 |
| HLRS | 4020-05-060 | | | R0.5 | 6 | 1.6 | 50 | 4 | 348 |
| HRRS | 4020-05-06 | | | R0.5 | 6 | 2 | 70 | 4 | 362 |
| CRRS | 4020-05-06 | | | R0.5 | 6 | 2 | 70 | 4 | 370 |
| CBN-LRF | 2020-050080 | 2 Flutes | | R0.5 | 8 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-05-080 | | | R0.5 | 8 | 2 | 50 | 4 | 326 |
| HLRS | 2020-05-080E | | | R0.5 | 8 | 2 | 50 | 4 | 326 |
| HLRS | 4020-05-080 | 4 Flutes | | R0.5 | 8 | 1.6 | 50 | 4 | 348 |
| CBN-LRF | 2020-050100 | 2 Flutes | | R0.5 | 10 | 1.2 | 50 | 4 | 135 |
| HLRS | 2020-05-100 | | | R0.5 | 10 | 2 | 50 | 4 | 326 |
| HLRS | 2020-05-100E | | | R0.5 | 10 | 2 | 50 | 4 | 326 |
| HLRS | 4020-05-100 | 4 Flutes | | R0.5 | 10 | 1.6 | 50 | 4 | 348 |
| DCLRS | 4020-05-100 | | | R0.5 | 10 | 4 | 50 | 4 | 377 |
| HLRS | 2020-05-120 | 2 Flutes | | R0.5 | 12 | 2 | 55 | 4 | 326 |
| HLRS | 2020-05-120E | | | R0.5 | 12 | 2 | 55 | 4 | 326 |
| HLRS | 4020-05-120 | 4 Flutes | | R0.5 | 12 | 1.6 | 55 | 4 | 348 |
| HLRS | 2020-05-160 | 2 Flutes | | R0.5 | 16 | 2 | 60 | 4 | 326 |
| HLRS | 4020-05-160 | 4 Flutes | | R0.5 | 16 | 1.6 | 60 | 4 | 348 |
| HLRS | 2020-05-200 | 2 Flutes | | R0.5 | 20 | 2 | 60 | 4 | 326 |
| HLRS | 4020-05-200 | 4 Flutes | | R0.5 | 20 | 1.6 | 60 | 4 | 348 |
| DCLRS | 4020-05-200 | | | R0.5 | 20 | 4 | 60 | 4 | 377 |
| HLRS | 4020-05-240 | | | R0.5 | 24 | 1.6 | 70 | 4 | 348 |
| HLRS | 2020-05-260 | 2 Flutes | | R0.5 | 26 | 2 | 70 | 4 | 326 |
| HLRS | 4020-05-260 | 4 Flutes | | R0.5 | 26 | 1.6 | 70 | 4 | 348 |
| HLRS | 2020-05-300 | 2 Flutes | | R0.5 | 30 | 2 | 70 | 4 | 326 |
| DCLRS | 4020-05-300 | 4 Flutes | | R0.5 | 30 | 4 | 80 | 4 | 377 |
| HLRS | 4020-05-300 | | | R0.5 | 30 | 1.6 | 70 | 4 | 348 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4025-01-060 | 4 Flutes | 2.5 | R0.1 | 6 | 2 | 50 | 4 | 348 |
| HLRS | 4025-01-080 | 4 Flutes | 2.5 | R0.1 | 8 | 2 | 50 | 4 | 348 |
| HLRS | 2025-01-100 | 2 Flutes | 2.5 | R0.1 | 10 | 2.5 | 50 | 4 | 326 |
| HLRS | 4025-01-100 | 4 Flutes | 2.5 | R0.1 | 10 | 2 | 50 | 4 | 348 |
| HLRS | 4025-01-160 | 4 Flutes | 2.5 | R0.1 | 16 | 2 | 60 | 4 | 348 |
| HLRS | 2025-01-200 | 2 Flutes | 2.5 | R0.1 | 20 | 2.5 | 60 | 4 | 326 |
| HLRS | 4025-01-200 | 4 Flutes | 2.5 | R0.1 | 20 | 2 | 60 | 4 | 348 |
| HLRS | 2025-01-300 | 2 Flutes | 2.5 | R0.1 | 30 | 2.5 | 70 | 4 | 326 |
| HLRS | 4025-01-300 | 4 Flutes | 2.5 | R0.1 | 30 | 2 | 70 | 4 | 348 |
| C-CRS | 2025-02 | 2 Flutes | 2.5 | R0.2 | — | 5 | 45 | 4 | 290 |
| CRS40HSP | 3025-020-06 | 3 Flutes | 2.5 | R0.2 | 6 | 4 | 38 | 3 | 568 |
| HLRS | 4025-02-060 | 4 Flutes | 2.5 | R0.2 | 6 | 2 | 50 | 4 | 348 |
| HLRS | 4025-02-080 | 4 Flutes | 2.5 | R0.2 | 8 | 2 | 50 | 4 | 348 |
| HLRS | 2025-02-100 | 2 Flutes | 2.5 | R0.2 | 10 | 2.5 | 50 | 4 | 326 |
| HLRS | 4025-02-100 | 4 Flutes | 2.5 | R0.2 | 10 | 2 | 50 | 4 | 348 |
| HLRS | 4025-02-160 | 4 Flutes | 2.5 | R0.2 | 16 | 2 | 60 | 4 | 348 |
| HLRS | 2025-02-200 | 2 Flutes | 2.5 | R0.2 | 20 | 2.5 | 60 | 4 | 326 |
| HLRS | 4025-02-200 | 4 Flutes | 2.5 | R0.2 | 20 | 2 | 60 | 4 | 348 |
| HLRS | 2025-02-300 | 2 Flutes | 2.5 | R0.2 | 30 | 2.5 | 70 | 4 | 326 |
| HLRS | 4025-02-300 | 4 Flutes | 2.5 | R0.2 | 30 | 2 | 70 | 4 | 348 |
| CRS20HSP | 4025-025-06 | 4 Flutes | 2.5 | R0.25 | 6 | 3 | 50 | 6 | 570 |
| C-CRS | 2025-03 | 2 Flutes | 2.5 | R0.3 | — | 5 | 45 | 4 | 290 |
| CXERS | 4025-03-0625 | 4 Flutes | 2.5 | R0.3 | — | 6.25 | 50 | 4 | 298 |
| HLRS | 4025-03-060 | 4 Flutes | 2.5 | R0.3 | 6 | 2 | 50 | 4 | 348 |
| HLRS | 4025-03-080 | 4 Flutes | 2.5 | R0.3 | 8 | 2 | 50 | 4 | 348 |
| HLRS | 2025-03-100 | 2 Flutes | 2.5 | R0.3 | 10 | 2.5 | 50 | 4 | 326 |
| HLRS | 4025-03-100 | 4 Flutes | 2.5 | R0.3 | 10 | 2 | 50 | 4 | 348 |
| HLRS | 4025-03-160 | 4 Flutes | 2.5 | R0.3 | 16 | 2 | 60 | 4 | 348 |
| HLRS | 2025-03-200 | 2 Flutes | 2.5 | R0.3 | 20 | 2.5 | 60 | 4 | 326 |
| HLRS | 4025-03-200 | 4 Flutes | 2.5 | R0.3 | 20 | 2 | 60 | 4 | 348 |
| HLRS | 2025-03-300 | 2 Flutes | 2.5 | R0.3 | 30 | 2.5 | 70 | 4 | 326 |
| HLRS | 4025-03-300 | 4 Flutes | 2.5 | R0.3 | 30 | 2 | 70 | 4 | 348 |
| C-CRS | 2025-05 | 2 Flutes | 2.5 | R0.5 | — | 5 | 45 | 4 | 290 |
| CXERS | 4025-05-0625 | 4 Flutes | 2.5 | R0.5 | — | 6.25 | 50 | 4 | 298 |
| HLRS | 4025-05-060 | 4 Flutes | 2.5 | R0.5 | 6 | 2 | 50 | 4 | 348 |
| HLRS | 4025-05-080 | 4 Flutes | 2.5 | R0.5 | 8 | 2 | 50 | 4 | 348 |
| HLRS | 2025-05-100 | 2 Flutes | 2.5 | R0.5 | 10 | 2.5 | 50 | 4 | 326 |
| HLRS | 4025-05-100 | 4 Flutes | 2.5 | R0.5 | 10 | 2 | 50 | 4 | 348 |
| HLRS | 4025-05-160 | 4 Flutes | 2.5 | R0.5 | 16 | 2 | 60 | 4 | 348 |
| HLRS | 2025-05-200 | 2 Flutes | 2.5 | R0.5 | 20 | 2.5 | 60 | 4 | 326 |
| HLRS | 4025-05-200 | 4 Flutes | 2.5 | R0.5 | 20 | 2 | 60 | 4 | 348 |
| HLRS | 2025-05-300 | 2 Flutes | 2.5 | R0.5 | 30 | 2.5 | 70 | 4 | 326 |
| HLRS | 4025-05-300 | 4 Flutes | 2.5 | R0.5 | 30 | 2 | 70 | 4 | 348 |
| HLRS | 4030-005-040 | 4 Flutes | 3 | R0.05 | 4 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-005-060 | 4 Flutes | 3 | R0.05 | 6 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-005-080 | 4 Flutes | 3 | R0.05 | 8 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-005-100 | 4 Flutes | 3 | R0.05 | 10 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-005-120 | 4 Flutes | 3 | R0.05 | 12 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-005-160 | 4 Flutes | 3 | R0.05 | 16 | 2.4 | 60 | 6 | 350 |
| DCLRS | 4030-005-160 | 4 Flutes | 3 | R0.05 | 16 | 6 | 60 | 4 | 377 |
| HLRS | 4030-005-200 | 4 Flutes | 3 | R0.05 | 20 | 2.4 | 60 | 6 | 350 |
| DCLRS | 4030-005-200 | 4 Flutes | 3 | R0.05 | 20 | 6 | 60 | 4 | 377 |
| DCLRS | 4030-005-300 | 4 Flutes | 3 | R0.05 | 30 | 6 | 80 | 4 | 377 |
| HMERS | 4030-01-075 | 4 Flutes | 3 | R0.1 | — | 7.5 | 60 | 6 | 312 |
| HLRS | 4030-01-040 | 4 Flutes | 3 | R0.1 | 4 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-01-060 | 2 Flutes | 3 | R0.1 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 2030-01-060E | 2 Flutes | 3 | R0.1 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 4030-01-060 | 4 Flutes | 3 | R0.1 | 6 | 2.4 | 55 | 6 | 350 |
| CRS40HSP | 3030-010-07 | 3 Flutes | 3 | R0.1 | 7 | 4 | 38 | 3 | 568 |
| CPRS25NSP | 2030-010-08 | 2 Flutes | 3 | R0.1 | 8 | 4 | 38 | 3 | 564 |
| HLRS | 4030-01-080 | 4 Flutes | 3 | R0.1 | 8 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-01-100 | 4 Flutes | 3 | R0.1 | 10 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-01-120 | 2 Flutes | 3 | R0.1 | 12 | 3 | 55 | 6 | 328 |
| HLRS | 4030-01-120 | 4 Flutes | 3 | R0.1 | 12 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-01-160 | 2 Flutes | 3 | R0.1 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 2030-01-160E | 2 Flutes | 3 | R0.1 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 4030-01-160 | 4 Flutes | 3 | R0.1 | 16 | 2.4 | 60 | 6 | 350 |
| HLRS | 2030-01-180 | 2 Flutes | 3 | R0.1 | 18 | 3 | 60 | 6 | 328 |
| HLRS | 4030-01-180 | 4 Flutes | 3 | R0.1 | 18 | 2.4 | 60 | 6 | 350 |
| HLRS | 2030-01-200 | 2 Flutes | 3 | R0.1 | 20 | 3 | 60 | 6 | 328 |
| HLRS | 4030-01-200 | 4 Flutes | 3 | R0.1 | 20 | 2.4 | 60 | 6 | 350 |
| HLRS | 4030-01-240 | 4 Flutes | 3 | R0.1 | 24 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-01-260 | 2 Flutes | 3 | R0.1 | 26 | 3 | 70 | 6 | 328 |
| HLRS | 4030-01-260 | 4 Flutes | 3 | R0.1 | 26 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-01-300 | 2 Flutes | 3 | R0.1 | 30 | 3 | 70 | 6 | 328 |
| HLRS | 4030-01-300 | 4 Flutes | 3 | R0.1 | 30 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-01-360 | 2 Flutes | 3 | R0.1 | 36 | 3 | 80 | 6 | 328 |
| C-CRS | 2030-02 | 2 Flutes | 3 | R0.2 | — | 10 | 45 | 6 | 290 |
| CXERS | 4030-02-075 | 4 Flutes | 3 | R0.2 | — | 7.5 | 60 | 6 | 298 |
| HMERS | 4030-02-075 | 4 Flutes | 3 | R0.2 | — | 7.5 | 60 | 6 | 312 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4030-02-040 | 4 Flutes | 3 | R0.2 | 4 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-02-060 | 2 Flutes | | R0.2 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 2030-02-060E | | | R0.2 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 4030-02-060 | 4 Flutes | | R0.2 | 6 | 2.4 | 55 | 6 | 350 |
| CRS40HSP | 3030-020-07 | 3 Flutes | | R0.2 | 7 | 4 | 38 | 3 | 568 |
| HLRS | 4030-02-080 | 4 Flutes | | R0.2 | 8 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-02-100 | | | R0.2 | 10 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-02-120 | 2 Flutes | | R0.2 | 12 | 3 | 55 | 6 | 328 |
| HLRS | 4030-02-120 | 4 Flutes | | R0.2 | 12 | 2.4 | 55 | 6 | 350 |
| CRS40HSP | 3030-020-14 | 3 Flutes | | R0.2 | 14 | 4 | 60 | 3 | 568 |
| HLRS | 2030-02-160 | 2 Flutes | | R0.2 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 2030-02-160E | | | R0.2 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 4030-02-160 | 4 Flutes | | R0.2 | 16 | 2.4 | 60 | 6 | 350 |
| DCLRS | 4030-02-160 | | | R0.2 | 16 | 6 | 60 | 4 | 377 |
| HLRS | 2030-02-180 | 2 Flutes | | R0.2 | 18 | 3 | 60 | 6 | 328 |
| HLRS | 4030-02-180 | 4 Flutes | | R0.2 | 18 | 2.4 | 60 | 6 | 350 |
| HLRS | 2030-02-200 | 2 Flutes | | R0.2 | 20 | 3 | 60 | 6 | 328 |
| HLRS | 4030-02-200 | 4 Flutes | | R0.2 | 20 | 2.4 | 60 | 6 | 350 |
| DCLRS | 4030-02-200 | | | R0.2 | 20 | 6 | 60 | 4 | 377 |
| HLRS | 4030-02-240 | | | R0.2 | 24 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-02-260 | 2 Flutes | | R0.2 | 26 | 3 | 70 | 6 | 328 |
| HLRS | 4030-02-260 | 4 Flutes | | R0.2 | 26 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-02-300 | 2 Flutes | | R0.2 | 30 | 3 | 70 | 6 | 328 |
| HLRS | 4030-02-300 | 4 Flutes | | R0.2 | 30 | 2.4 | 70 | 6 | 350 |
| DCLRS | 4030-02-300 | | | R0.2 | 30 | 6 | 80 | 4 | 377 |
| HLRS | 2030-02-360 | 2 Flutes | | R0.2 | 36 | 3 | 80 | 6 | 328 |
| HLRS | 4030-02-360 | 4 Flutes | | R0.2 | 36 | 2.4 | 80 | 6 | 350 |
| C-CRS | 2030-03 | 2 Flutes | | R0.3 | — | 10 | 45 | 6 | 290 |
| CXERS | 4030-03-075 | 4 Flutes | | R0.3 | — | 7.5 | 60 | 6 | 298 |
| HMERS | 4030-03-075 | | | R0.3 | — | 7.5 | 60 | 6 | 312 |
| HLRS | 4030-03-040 | | | R0.3 | 4 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-03-060 | 2 Flutes | | R0.3 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 2030-03-060E | | | R0.3 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 4030-03-060 | 4 Flutes | | R0.3 | 6 | 2.4 | 55 | 6 | 350 |
| CRS20HSP | 4030-030-07 | | | R0.3 | 7 | 4 | 50 | 6 | 570 |
| HLRS | 4030-03-080 | | | R0.3 | 8 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-03-100 | | | R0.3 | 10 | 2.4 | 55 | 6 | 350 |
| HLRS | 2030-03-120 | 2 Flutes | | R0.3 | 12 | 3 | 55 | 6 | 328 |
| HLRS | 4030-03-120 | 4 Flutes | | R0.3 | 12 | 2.4 | 55 | 6 | 350 |
| HLRS | 4030-03-140 | | | R0.3 | 14 | 2.4 | 55 | 6 | 350 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2030-03-160 | 2 Flutes | 3 | R0.3 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 2030-03-160E | | | R0.3 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 4030-03-160 | 4 Flutes | | R0.3 | 16 | 2.4 | 60 | 6 | 350 |
| HLRS | 2030-03-180 | 2 Flutes | | R0.3 | 18 | 3 | 60 | 6 | 328 |
| HLRS | 2030-03-200 | | | R0.3 | 20 | 3 | 60 | 6 | 328 |
| HLRS | 4030-03-200 | 4 Flutes | | R0.3 | 20 | 2.4 | 60 | 6 | 350 |
| HLRS | 4030-03-240 | | | R0.3 | 24 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-03-260 | 2 Flutes | | R0.3 | 26 | 3 | 70 | 6 | 328 |
| HLRS | 4030-03-260 | 4 Flutes | | R0.3 | 26 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-03-300 | 2 Flutes | | R0.3 | 30 | 3 | 70 | 6 | 328 |
| HLRS | 4030-03-300 | 4 Flutes | | R0.3 | 30 | 2.4 | 70 | 6 | 350 |
| HLRS | 2030-03-360 | 2 Flutes | | R0.3 | 36 | 3 | 80 | 6 | 328 |
| HLRS | 4030-03-360 | 4 Flutes | | R0.3 | 36 | 2.4 | 80 | 6 | 350 |
| C-CRS | 2030-05 | 2 Flutes | | R0.5 | — | 10 | 45 | 6 | 290 |
| CXERS | 4030-05-075 | 4 Flutes | | R0.5 | — | 7.5 | 60 | 6 | 298 |
| HMERS | 4030-05-075 | | | R0.5 | — | 7.5 | 60 | 6 | 312 |
| CXRS | 5030-05-0600 | 5 Flutes | | R0.5 | — | 6 | 50 | 6 | 309 |
| CXRS | 5030-05-0900 | | | R0.5 | — | 9 | 50 | 6 | 309 |
| HLRS | 4030-05-040 | 4 Flutes | | R0.5 | 4 | 2.4 | 55 | 6 | 352 |
| HLRS | 2030-05-060 | 2 Flutes | | R0.5 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 2030-05-060E | | | R0.5 | 6 | 3 | 55 | 6 | 328 |
| HLRS | 4030-05-060 | 4 Flutes | | R0.5 | 6 | 2.4 | 55 | 6 | 352 |
| HLRS | 4030-05-080 | | | R0.5 | 8 | 2.4 | 55 | 6 | 352 |
| CXLRS | 5030-05-09 | 5 Flutes | | R0.5 | 9 | 6 | 50 | 6 | 381 |
| HLRS | 4030-05-100 | 4 Flutes | | R0.5 | 10 | 2.4 | 55 | 6 | 352 |
| HLRS | 2030-05-120 | 2 Flutes | | R0.5 | 12 | 3 | 55 | 6 | 328 |
| HLRS | 4030-05-120 | 4 Flutes | | R0.5 | 12 | 2.4 | 55 | 6 | 352 |
| CXLRS | 5030-05-12 | 5 Flutes | | R0.5 | 12 | 6 | 50 | 6 | 381 |
| HLRS | 2030-05-160 | 2 Flutes | | R0.5 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 2030-05-160E | | | R0.5 | 16 | 3 | 60 | 6 | 328 |
| HLRS | 4030-05-160 | 4 Flutes | | R0.5 | 16 | 2.4 | 60 | 6 | 352 |
| DCLRS | 4030-05-160 | | | R0.5 | 16 | 6 | 60 | 4 | 377 |
| HLRS | 2030-05-180 | 2 Flutes | | R0.5 | 18 | 3 | 60 | 6 | 328 |
| HLRS | 2030-05-200 | | | R0.5 | 20 | 3 | 60 | 6 | 328 |
| HLRS | 4030-05-200 | 4 Flutes | | R0.5 | 20 | 2.4 | 60 | 6 | 352 |
| DCLRS | 4030-05-200 | | | R0.5 | 20 | 6 | 60 | 4 | 377 |
| HLRS | 4030-05-240 | | | R0.5 | 24 | 2.4 | 70 | 6 | 352 |
| HLRS | 2030-05-260 | 2 Flutes | | R0.5 | 26 | 3 | 70 | 6 | 328 |
| HLRS | 4030-05-260 | 4 Flutes | | R0.5 | 26 | 2.4 | 70 | 6 | 352 |
| HLRS | 2030-05-300 | 2 Flutes | | R0.5 | 30 | 3 | 70 | 6 | 328 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4030-05-300 | 4 Flutes | 3 | R0.5 | 30 | 2.4 | 70 | 6 | 352 |
| DCLRS | 4030-05-300 | | | R0.5 | 30 | 6 | 80 | 4 | 377 |
| HLRS | 2030-05-360 | 2 Flutes | | R0.5 | 36 | 3 | 80 | 6 | 328 |
| HLRS | 4030-05-360 | 4 Flutes | | R0.5 | 36 | 2.4 | 80 | 6 | 352 |
| HRRS | 4030-08-09-3S | | | R0.8 | 9 | 3 | 50 | 3 | 368 |
| HRRS | 4030-08-09S | | | R0.8 | 9 | 3 | 50 | 6 | 368 |
| HRRS | 4030-08-09-3 | | | R0.8 | 9 | 3 | 70 | 3 | 362 |
| HRRS | 4030-08-09 | | | R0.8 | 9 | 3 | 70 | 6 | 362 |
| CRRS | 4030-08-09 | | | R0.8 | 9 | 3 | 70 | 6 | 370 |
| C-CRS | 2030-10 | 2 Flutes | | R1 | — | 10 | 45 | 6 | 290 |
| HLRS | 2030-10-060 | | | R1 | 6 | 3 | 55 | 6 | 330 |
| HLRS | 2030-10-060E | | | R1 | 6 | 3 | 55 | 6 | 330 |
| HLRS | 4030-10-060 | 4 Flutes | | R1 | 6 | 2.4 | 55 | 6 | 352 |
| HLRS | 4030-10-080 | | | R1 | 8 | 2.4 | 55 | 6 | 352 |
| HLRS | 4030-10-100 | | | R1 | 10 | 2.4 | 55 | 6 | 352 |
| HLRS | 2030-10-120 | 2 Flutes | | R1 | 12 | 3 | 55 | 6 | 330 |
| HLRS | 4030-10-120 | 4 Flutes | | R1 | 12 | 2.4 | 55 | 6 | 352 |
| HLRS | 2030-10-160 | 2 Flutes | | R1 | 16 | 3 | 60 | 6 | 330 |
| HLRS | 2030-10-160E | | | R1 | 16 | 3 | 60 | 6 | 330 |
| HLRS | 4030-10-160 | 4 Flutes | | R1 | 16 | 2.4 | 60 | 6 | 352 |
| HLRS | 2030-10-180 | 2 Flutes | | R1 | 18 | 3 | 60 | 6 | 330 |
| HLRS | 2030-10-200 | | | R1 | 20 | 3 | 60 | 6 | 330 |
| HLRS | 4030-10-200 | 4 Flutes | | R1 | 20 | 2.4 | 60 | 6 | 352 |
| HLRS | 4030-10-240 | | | R1 | 24 | 2.4 | 70 | 6 | 352 |
| HLRS | 2030-10-260 | 2 Flutes | | R1 | 26 | 3 | 70 | 6 | 330 |
| HLRS | 4030-10-260 | 4 Flutes | | R1 | 26 | 2.4 | 70 | 6 | 352 |
| HLRS | 2030-10-300 | 2 Flutes | | R1 | 30 | 3 | 70 | 6 | 330 |
| HLRS | 4030-10-300 | 4 Flutes | | R1 | 30 | 2.4 | 70 | 6 | 352 |
| HLRS | 2030-10-360 | 2 Flutes | | R1 | 36 | 3 | 80 | 6 | 330 |
| HLRS | 4030-10-360 | 4 Flutes | | R1 | 36 | 2.4 | 80 | 6 | 352 |
| CRS40HSP | 3035-020-09 | 3 Flutes | 3.5 | R0.2 | 9 | 5 | 50 | 6 | 568 |
| HLRS | 4040-005-080 | 4 Flutes | 4 | R0.05 | 8 | 3.2 | 65 | 6 | 352 |
| HLRS | 4040-005-120 | | | R0.05 | 12 | 3.2 | 65 | 6 | 352 |
| HLRS | 4040-005-160 | | | R0.05 | 16 | 3.2 | 65 | 6 | 352 |
| HLRS | 4040-005-200 | | | R0.05 | 20 | 3.2 | 70 | 6 | 352 |
| HLRS | 4040-005-240 | | | R0.05 | 24 | 3.2 | 70 | 6 | 352 |
| HLRS | 4040-005-320 | | | R0.05 | 32 | 3.2 | 80 | 6 | 352 |
| HMERS | 4040-01-100 | | | R0.1 | — | 10 | 60 | 6 | 312 |
| HLRS | 2040-01-080 | 2 Flutes | | R0.1 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 2040-01-080E | | | R0.1 | 8 | 4 | 65 | 6 | 330 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 4040-01-080 | 4 Flutes | 4 | R0.1 | 8 | 3.2 | 65 | 6 | 352 |
| CPRS25NSP | 2040-010-12 | 2 Flutes | | R0.1 | 12 | 5 | 50 | 4 | 564 |
| HLRS | 2040-01-120 | | | R0.1 | 12 | 4 | 65 | 6 | 330 |
| HLRS | 4040-01-120 | 4 Flutes | | R0.1 | 12 | 3.2 | 65 | 6 | 352 |
| HLRS | 2040-01-160 | 2 Flutes | | R0.1 | 16 | 4 | 65 | 6 | 330 |
| HLRS | 4040-01-160 | 4 Flutes | | R0.1 | 16 | 3.2 | 65 | 6 | 352 |
| HLRS | 2040-01-200 | 2 Flutes | | R0.1 | 20 | 4 | 65 | 6 | 330 |
| HLRS | 2040-01-200E | | | R0.1 | 20 | 4 | 65 | 6 | 330 |
| HLRS | 4040-01-200 | 4 Flutes | | R0.1 | 20 | 3.2 | 70 | 6 | 352 |
| HLRS | 2040-01-240 | 2 Flutes | | R0.1 | 24 | 4 | 70 | 6 | 330 |
| HLRS | 4040-01-240 | 4 Flutes | | R0.1 | 24 | 3.2 | 70 | 6 | 352 |
| HLRS | 2040-01-320 | 2 Flutes | | R0.1 | 32 | 4 | 80 | 6 | 330 |
| HLRS | 4040-01-320 | 4 Flutes | | R0.1 | 32 | 3.2 | 80 | 6 | 352 |
| HLRS | 2040-01-480 | 2 Flutes | | R0.1 | 48 | 4 | 100 | 6 | 330 |
| HLRS | 4040-01-480 | 4 Flutes | | R0.1 | 48 | 3.2 | 100 | 6 | 352 |
| C-CRS | 2040-02 | 2 Flutes | | R0.2 | — | 12 | 45 | 6 | 291 |
| HMERS | 4040-02-100 | 4 Flutes | | R0.2 | — | 10 | 60 | 6 | 312 |
| CXERS | 4040-02-100 | | | R0.2 | — | 10 | 60 | 6 | 299 |
| HLRS | 2040-02-080 | 2 Flutes | | R0.2 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 2040-02-080E | | | R0.2 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 4040-02-080 | 4 Flutes | | R0.2 | 8 | 3.2 | 65 | 6 | 352 |
| CRS40HSP | 3040-020-09 | 3 Flutes | | R0.2 | 9 | 5 | 50 | 6 | 568 |
| HLRS | 2040-02-120 | 2 Flutes | | R0.2 | 12 | 4 | 65 | 6 | 330 |
| HLRS | 4040-02-120 | 4 Flutes | | R0.2 | 12 | 3.2 | 65 | 6 | 352 |
| HLRS | 2040-02-160 | 2 Flutes | | R0.2 | 16 | 4 | 65 | 6 | 330 |
| HLRS | 4040-02-160 | 4 Flutes | | R0.2 | 16 | 3.2 | 65 | 6 | 352 |
| CRS40HSP | 3040-020-18 | 3 Flutes | | R0.2 | 18 | 5 | 65 | 6 | 568 |
| HLRS | 2040-02-200 | 2 Flutes | | R0.2 | 20 | 4 | 65 | 6 | 330 |
| HLRS | 2040-02-200E | | | R0.2 | 20 | 4 | 65 | 6 | 330 |
| DCLRS | 4040-02-200 | 4 Flutes | | R0.2 | 20 | 8 | 60 | 6 | 377 |
| HLRS | 4040-02-200 | | | R0.2 | 20 | 3.2 | 70 | 6 | 352 |
| HLRS | 2040-02-240 | 2 Flutes | | R0.2 | 24 | 4 | 70 | 6 | 330 |
| HLRS | 4040-02-240 | 4 Flutes | | R0.2 | 24 | 3.2 | 70 | 6 | 352 |
| DCLRS | 4040-02-300 | | | R0.2 | 30 | 8 | 80 | 6 | 377 |
| HLRS | 2040-02-320 | 2 Flutes | | R0.2 | 32 | 4 | 80 | 6 | 330 |
| HLRS | 4040-02-320 | 4 Flutes | | R0.2 | 32 | 3.2 | 80 | 6 | 352 |
| DCLRS | 4040-02-400 | | | R0.2 | 40 | 8 | 80 | 6 | 377 |
| HLRS | 2040-02-480 | 2 Flutes | | R0.2 | 48 | 4 | 100 | 6 | 330 |
| HLRS | 4040-02-480 | 4 Flutes | | R0.2 | 48 | 3.2 | 100 | 6 | 352 |
| C-CRS | 2040-03 | 2 Flutes | | R0.3 | — | 12 | 45 | 6 | 291 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HMERS | 4040-03-100 | 4 Flutes | 4 | R0.3 | — | 10 | 60 | 6 | 312 |
| CXERS | 4040-03-100 | | | R0.3 | — | 10 | 60 | 6 | 299 |
| HLRS | 2040-03-080 | 2 Flutes | | R0.3 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 2040-03-080E | | | R0.3 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 4040-03-080 | 4 Flutes | | R0.3 | 8 | 3.2 | 65 | 6 | 354 |
| CRS40HSP | 3040-030-09 | 3 Flutes | | R0.3 | 9 | 5 | 50 | 6 | 568 |
| CPRS30N | 2040-030-10 | 2 Flutes | | R0.3 | 10 | 5 | 50 | 6 | 566 |
| HLRS | 2040-03-120 | | | R0.3 | 12 | 4 | 65 | 6 | 330 |
| CRRS | 4040-03-12 | 4 Flutes | | R0.3 | 12 | 4 | 60 | 6 | 370 |
| HLRS | 4040-03-120 | | | R0.3 | 12 | 3.2 | 65 | 6 | 354 |
| HRRS | 4040-03-12-6 | | | R0.3 | 12 | 4 | 70 | 6 | 362 |
| HLRS | 4040-03-140 | | | R0.3 | 14 | 3.2 | 65 | 6 | 354 |
| HLRS | 2040-03-160 | 2 Flutes | | R0.3 | 16 | 4 | 65 | 6 | 330 |
| HLRS | 4040-03-160 | 4 Flutes | | R0.3 | 16 | 3.2 | 65 | 6 | 354 |
| HLRS | 2040-03-200 | 2 Flutes | | R0.3 | 20 | 4 | 65 | 6 | 330 |
| HLRS | 2040-03-200E | | | R0.3 | 20 | 4 | 65 | 6 | 330 |
| HLRS | 4040-03-200 | 4 Flutes | | R0.3 | 20 | 3.2 | 70 | 6 | 354 |
| HRRS | 4040-03-20-6 | | | R0.3 | 20 | 4 | 70 | 6 | 362 |
| HLRS | 2040-03-240 | 2 Flutes | | R0.3 | 24 | 4 | 70 | 6 | 330 |
| HLRS | 4040-03-240 | 4 Flutes | | R0.3 | 24 | 3.2 | 70 | 6 | 354 |
| HLRS | 2040-03-320 | 2 Flutes | | R0.3 | 32 | 4 | 80 | 6 | 330 |
| HLRS | 4040-03-320 | 4 Flutes | | R0.3 | 32 | 3.2 | 80 | 6 | 354 |
| HLRS | 2040-03-480 | 2 Flutes | | R0.3 | 48 | 4 | 100 | 6 | 330 |
| HLRS | 4040-03-480 | 4 Flutes | | R0.3 | 48 | 3.2 | 100 | 6 | 354 |
| CXERS | 4040-04-100 | | | R0.4 | — | 10 | 60 | 6 | 299 |
| CRS20HSP | 4040-040-09 | | | R0.4 | 9 | 5 | 50 | 6 | 570 |
| C-CRS | 2040-05 | 2 Flutes | | R0.5 | — | 12 | 45 | 6 | 291 |
| HMERS | 4040-05-100 | 4 Flutes | | R0.5 | — | 10 | 60 | 6 | 312 |
| CXERS | 4040-05-100 | | | R0.5 | — | 10 | 60 | 6 | 299 |
| CXRS | 5040-05-0800 | 5 Flutes | | R0.5 | — | 8 | 60 | 6 | 309 |
| CXRS | 5040-05-1200 | | | R0.5 | — | 12 | 60 | 6 | 309 |
| HLRS | 2040-05-080 | 2 Flutes | | R0.5 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 2040-05-080E | | | R0.5 | 8 | 4 | 65 | 6 | 330 |
| HLRS | 4040-05-080 | 4 Flutes | | R0.5 | 8 | 3.2 | 65 | 6 | 354 |
| CRS40HSP | 3040-050-09 | 3 Flutes | | R0.5 | 9 | 5 | 50 | 6 | 568 |
| HLRS | 2040-05-120 | 2 Flutes | | R0.5 | 12 | 4 | 65 | 6 | 330 |
| HRRS | 4040-05-12S | 4 Flutes | | R0.5 | 12 | 4 | 50 | 4 | 368 |
| HRRS | 4040-05-12-6S | | | R0.5 | 12 | 4 | 50 | 6 | 368 |
| CRRS | 4040-05-12 | | | R0.5 | 12 | 4 | 60 | 6 | 370 |
| HLRS | 4040-05-120 | | | R0.5 | 12 | 3.2 | 65 | 6 | 354 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HRRS | 4040-05-12 | 4 Flutes | 4 | R0.5 | 12 | 4 | 70 | 4 | 362 |
| CRRS | 4040-05-12-4 | | | R0.5 | 12 | 4 | 70 | 4 | 370 |
| HRRS | 4040-05-12-6 | | | R0.5 | 12 | 4 | 70 | 6 | 362 |
| CXLRS | 5040-05-12 | 5 Flutes | | R0.5 | 12 | 8 | 60 | 6 | 381 |
| HLRS | 2040-05-160 | 2 Flutes | | R0.5 | 16 | 4 | 65 | 6 | 330 |
| HLRS | 4040-05-160 | 4 Flutes | | R0.5 | 16 | 3.2 | 65 | 6 | 354 |
| CXLRS | 5040-05-16 | 5 Flutes | | R0.5 | 16 | 8 | 60 | 6 | 381 |
| HLRS | 2040-05-200 | 2 Flutes | | R0.5 | 20 | 4 | 65 | 6 | 330 |
| HLRS | 2040-05-200E | | | R0.5 | 20 | 4 | 65 | 6 | 330 |
| DCLRS | 4040-05-200 | 4 Flutes | | R0.5 | 20 | 8 | 60 | 6 | 377 |
| HLRS | 4040-05-200 | | | R0.5 | 20 | 3.2 | 70 | 6 | 354 |
| HRRS | 4040-05-20-6 | | | R0.5 | 20 | 4 | 70 | 6 | 362 |
| HLRS | 2040-05-240 | 2 Flutes | | R0.5 | 24 | 4 | 70 | 6 | 330 |
| HLRS | 4040-05-240 | 4 Flutes | | R0.5 | 24 | 3.2 | 70 | 6 | 354 |
| DCLRS | 4040-05-300 | | | R0.5 | 30 | 8 | 80 | 6 | 377 |
| HLRS | 2040-05-320 | 2 Flutes | | R0.5 | 32 | 4 | 80 | 6 | 330 |
| HLRS | 4040-05-320 | 4 Flutes | | R0.5 | 32 | 3.2 | 80 | 6 | 354 |
| DCLRS | 4040-05-400 | | | R0.5 | 40 | 8 | 80 | 6 | 377 |
| HLRS | 4040-05-400 | | | R0.5 | 40 | 3.2 | 100 | 6 | 354 |
| HLRS | 2040-05-480 | 2 Flutes | | R0.5 | 48 | 4 | 100 | 6 | 330 |
| HLRS | 4040-05-480 | 4 Flutes | | R0.5 | 48 | 3.2 | 100 | 6 | 354 |
| C-CRS | 2040-10 | 2 Flutes | | R1 | — | 12 | 45 | 6 | 291 |
| HMERS | 4040-10-100 | 4 Flutes | | R1 | — | 10 | 60 | 6 | 312 |
| CXERS | 4040-10-100 | | | R1 | — | 10 | 60 | 6 | 299 |
| CXRS | 5040-10-0800 | 5 Flutes | | R1 | — | 8 | 60 | 6 | 309 |
| CXRS | 5040-10-1200 | | | R1 | — | 12 | 60 | 6 | 309 |
| HLRS | 2040-10-080 | 2 Flutes | | R1 | 8 | 4 | 65 | 6 | 332 |
| HLRS | 2040-10-080E | | | R1 | 8 | 4 | 65 | 6 | 332 |
| HLRS | 4040-10-080 | 4 Flutes | | R1 | 8 | 3.2 | 65 | 6 | 354 |
| HLRS | 2040-10-120 | 2 Flutes | | R1 | 12 | 4 | 65 | 6 | 332 |
| HRRS | 4040-10-12S | 4 Flutes | | R1 | 12 | 4 | 50 | 4 | 368 |
| HRRS | 4040-10-12-6S | | | R1 | 12 | 4 | 50 | 6 | 368 |
| HLRS | 4040-10-120 | | | R1 | 12 | 3.2 | 65 | 6 | 354 |
| HRRS | 4040-10-12 | | | R1 | 12 | 4 | 70 | 4 | 362 |
| CRRS | 4040-10-12-4 | | | R1 | 12 | 4 | 70 | 4 | 370 |
| HRRS | 4040-10-12-6 | | | R1 | 12 | 4 | 70 | 6 | 362 |
| CRRS | 4040-10-12 | | | R1 | 12 | 4 | 70 | 6 | 370 |
| CXLRS | 5040-10-12 | 5 Flutes | | R1 | 12 | 8 | 60 | 6 | 381 |
| HLRS | 2040-10-160 | 2 Flutes | | R1 | 16 | 4 | 65 | 6 | 332 |
| HLRS | 4040-10-160 | 4 Flutes | | R1 | 16 | 3.2 | 65 | 6 | 354 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CXLRS | 5040-10-16 | 5 Flutes | 4 | R1 | 16 | 8 | 60 | 6 | 381 |
| HLRS | 2040-10-200 | 2 Flutes | 4 | R1 | 20 | 4 | 65 | 6 | 332 |
| HLRS | 2040-10-200E | 2 Flutes | 4 | R1 | 20 | 4 | 65 | 6 | 332 |
| HLRS | 4040-10-200 | 4 Flutes | 4 | R1 | 20 | 3.2 | 70 | 6 | 354 |
| HRRS | 4040-10-20-6 | 4 Flutes | 4 | R1 | 20 | 4 | 70 | 6 | 362 |
| HLRS | 2040-10-240 | 2 Flutes | 4 | R1 | 24 | 4 | 70 | 6 | 332 |
| HLRS | 4040-10-240 | 4 Flutes | 4 | R1 | 24 | 3.2 | 70 | 6 | 354 |
| HLRS | 2040-10-320 | 2 Flutes | 4 | R1 | 32 | 4 | 80 | 6 | 332 |
| HLRS | 4040-10-320 | 4 Flutes | 4 | R1 | 32 | 3.2 | 80 | 6 | 354 |
| HLRS | 2040-10-480 | 2 Flutes | 4 | R1 | 48 | 4 | 100 | 6 | 332 |
| HLRS | 4040-10-480 | 4 Flutes | 4 | R1 | 48 | 3.2 | 100 | 6 | 354 |
| HLRS | 4050-005-160 | 4 Flutes | 5 | R0.05 | 16 | 4 | 65 | 6 | 354 |
| HLRS | 4050-005-200 | 4 Flutes | 5 | R0.05 | 20 | 4 | 70 | 6 | 354 |
| HLRS | 4050-005-400 | 4 Flutes | 5 | R0.05 | 40 | 4 | 100 | 6 | 354 |
| HMERS | 4050-01-125 | 4 Flutes | 5 | R0.1 | — | 12.5 | 60 | 6 | 312 |
| CPRS25NSP | 2050-010-14 | 2 Flutes | 5 | R0.1 | 14 | 8 | 50 | 6 | 564 |
| HLRS | 4050-01-160 | 4 Flutes | 5 | R0.1 | 16 | 4 | 65 | 6 | 354 |
| HLRS | 4050-01-200 | 4 Flutes | 5 | R0.1 | 20 | 4 | 70 | 6 | 354 |
| HLRS | 4050-01-400 | 4 Flutes | 5 | R0.1 | 40 | 4 | 100 | 6 | 354 |
| C-CRS | 2050-02 | 2 Flutes | 5 | R0.2 | — | 15 | 50 | 6 | 291 |
| HMERS | 4050-02-125 | 4 Flutes | 5 | R0.2 | — | 12.5 | 60 | 6 | 312 |
| CXERS | 4050-02-125 | 4 Flutes | 5 | R0.2 | — | 12.5 | 60 | 6 | 299 |
| CRS40HSP | 3050-020-11 | 3 Flutes | 5 | R0.2 | 11 | 6 | 50 | 6 | 568 |
| HLRS | 4050-02-160 | 4 Flutes | 5 | R0.2 | 16 | 4 | 65 | 6 | 354 |
| HLRS | 2050-02-200 | 2 Flutes | 5 | R0.2 | 20 | 5 | 70 | 6 | 332 |
| HLRS | 4050-02-200 | 4 Flutes | 5 | R0.2 | 20 | 4 | 70 | 6 | 354 |
| CRS40HSP | 3050-020-22 | 3 Flutes | 5 | R0.2 | 22 | 6 | 65 | 6 | 568 |
| HLRS | 2050-02-400 | 2 Flutes | 5 | R0.2 | 40 | 5 | 90 | 6 | 332 |
| HLRS | 4050-02-400 | 4 Flutes | 5 | R0.2 | 40 | 4 | 100 | 6 | 354 |
| C-CRS | 2050-03 | 2 Flutes | 5 | R0.3 | — | 15 | 50 | 6 | 291 |
| HMERS | 4050-03-125 | 4 Flutes | 5 | R0.3 | — | 12.5 | 60 | 6 | 312 |
| CXERS | 4050-03-125 | 4 Flutes | 5 | R0.3 | — | 12.5 | 60 | 6 | 299 |
| HLRS | 4050-03-160 | 4 Flutes | 5 | R0.3 | 16 | 4 | 65 | 6 | 354 |
| HLRS | 2050-03-200 | 2 Flutes | 5 | R0.3 | 20 | 5 | 70 | 6 | 332 |
| HLRS | 4050-03-200 | 4 Flutes | 5 | R0.3 | 20 | 4 | 70 | 6 | 354 |
| HLRS | 2050-03-400 | 2 Flutes | 5 | R0.3 | 40 | 5 | 90 | 6 | 332 |
| HLRS | 4050-03-400 | 4 Flutes | 5 | R0.3 | 40 | 4 | 100 | 6 | 354 |
| CXERS | 4050-04-125 | 4 Flutes | 5 | R0.4 | — | 12.5 | 60 | 6 | 299 |
| C-CRS | 2050-05 | 2 Flutes | 5 | R0.5 | — | 15 | 50 | 6 | 291 |
| HMERS | 4050-05-125 | 4 Flutes | 5 | R0.5 | — | 12.5 | 60 | 6 | 312 |
| CXERS | 4050-05-125 | 4 Flutes | 5 | R0.5 | — | 12.5 | 60 | 6 | 299 |
| CRS20HSP | 4050-050-12 | 4 Flutes | 5 | R0.5 | 12 | 6 | 50 | 6 | 570 |
| HLRS | 4050-05-160 | 4 Flutes | 5 | R0.5 | 16 | 4 | 65 | 6 | 354 |
| HLRS | 2050-05-200 | 2 Flutes | 5 | R0.5 | 20 | 5 | 70 | 6 | 332 |
| HLRS | 4050-05-200 | 4 Flutes | 5 | R0.5 | 20 | 4 | 70 | 6 | 354 |
| HLRS | 2050-05-400 | 2 Flutes | 5 | R0.5 | 40 | 5 | 90 | 6 | 332 |
| HLRS | 4050-05-400 | 4 Flutes | 5 | R0.5 | 40 | 4 | 100 | 6 | 354 |
| C-CRS | 2050-10 | 2 Flutes | 5 | R1 | — | 15 | 50 | 6 | 291 |
| HMERS | 4050-10-125 | 4 Flutes | 5 | R1 | — | 12.5 | 60 | 6 | 312 |
| CXERS | 4050-10-125 | 4 Flutes | 5 | R1 | — | 12.5 | 60 | 6 | 299 |
| HLRS | 4050-10-160 | 4 Flutes | 5 | R1 | 16 | 4 | 65 | 6 | 354 |
| HLRS | 2050-10-200 | 2 Flutes | 5 | R1 | 20 | 5 | 70 | 6 | 332 |
| HLRS | 4050-10-200 | 4 Flutes | 5 | R1 | 20 | 4 | 70 | 6 | 354 |
| HLRS | 2050-10-400 | 2 Flutes | 5 | R1 | 40 | 5 | 90 | 6 | 332 |
| HLRS | 4050-10-400 | 4 Flutes | 5 | R1 | 40 | 4 | 100 | 6 | 354 |
| HRRS | 4050-12-15S | 4 Flutes | 5 | R1.2 | 15 | 5 | 50 | 6 | 368 |
| HRRS | 4050-12-15 | 4 Flutes | 5 | R1.2 | 15 | 5 | 70 | 6 | 363 |
| CRRS | 4050-12-15 | 4 Flutes | 5 | R1.2 | 15 | 5 | 70 | 6 | 370 |
| HLRS | 4060-005-120 | 4 Flutes | 6 | R0.05 | 12 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-005-160 | 4 Flutes | 6 | R0.05 | 16 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-005-200 | 4 Flutes | 6 | R0.05 | 20 | 4.8 | 70 | 6 | 356 |
| HLRS | 4060-005-240 | 4 Flutes | 6 | R0.05 | 24 | 4.8 | 70 | 6 | 356 |
| HLRS | 4060-005-300 | 4 Flutes | 6 | R0.05 | 30 | 4.8 | 100 | 6 | 356 |
| HLRS | 4060-005-480 | 4 Flutes | 6 | R0.05 | 48 | 4.8 | 120 | 6 | 356 |
| CPRS25NSP | 2060-010 | 2 Flutes | 6 | R0.1 | — | 13 | 50 | 6 | 564 |
| HMERS | 6060-01-130 | 6 Flutes | 6 | R0.1 | — | 13 | 60 | 6 | 313 |
| HLRS | 2060-01-120 | 2 Flutes | 6 | R0.1 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 2060-01-120E | 2 Flutes | 6 | R0.1 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 4060-01-120 | 4 Flutes | 6 | R0.1 | 12 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-01-160 | 4 Flutes | 6 | R0.1 | 16 | 4.8 | 65 | 6 | 356 |
| CPRS25NSP | 2060-010-18 | 2 Flutes | 6 | R0.1 | 18 | 8 | 65 | 6 | 564 |
| HLRS | 4060-01-180 | 4 Flutes | 6 | R0.1 | 18 | 4.8 | 70 | 6 | 356 |
| HLRS | 2060-01-200 | 2 Flutes | 6 | R0.1 | 20 | 6 | 70 | 6 | 332 |
| HLRS | 4060-01-200 | 4 Flutes | 6 | R0.1 | 20 | 4.8 | 70 | 6 | 356 |
| HHRS | 6060-01-210 | 6 Flutes | 6 | R0.1 | 21 | 6 | 60 | 6 | 384 |
| HLRS | 4060-01-240 | 4 Flutes | 6 | R0.1 | 24 | 4.8 | 70 | 6 | 356 |
| HLRS | 2060-01-300 | 2 Flutes | 6 | R0.1 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 2060-01-300E | 2 Flutes | 6 | R0.1 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 4060-01-300 | 4 Flutes | 6 | R0.1 | 30 | 4.8 | 100 | 6 | 356 |
| HLRS | 4060-01-480 | 4 Flutes | 6 | R0.1 | 48 | 4.8 | 120 | 6 | 356 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HLRS | 2060-01-600 | 2 Flutes | 6 | R0.1 | 60 | 6 | 120 | 6 | 332 |
| C-CRS | 2060-02 | | | R0.2 | — | 15 | 50 | 6 | 291 |
| CXERS | 4060-02-150 | 4 Flutes | | R0.2 | — | 15 | 60 | 6 | 299 |
| HMERS | 6060-02-130 | 6 Flutes | | R0.2 | — | 13 | 60 | 6 | 313 |
| HLRS | 2060-02-120 | 2 Flutes | | R0.2 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 2060-02-120E | | | R0.2 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 4060-02-120 | 4 Flutes | | R0.2 | 12 | 4.8 | 65 | 6 | 356 |
| CRS40HSP | 3060-020-14 | 3 Flutes | | R0.2 | 14 | 7 | 60 | 6 | 568 |
| HLRS | 4060-02-160 | 4 Flutes | | R0.2 | 16 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-02-180 | | | R0.2 | 18 | 4.8 | 70 | 6 | 356 |
| HLRS | 2060-02-200 | 2 Flutes | | R0.2 | 20 | 6 | 70 | 6 | 332 |
| HLRS | 4060-02-200 | 4 Flutes | | R0.2 | 20 | 4.8 | 70 | 6 | 356 |
| HHRS | 6060-02-210 | 6 Flutes | | R0.2 | 21 | 6 | 60 | 6 | 384 |
| HLRS | 4060-02-240 | 4 Flutes | | R0.2 | 24 | 4.8 | 70 | 6 | 356 |
| HLRS | 2060-02-300 | 2 Flutes | | R0.2 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 2060-02-300E | | | R0.2 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 4060-02-300 | 4 Flutes | | R0.2 | 30 | 4.8 | 100 | 6 | 356 |
| DCLRS | 4060-02-300 | | | R0.2 | 30 | 12 | 100 | 6 | 377 |
| HLRS | 4060-02-480 | | | R0.2 | 48 | 4.8 | 120 | 6 | 356 |
| HLRS | 2060-02-600 | 2 Flutes | | R0.2 | 60 | 6 | 120 | 6 | 332 |
| DCLRS | 4060-02-600 | 4 Flutes | | R0.2 | 60 | 12 | 120 | 6 | 377 |
| CPRS30N | 2060-025-20 | 2 Flutes | | R0.25 | 20 | 8 | 60 | 6 | 566 |
| C-CRS | 2060-03 | | | R0.3 | — | 15 | 50 | 6 | 291 |
| CXERS | 4060-03-150 | 4 Flutes | | R0.3 | — | 15 | 60 | 6 | 299 |
| HMERS | 6060-03-130 | 6 Flutes | | R0.3 | — | 13 | 60 | 6 | 313 |
| HLRS | 2060-03-120 | 2 Flutes | | R0.3 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 2060-03-120E | | | R0.3 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 4060-03-120 | 4 Flutes | | R0.3 | 12 | 4.8 | 65 | 6 | 356 |
| CRS40HSP | 3060-030-14 | 3 Flutes | | R0.3 | 14 | 7 | 60 | 6 | 568 |
| HLRS | 4060-03-160 | 4 Flutes | | R0.3 | 16 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-03-180 | | | R0.3 | 18 | 4.8 | 70 | 6 | 356 |
| HRRS | 4060-03-18 | | | R0.3 | 18 | 6 | 90 | 6 | 363 |
| CRRS | 4060-03-18 | | | R0.3 | 18 | 6 | 90 | 6 | 370 |
| HLRS | 2060-03-200 | 2 Flutes | | R0.3 | 20 | 6 | 70 | 6 | 332 |
| HLRS | 4060-03-200 | 4 Flutes | | R0.3 | 20 | 4.8 | 70 | 6 | 356 |
| HHRS | 6060-03-210 | 6 Flutes | | R0.3 | 21 | 6 | 60 | 6 | 384 |
| HLRS | 4060-03-240 | 4 Flutes | | R0.3 | 24 | 4.8 | 70 | 6 | 356 |
| CRS40HSP | 3060-030-26 | 3 Flutes | | R0.3 | 26 | 7 | 80 | 6 | 568 |
| HLRS | 2060-03-300 | 2 Flutes | | R0.3 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 2060-03-300E | | | R0.3 | 30 | 6 | 100 | 6 | 332 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HRRS | 4060-03-30 | 4 Flutes | 6 | R0.3 | 30 | 6 | 90 | 6 | 363 |
| HLRS | 4060-03-300 | | | R0.3 | 30 | 4.8 | 100 | 6 | 356 |
| HLRS | 4060-03-480 | | | R0.3 | 48 | 4.8 | 120 | 6 | 356 |
| HLRS | 2060-03-600 | 2 Flutes | | R0.3 | 60 | 6 | 120 | 6 | 332 |
| CXERS | 4060-04-150 | 4 Flutes | | R0.4 | — | 15 | 60 | 6 | 299 |
| C-CRS | 2060-05 | 2 Flutes | | R0.5 | — | 15 | 50 | 6 | 291 |
| CXERS | 4060-05-150 | 4 Flutes | | R0.5 | — | 15 | 60 | 6 | 299 |
| CNRS | 4060-05-16 | | | R0.5 | — | 16 | 90 | 6 | 294 |
| CXRS | 5060-05-1200 | 5 Flutes | | R0.5 | — | 12 | 70 | 6 | 309 |
| CXRS | 5060-05-1800 | | | R0.5 | — | 18 | 70 | 6 | 309 |
| HMERS | 6060-05-130 | 6 Flutes | | R0.5 | — | 13 | 60 | 6 | 313 |
| HLRS | 2060-05-120 | 2 Flutes | | R0.5 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 2060-05-120E | | | R0.5 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 4060-05-120 | 4 Flutes | | R0.5 | 12 | 4.8 | 65 | 6 | 356 |
| CRS40HSP | 3060-050-14 | 3 Flutes | | R0.5 | 14 | 7 | 60 | 6 | 568 |
| HLRS | 4060-05-160 | 4 Flutes | | R0.5 | 16 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-05-180 | | | R0.5 | 18 | 4.8 | 70 | 6 | 356 |
| HRRS | 4060-05-18S | | | R0.5 | 18 | 6 | 50 | 6 | 368 |
| CRRS | 4060-05-18 | | | R0.5 | 18 | 6 | 60 | 6 | 370 |
| HRRS | 4060-05-18 | | | R0.5 | 18 | 6 | 90 | 6 | 363 |
| CXLRS | 5060-05-18 | 5 Flutes | | R0.5 | 18 | 12 | 70 | 6 | 381 |
| CPRS30N | 2060-050-20 | 2 Flutes | | R0.5 | 20 | 8 | 60 | 6 | 566 |
| HLRS | 2060-05-200 | | | R0.5 | 20 | 6 | 70 | 6 | 332 |
| HLRS | 4060-05-200 | 4 Flutes | | R0.5 | 20 | 4.8 | 70 | 6 | 356 |
| HHRS | 6060-05-210 | 6 Flutes | | R0.5 | 21 | 6 | 60 | 6 | 384 |
| HLRS | 4060-05-240 | 4 Flutes | | R0.5 | 24 | 4.8 | 70 | 6 | 356 |
| CXLRS | 5060-05-24 | 5 Flutes | | R0.5 | 24 | 12 | 70 | 6 | 381 |
| HLRS | 2060-05-300 | 2 Flutes | | R0.5 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 2060-05-300E | | | R0.5 | 30 | 6 | 100 | 6 | 332 |
| HRRS | 4060-05-30 | 4 Flutes | | R0.5 | 30 | 6 | 90 | 6 | 363 |
| HLRS | 4060-05-300 | | | R0.5 | 30 | 4.8 | 100 | 6 | 356 |
| DCLRS | 4060-05-300 | | | R0.5 | 30 | 12 | 100 | 6 | 377 |
| HLRS | 4060-05-400 | | | R0.5 | 40 | 4.8 | 100 | 6 | 356 |
| HLRS | 4060-05-480 | | | R0.5 | 48 | 4.8 | 120 | 6 | 356 |
| HLRS | 2060-05-600 | 2 Flutes | | R0.5 | 60 | 6 | 120 | 6 | 332 |
| DCLRS | 4060-05-600 | 4 Flutes | | R0.5 | 60 | 12 | 120 | 6 | 377 |
| CRS20HSP | 4060-060-14 | | | R0.6 | 14 | 7 | 55 | 6 | 570 |
| C-CRS | 2060-10 | 2 Flutes | | R1 | — | 15 | 50 | 6 | 291 |
| CXERS | 4060-10-150 | 4 Flutes | | R1 | — | 15 | 60 | 6 | 299 |
| CNRS | 4060-10-16 | | | R1 | — | 16 | 90 | 6 | 294 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CXRS | 5060-10-1200 | 5 Flutes | 6 | R1 | — | 12 | 70 | 6 | 309 |
| CXRS | 5060-10-1800 | 5 Flutes | 6 | R1 | — | 18 | 70 | 6 | 309 |
| HMERS | 6060-10-130 | 6 Flutes | 6 | R1 | — | 13 | 60 | 6 | 313 |
| HLRS | 2060-10-120 | 2 Flutes | 6 | R1 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 2060-10-120E | 2 Flutes | 6 | R1 | 12 | 6 | 65 | 6 | 332 |
| HLRS | 4060-10-120 | 4 Flutes | 6 | R1 | 12 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-10-160 | 4 Flutes | 6 | R1 | 16 | 4.8 | 65 | 6 | 356 |
| HLRS | 4060-10-180 | 4 Flutes | 6 | R1 | 18 | 4.8 | 70 | 6 | 356 |
| HRRS | 4060-10-18S | 4 Flutes | 6 | R1 | 18 | 6 | 50 | 6 | 368 |
| CRRS | 4060-10-18 | 4 Flutes | 6 | R1 | 18 | 6 | 60 | 6 | 370 |
| HRRS | 4060-10-18 | 4 Flutes | 6 | R1 | 18 | 6 | 90 | 6 | 363 |
| CXLRS | 5060-10-18 | 5 Flutes | 6 | R1 | 18 | 12 | 70 | 6 | 381 |
| HLRS | 2060-10-200 | 2 Flutes | 6 | R1 | 20 | 6 | 70 | 6 | 332 |
| HLRS | 4060-10-200 | 4 Flutes | 6 | R1 | 20 | 4.8 | 70 | 6 | 356 |
| HHRS | 6060-10-210 | 6 Flutes | 6 | R1 | 21 | 6 | 60 | 6 | 384 |
| HLRS | 4060-10-240 | 4 Flutes | 6 | R1 | 24 | 4.8 | 70 | 6 | 356 |
| CXLRS | 5060-10-24 | 5 Flutes | 6 | R1 | 24 | 12 | 70 | 6 | 381 |
| HLRS | 2060-10-300 | 2 Flutes | 6 | R1 | 30 | 6 | 100 | 6 | 332 |
| HLRS | 2060-10-300E | 2 Flutes | 6 | R1 | 30 | 6 | 100 | 6 | 332 |
| HRRS | 4060-10-30 | 4 Flutes | 6 | R1 | 30 | 6 | 90 | 6 | 363 |
| HLRS | 4060-10-300 | 4 Flutes | 6 | R1 | 30 | 4.8 | 100 | 6 | 356 |
| HLRS | 4060-10-400 | 4 Flutes | 6 | R1 | 40 | 4.8 | 100 | 6 | 356 |
| HLRS | 4060-10-480 | 4 Flutes | 6 | R1 | 48 | 4.8 | 120 | 6 | 356 |
| HLRS | 2060-10-600 | 2 Flutes | 6 | R1 | 60 | 6 | 120 | 6 | 332 |
| CXERS | 4060-12-150 | 4 Flutes | 6 | R1.2 | — | 15 | 60 | 6 | 299 |
| C-CRS | 2060-15 | 2 Flutes | 6 | R1.5 | — | 15 | 50 | 6 | 291 |
| HMERS | 6060-15-130 | 6 Flutes | 6 | R1.5 | — | 13 | 60 | 6 | 313 |
| HRRS | 4060-15-18S | 4 Flutes | 6 | R1.5 | 18 | 6 | 50 | 6 | 368 |
| HRRS | 4060-15-18 | 4 Flutes | 6 | R1.5 | 18 | 6 | 90 | 6 | 363 |
| CRRS | 4060-15-18 | 4 Flutes | 6 | R1.5 | 18 | 6 | 90 | 6 | 370 |
| HRRS | 4060-15-30 | 4 Flutes | 6 | R1.5 | 30 | 6 | 90 | 6 | 363 |
| C-CRS | 2060-20 | 2 Flutes | 6 | R2 | — | 15 | 50 | 6 | 291 |
| HRRS | 4060-20-18S | 4 Flutes | 6 | R2 | 18 | 6 | 50 | 6 | 368 |
| HRRS | 4060-20-18 | 4 Flutes | 6 | R2 | 18 | 6 | 90 | 6 | 363 |
| CPRS25NSP | 2080-010 | 2 Flutes | 8 | R0.1 | — | 13 | 50 | 8 | 564 |
| CPRS25NSP | 2080-010-22 | 2 Flutes | 8 | R0.1 | 22 | 10 | 80 | 8 | 564 |
| CXERS | 4080-02-200 | 4 Flutes | 8 | R0.2 | — | 20 | 70 | 8 | 299 |
| HMERS | 6080-02-190 | 6 Flutes | 8 | R0.2 | — | 19 | 70 | 8 | 313 |
| CRS40HSP | 3080-020-18 | 3 Flutes | 8 | R0.2 | 18 | 9 | 60 | 8 | 569 |
| CXERS | 4080-03-200 | 4 Flutes | 8 | R0.3 | — | 20 | 70 | 8 | 299 |
| HMERS | 6080-03-190 | 6 Flutes | 8 | R0.3 | — | 19 | 70 | 8 | 313 |
| HRRS | 4080-03-24 | 4 Flutes | 8 | R0.3 | 24 | 8 | 100 | 8 | 363 |
| CRRS | 4080-03-24 | 4 Flutes | 8 | R0.3 | 24 | 8 | 100 | 8 | 370 |
| HHRS | 6080-03-260 | 6 Flutes | 8 | R0.3 | 26 | 8 | 80 | 8 | 384 |
| CPRS30N | 2080-030-30 | 2 Flutes | 8 | R0.3 | 30 | 10 | 80 | 8 | 566 |
| HRRS | 4080-03-40 | 4 Flutes | 8 | R0.3 | 40 | 8 | 100 | 8 | 363 |
| CXERS | 4080-04-200 | 4 Flutes | 8 | R0.4 | — | 20 | 70 | 8 | 299 |
| C-CRS | 2080-05 | 2 Flutes | 8 | R0.5 | — | 20 | 60 | 8 | 291 |
| CXERS | 4080-05-200 | 4 Flutes | 8 | R0.5 | — | 20 | 70 | 8 | 299 |
| CNRS | 4080-05-16 | 4 Flutes | 8 | R0.5 | — | 16 | 100 | 8 | 294 |
| CXRS | 5080-05-1600 | 5 Flutes | 8 | R0.5 | — | 16 | 70 | 8 | 309 |
| CXRS | 5080-05-2400 | 5 Flutes | 8 | R0.5 | — | 24 | 70 | 8 | 309 |
| HMERS | 6080-05-190 | 6 Flutes | 8 | R0.5 | — | 19 | 70 | 8 | 313 |
| CRS40HSP | 3080-050-18 | 3 Flutes | 8 | R0.5 | 18 | 9 | 60 | 8 | 569 |
| HRRS | 4080-05-24S | 4 Flutes | 8 | R0.5 | 24 | 8 | 60 | 8 | 368 |
| HRRS | 4080-05-24 | 4 Flutes | 8 | R0.5 | 24 | 8 | 100 | 8 | 363 |
| CXLRS | 5080-05-24 | 5 Flutes | 8 | R0.5 | 24 | 16 | 70 | 8 | 381 |
| CRRS | 4080-05-26 | 4 Flutes | 8 | R0.5 | 26 | 8 | 70 | 8 | 370 |
| HHRS | 6080-05-260 | 6 Flutes | 8 | R0.5 | 26 | 8 | 80 | 8 | 384 |
| CXLRS | 5080-05-32 | 5 Flutes | 8 | R0.5 | 32 | 16 | 70 | 8 | 381 |
| CRS40HSP | 3080-050-36 | 3 Flutes | 8 | R0.5 | 36 | 9 | 90 | 8 | 569 |
| HRRS | 4080-05-40 | 4 Flutes | 8 | R0.5 | 40 | 8 | 100 | 8 | 363 |
| CPRS30N | 2080-060-30 | 2 Flutes | 8 | R0.6 | 30 | 10 | 80 | 8 | 566 |
| CRS20HSP | 4080-080-18 | 4 Flutes | 8 | R0.8 | 18 | 10 | 60 | 8 | 570 |
| C-CRS | 2080-10 | 2 Flutes | 8 | R1 | — | 20 | 60 | 8 | 291 |
| CXERS | 4080-10-200 | 4 Flutes | 8 | R1 | — | 20 | 70 | 8 | 299 |
| CNRS | 4080-10-16 | 4 Flutes | 8 | R1 | — | 16 | 100 | 8 | 294 |
| CXRS | 5080-10-1600 | 5 Flutes | 8 | R1 | — | 16 | 70 | 8 | 309 |
| CXRS | 5080-10-2400 | 5 Flutes | 8 | R1 | — | 24 | 70 | 8 | 309 |
| HMERS | 6080-10-190 | 6 Flutes | 8 | R1 | — | 19 | 70 | 8 | 313 |
| HRRS | 4080-10-24S | 4 Flutes | 8 | R1 | 24 | 8 | 60 | 8 | 368 |
| HRRS | 4080-10-24 | 4 Flutes | 8 | R1 | 24 | 8 | 100 | 8 | 363 |
| CXLRS | 5080-10-24 | 5 Flutes | 8 | R1 | 24 | 16 | 70 | 8 | 381 |
| CRRS | 4080-10-26 | 4 Flutes | 8 | R1 | 26 | 8 | 70 | 8 | 370 |
| HHRS | 6080-10-260 | 6 Flutes | 8 | R1 | 26 | 8 | 80 | 8 | 384 |
| CXLRS | 5080-10-32 | 5 Flutes | 8 | R1 | 32 | 16 | 70 | 8 | 381 |
| HRRS | 4080-10-40 | 4 Flutes | 8 | R1 | 40 | 8 | 100 | 8 | 363 |
| CXERS | 4080-12-200 | 4 Flutes | 8 | R1.2 | — | 20 | 70 | 8 | 299 |
| C-CRS | 2080-15 | 2 Flutes | 8 | R1.5 | — | 20 | 60 | 8 | 291 |
| CXERS | 4080-15-200 | 4 Flutes | 8 | R1.5 | — | 20 | 70 | 8 | 299 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| C-CRS | 2080-20 | 2 Flutes | 8 | R2 | — | 20 | 60 | 8 | 291 |
| CXERS | 4080-20-200 | 4 Flutes | | R2 | — | 20 | 70 | 8 | 299 |
| HMERS | 6080-20-190 | 6 Flutes | | R2 | — | 19 | 70 | 8 | 313 |
| HRRS | 4080-20-24S | 4 Flutes | | R2 | 24 | 8 | 60 | 8 | 368 |
| HRRS | 4080-20-24 | | | R2 | 24 | 8 | 100 | 8 | 363 |
| CRRS | 4080-20-24 | | | R2 | 24 | 8 | 100 | 8 | 370 |
| HRRS | 4080-20-40 | | | R2 | 40 | 8 | 100 | 8 | 363 |
| C-CRS | 2080-25 | 2 Flutes | | R2.5 | — | 20 | 60 | 8 | 291 |
| HRRS | 4080-30-24S | 4 Flutes | | R3 | 24 | 8 | 60 | 8 | 368 |
| HRRS | 4080-30-24 | | | R3 | 24 | 8 | 100 | 8 | 363 |
| CPRS25HSP | 2100-010-28 | 2 Flutes | 10 | R0.1 | 28 | 14 | 80 | 10 | 564 |
| CXERS | 4100-02-250 | 4 Flutes | | R0.2 | — | 25 | 80 | 10 | 299 |
| HMERS | 6100-02-220 | 6 Flutes | | R0.2 | — | 22 | 80 | 10 | 313 |
| CRS40HSP | 3100-020-25 | 3 Flutes | | R0.2 | 25 | 12 | 70 | 10 | 569 |
| CXERS | 4100-03-250 | 4 Flutes | | R0.3 | — | 25 | 80 | 10 | 299 |
| HMERS | 6100-03-220 | 6 Flutes | | R0.3 | — | 22 | 80 | 10 | 313 |
| HRRS | 4100-03-30S | 4 Flutes | | R0.3 | 30 | 10 | 65 | 10 | 368 |
| HRRS | 4100-03-30 | | | R0.3 | 30 | 10 | 110 | 10 | 363 |
| CRRS | 4100-03-30 | | | R0.3 | 30 | 10 | 110 | 10 | 370 |
| HHRS | 6100-03-310 | 6 Flutes | | R0.3 | 31 | 10 | 80 | 10 | 384 |
| CPRS30N | 2100-030-36 | 2 Flutes | | R0.3 | 36 | 12 | 80 | 10 | 566 |
| HRRS | 4100-03-50 | 4 Flutes | | R0.3 | 50 | 10 | 110 | 10 | 363 |
| CXERS | 4100-04-250 | | | R0.4 | — | 25 | 80 | 10 | 299 |
| C-CRS | 2100-05 | 2 Flutes | | R0.5 | — | 25 | 70 | 10 | 291 |
| CXERS | 4100-05-250 | 4 Flutes | | R0.5 | — | 25 | 80 | 10 | 299 |
| CNRS | 4100-05-26 | | | R0.5 | — | 26 | 110 | 10 | 294 |
| CXRS | 5100-05-2000 | 5 Flutes | | R0.5 | — | 20 | 80 | 10 | 309 |
| CXRS | 5100-05-3000 | | | R0.5 | — | 30 | 80 | 10 | 309 |
| HMERS | 6100-05-220 | 6 Flutes | | R0.5 | — | 22 | 80 | 10 | 313 |
| CRS40HSP | 3100-050-25 | 3 Flutes | | R0.5 | 25 | 12 | 70 | 10 | 569 |
| HRRS | 4100-05-30S | 4 Flutes | | R0.5 | 30 | 10 | 65 | 10 | 368 |
| CRRS | 4100-05-30 | | | R0.5 | 30 | 10 | 80 | 10 | 370 |
| HRRS | 4100-05-30 | | | R0.5 | 30 | 10 | 110 | 10 | 363 |
| CXLRS | 5100-05-30 | 5 Flutes | | R0.5 | 30 | 20 | 80 | 10 | 381 |
| HHRS | 6100-05-310 | 6 Flutes | | R0.5 | 31 | 10 | 80 | 10 | 384 |
| CXLRS | 5100-05-40 | 5 Flutes | | R0.5 | 40 | 20 | 80 | 10 | 381 |
| CRS40HSP | 3100-050-45 | 3 Flutes | | R0.5 | 45 | 12 | 100 | 10 | 569 |
| HRRS | 4100-05-50 | 4 Flutes | | R0.5 | 50 | 10 | 110 | 10 | 363 |
| CPRS30N | 2100-080-36 | 2 Flutes | | R0.8 | 36 | 12 | 80 | 10 | 566 |
| C-CRS | 2100-10 | | | R1 | — | 25 | 70 | 10 | 291 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CXERS | 4100-10-250 | 4 Flutes | 10 | R1 | — | 25 | 80 | 10 | 299 |
| CNRS | 4100-10-26 | | | R1 | — | 26 | 110 | 10 | 294 |
| CXRS | 5100-10-2000 | 5 Flutes | | R1 | — | 20 | 80 | 10 | 309 |
| CXRS | 5100-10-3000 | | | R1 | — | 30 | 80 | 10 | 309 |
| HMERS | 6100-10-220 | 6 Flutes | | R1 | — | 22 | 80 | 10 | 313 |
| CRS20HSP | 4100-100-25 | 4 Flutes | | R1 | 25 | 12 | 70 | 10 | 570 |
| HRRS | 4100-10-30S | | | R1 | 30 | 10 | 65 | 10 | 368 |
| CRRS | 4100-10-30 | | | R1 | 30 | 10 | 80 | 10 | 370 |
| HRRS | 4100-10-30 | | | R1 | 30 | 10 | 110 | 10 | 363 |
| CXLRS | 5100-10-30 | 5 Flutes | | R1 | 30 | 20 | 80 | 10 | 381 |
| HHRS | 6100-10-310 | 6 Flutes | | R1 | 31 | 10 | 80 | 10 | 384 |
| CXLRS | 5100-10-40 | 5 Flutes | | R1 | 40 | 20 | 80 | 10 | 381 |
| HRRS | 4100-10-50 | 4 Flutes | | R1 | 50 | 10 | 110 | 10 | 363 |
| CXERS | 4100-12-250 | | | R1.2 | — | 25 | 80 | 10 | 299 |
| C-CRS | 2100-15 | 2 Flutes | | R1.5 | — | 25 | 70 | 10 | 291 |
| CXERS | 4100-15-250 | 4 Flutes | | R1.5 | — | 25 | 80 | 10 | 299 |
| CNRS | 4100-15-26 | | | R1.5 | — | 26 | 110 | 10 | 294 |
| CXRS | 5100-15-2000 | 5 Flutes | | R1.5 | — | 20 | 80 | 10 | 309 |
| CXRS | 5100-15-3000 | | | R1.5 | — | 30 | 80 | 10 | 309 |
| HMERS | 6100-15-220 | 6 Flutes | | R1.5 | — | 22 | 80 | 10 | 313 |
| CXLRS | 5100-15-30 | 5 Flutes | | R1.5 | 30 | 20 | 80 | 10 | 381 |
| CXLRS | 5100-15-40 | | | R1.5 | 40 | 20 | 80 | 10 | 381 |
| C-CRS | 2100-20 | 2 Flutes | | R2 | — | 25 | 70 | 10 | 291 |
| CXERS | 4100-20-250 | 4 Flutes | | R2 | — | 25 | 80 | 10 | 299 |
| CNRS | 4100-20-26 | | | R2 | — | 26 | 110 | 10 | 294 |
| CXRS | 5100-20-2000 | 5 Flutes | | R2 | — | 20 | 80 | 10 | 309 |
| CXRS | 5100-20-3000 | | | R2 | — | 30 | 80 | 10 | 309 |
| HMERS | 6100-20-220 | 6 Flutes | | R2 | — | 22 | 80 | 10 | 313 |
| HRRS | 4100-20-30S | 4 Flutes | | R2 | 30 | 10 | 65 | 10 | 368 |
| HRRS | 4100-20-30 | | | R2 | 30 | 10 | 110 | 10 | 363 |
| CRRS | 4100-20-30 | | | R2 | 30 | 10 | 110 | 10 | 370 |
| CXLRS | 5100-20-30 | 5 Flutes | | R2 | 30 | 20 | 80 | 10 | 381 |
| CXLRS | 5100-20-40 | | | R2 | 40 | 20 | 80 | 10 | 381 |
| HRRS | 4100-20-50 | 4 Flutes | | R2 | 50 | 10 | 110 | 10 | 363 |
| C-CRS | 2100-25 | 2 Flutes | | R2.5 | — | 25 | 70 | 10 | 291 |
| C-CRS | 2100-30 | | | R3 | — | 25 | 70 | 10 | 291 |
| HRRS | 4100-30-30S | 4 Flutes | | R3 | 30 | 10 | 65 | 10 | 368 |
| HRRS | 4100-30-30 | | | R3 | 30 | 10 | 110 | 10 | 363 |
| CPRS25HSP | 2120-010-35 | 2 Flutes | 12 | R0.1 | 35 | 16 | 90 | 12 | 564 |
| CXERS | 4120-02-300 | 4 Flutes | | R0.2 | — | 30 | 100 | 12 | 299 |

# Simplified Table

## Radius

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| HMERS | 6120-02-260 | 6 Flutes | 12 | R0.2 | — | 26 | 100 | 12 | 313 |
| CXERS | 4120-03-300 | 4 Flutes | | R0.3 | — | 30 | 100 | 12 | 299 |
| HMERS | 6120-03-260 | 6 Flutes | | R0.3 | — | 26 | 100 | 12 | 313 |
| HRRS | 4120-03-36 | 4 Flutes | | R0.3 | 36 | 12 | 120 | 12 | 363 |
| CRRS | 4120-03-36 | | | R0.3 | 36 | 12 | 120 | 12 | 370 |
| HHRS | 6120-03-370 | 6 Flutes | | R0.3 | 37 | 12 | 100 | 12 | 384 |
| HRRS | 4120-03-60 | 4 Flutes | | R0.3 | 60 | 12 | 120 | 12 | 363 |
| CXERS | 4120-04-300 | | | R0.4 | — | 30 | 100 | 12 | 299 |
| C-CRS | 2120-05 | 2 Flutes | | R0.5 | — | 25 | 75 | 12 | 291 |
| CXERS | 4120-05-300 | 4 Flutes | | R0.5 | — | 30 | 100 | 12 | 299 |
| CNRS | 4120-05-26 | | | R0.5 | — | 26 | 120 | 12 | 294 |
| CXRS | 5120-05-2400 | 5 Flutes | | R0.5 | — | 24 | 80 | 12 | 309 |
| CXRS | 5120-05-3600 | | | R0.5 | — | 36 | 100 | 12 | 309 |
| HMERS | 6120-05-260 | 6 Flutes | | R0.5 | — | 26 | 100 | 12 | 313 |
| CRS40HSP | 3120-050-30 | 3 Flutes | | R0.5 | 30 | 15 | 75 | 12 | 569 |
| HRRS | 4120-05-36S | 4 Flutes | | R0.5 | 36 | 12 | 75 | 12 | 368 |
| HRRS | 4120-05-36 | | | R0.5 | 36 | 12 | 120 | 12 | 363 |
| CRRS | 4120-05-36 | | | R0.5 | 36 | 12 | 120 | 12 | 370 |
| CXLRS | 5120-05-36 | 5 Flutes | | R0.5 | 36 | 24 | 80 | 12 | 381 |
| HHRS | 6120-05-370 | 6 Flutes | | R0.5 | 37 | 12 | 100 | 12 | 384 |
| CXLRS | 5120-05-48 | 5 Flutes | | R0.5 | 48 | 24 | 100 | 12 | 381 |
| CRS40HSP | 3120-050-54 | 3 Flutes | | R0.5 | 54 | 15 | 120 | 12 | 569 |
| HRRS | 4120-05-60 | 4 Flutes | | R0.5 | 60 | 12 | 120 | 12 | 363 |
| C-CRS | 2120-10 | 2 Flutes | | R1 | — | 25 | 75 | 12 | 291 |
| CXERS | 4120-10-300 | 4 Flutes | | R1 | — | 30 | 100 | 12 | 299 |
| CNRS | 4120-10-26 | | | R1 | — | 26 | 120 | 12 | 294 |
| CXRS | 5120-10-2400 | 5 Flutes | | R1 | — | 24 | 80 | 12 | 309 |
| CXRS | 5120-10-3600 | | | R1 | — | 36 | 100 | 12 | 309 |
| HMERS | 6120-10-260 | 6 Flutes | | R1 | — | 26 | 100 | 12 | 313 |
| HRRS | 4120-10-36S | 4 Flutes | | R1 | 36 | 12 | 75 | 12 | 368 |
| HRRS | 4120-10-36 | | | R1 | 36 | 12 | 120 | 12 | 363 |
| CRRS | 4120-10-36 | | | R1 | 36 | 12 | 120 | 12 | 370 |
| CXLRS | 5120-10-36 | 5 Flutes | | R1 | 36 | 24 | 80 | 12 | 381 |
| HHRS | 6120-10-370 | 6 Flutes | | R1 | 37 | 12 | 100 | 12 | 384 |
| CXLRS | 5120-10-48 | 5 Flutes | | R1 | 48 | 24 | 100 | 12 | 381 |
| HRRS | 4120-10-60 | 4 Flutes | | R1 | 60 | 12 | 120 | 12 | 363 |
| CXERS | 4120-12-300 | | | R1.2 | — | 30 | 100 | 12 | 299 |
| CRS20HSP | 4120-120-30 | | | R1.2 | 30 | 15 | 75 | 12 | 570 |
| C-CRS | 2120-15 | 2 Flutes | | R1.5 | — | 25 | 75 | 12 | 291 |
| CXERS | 4120-15-300 | 4 Flutes | | R1.5 | — | 30 | 100 | 12 | 299 |

| Model Number | | Number of Flutes | Outside Diameter | Corner Radius | Effective Length | Lenght of Cut | Overall Length | Shank Diameter | Page |
|---|---|---|---|---|---|---|---|---|---|
| CNRS | 4120-15-26 | 4 Flutes | 12 | R1.5 | — | 26 | 120 | 12 | 294 |
| CXRS | 5120-15-2400 | 5 Flutes | | R1.5 | — | 24 | 80 | 12 | 309 |
| CXRS | 5120-15-3600 | | | R1.5 | — | 36 | 100 | 12 | 309 |
| HMERS | 6120-15-260 | 6 Flutes | | R1.5 | — | 26 | 100 | 12 | 313 |
| CXLRS | 5120-15-36 | 5 Flutes | | R1.5 | 36 | 24 | 80 | 12 | 381 |
| CXLRS | 5120-15-48 | | | R1.5 | 48 | 24 | 100 | 12 | 381 |
| C-CRS | 2120-20 | 2 Flutes | | R2 | — | 25 | 75 | 12 | 291 |
| CXERS | 4120-20-300 | 4 Flutes | | R2 | — | 30 | 100 | 12 | 299 |
| CNRS | 4120-20-26 | | | R2 | — | 26 | 120 | 12 | 294 |
| CXRS | 5120-20-2400 | 5 Flutes | | R2 | — | 24 | 80 | 12 | 309 |
| CXRS | 5120-20-3600 | | | R2 | — | 36 | 100 | 12 | 309 |
| HMERS | 6120-20-260 | 6 Flutes | | R2 | — | 26 | 100 | 12 | 313 |
| HRRS | 4120-20-36S | 4 Flutes | | R2 | 36 | 12 | 75 | 12 | 368 |
| HRRS | 4120-20-36 | | | R2 | 36 | 12 | 120 | 12 | 363 |
| CRRS | 4120-20-36 | | | R2 | 36 | 12 | 120 | 12 | 370 |
| CXLRS | 5120-20-36 | 5 Flutes | | R2 | 36 | 24 | 80 | 12 | 381 |
| CXLRS | 5120-20-48 | | | R2 | 48 | 24 | 100 | 12 | 381 |
| HRRS | 4120-20-60 | 4 Flutes | | R2 | 60 | 12 | 120 | 12 | 363 |
| C-CRS | 2120-25 | 2 Flutes | | R2.5 | — | 25 | 75 | 12 | 291 |
| C-CRS | 2120-30 | | | R3 | — | 25 | 75 | 12 | 291 |
| CXERS | 4120-30-300 | 4 Flutes | | R3 | — | 30 | 100 | 12 | 299 |
| HRRS | 4120-40-36S | | | R4 | 36 | 12 | 75 | 12 | 368 |
| HRRS | 4120-40-36 | | | R4 | 36 | 12 | 120 | 12 | 363 |

Size **R0.4～R1** UDC

# UDCBH

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Patent pending **NEW**

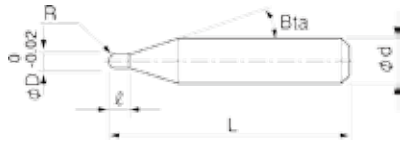
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ | | | ☆ | ◎ * |

＊ Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

## Features

**High efficiency and long life Ball End Mills for milling cemented carbide.**
**High-level treatment to reduce cutting resistance and mill at a high feed rate.**
**Wear resistance improved drastically with optimized Diamond coating.**
**Best for roughing and semi-finishing.**




Label Sample

#001 ϕD1.997 R+0.001/−0.001

Diameter and Ball R accuracy measurements are printed on the label to support High Precision milling.

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

Total 4 models

Unit（mm）

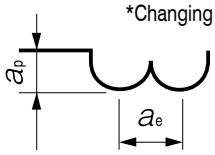
| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter ϕd | Price ¥ |
|---|---|---|---|---|---|---|
| **UDCBH 2008-0056** | R0.4 | 0.56 | 16° | 50 | 4 | 44,160 |
| **UDCBH 2010-0070** | R0.5 | 0.7 | 16° | 50 | 4 | 44,160 |
| **UDCBH 2015-0105** | R0.75 | 1.05 | 16° | 50 | 4 | 44,160 |
| **UDCBH 2020-0140** | R1 | 1.4 | 16° | 50 | 4 | 44,160 |

## Milling Conditions for UDCBH

| WORK MATERIAL | | | CEMENTED CARBIDE(≧87HRA) | | | | | CEMENTED CARBIDE(＜87HRA) | | | | | HARD BRITTLE MATERIALS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2008-0056** | **R0.4** | 0.56 | 30,000 | 750 | 250 | 0.04 | 0.19 | 30,000 | 1,250 | 420 | 0.19 | 0.04 | 30,000 | 250 | 25 | 0.04 | 0.19 |
| **2010-0070** | **R0.5** | 0.7 | 30,000 | 900 | 300 | 0.05 | 0.22 | 25,000 | 1,300 | 430 | 0.2 | 0.05 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2015-0105** | **R0.75** | 1.05 | 30,000 | 1,200 | 400 | 0.075 | 0.27 | 19,000 | 1,450 | 480 | 0.23 | 0.07 | 24,000 | 400 | 45 | 0.075 | 0.27 |
| **2020-0140** | **R1** | 1.4 | 30,000 | 1,500 | 500 | 0.1 | 0.3 | 16,500 | 1,600 | 530 | 0.25 | 0.1 | 18,000 | 600 | 200 | 0.1 | 0.3 |

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

※ Feed Rate2: Feed Rate of Approach and *Connection links.
*Changing from one engagement point to the next.




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.
- The tool life may shorten due to a large difference between the commanded feed speed and the actual machining speed caused by factors as machining model and machining machine.
- Decrease both feed rate and feed rate 2 proportionally.
- Tool damage may progress rapidly near the end of the tool life.

**Refer to page 583-587 for features and milling examples of UDC series.**

Size **R0.1～R3** UDC

# UDCBF

MG UDC 0° R ±0.01 Shank Dia 0/-0.005

Patented in Japan

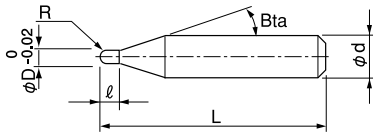
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ | | | ☆ | ◎ * |

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

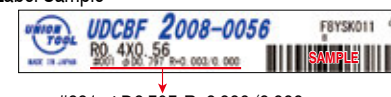
## Features

**Ball type End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials. Upgraded version of UDCB.**
**New Diamond coating and flute design increase material removal amount.**
**Chip pocket designed on tool tip improves the surface finishing quality.**
**Special cutting edge treatment helps to avoid the edge chipping & level gap. Recommended to use on semi-roughing & finishing process.**




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

Label Sample




#001 φD0.797 R+0.003/0.000

Diameter and Ball R accuracy measurements are printed on the label to support High Precision milling.

Total 16 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **UDCBF 2002-0014** | R0.1 | 0.14 | 16° | 50 | 4 | 47,000 |
| **UDCBF 2003-0021** | R0.15 | 0.21 | 16° | 50 | 4 | 47,000 |
| **UDCBF 2004-0028** | R0.2 | 0.28 | 16° | 50 | 4 | 42,800 |
| **UDCBF 2005-0035** | R0.25 | 0.35 | 16° | 50 | 4 | 42,800 |
| **UDCBF 2006-0042** | R0.3 | 0.42 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2007-0049** | R0.35 | 0.49 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2008-0056** | R0.4 | 0.56 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2009-0063** | R0.45 | 0.63 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2010-0070** | R0.5 | 0.7 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2012-0084** | R0.6 | 0.84 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2015-0105** | R0.75 | 1.05 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2020-0140** | R1 | 1.4 | 16° | 50 | 4 | 38,400 |
| **UDCBF 2030-0210** | R1.5 | 2.1 | 16° | 60 | 6 | 42,300 |
| **UDCBF 2040-0280** | R2 | 2.8 | 16° | 60 | 6 | 42,300 |
| **UDCBF 2050-0350** | R2.5 | 3.5 | 16° | 60 | 6 | 42,300 |
| **UDCBF 2060-0420** | R3 | 4.2 | — | 60 | 6 | 42,300 |

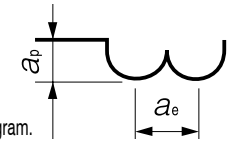
# Milling Conditions for UDCBF

| WORK MATERIAL | | | CEMENTED CARBIDE(≧87HRA) HARD BRITTLE MATERIALS | | | | | CEMENTED CARBIDE(<87HRA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2002-0014** | **R0.1** | 0.14 | 30,000 | 100 | 10 | 0.01 | 0.01 | 30,000 | 100 | 10 | 0.01 | 0.01 |
| **2003-0021** | **R0.15** | 0.21 | 30,000 | 125 | 13 | 0.015 | 0.03 | 30,000 | 125 | 13 | 0.015 | 0.03 |
| **2004-0028** | **R0.2** | 0.28 | 30,000 | 150 | 15 | 0.02 | 0.08 | 30,000 | 150 | 15 | 0.02 | 0.08 |
| **2005-0035** | **R0.25** | 0.35 | 30,000 | 175 | 18 | 0.025 | 0.11 | 30,000 | 175 | 18 | 0.025 | 0.11 |
| **2006-0042** | **R0.3** | 0.42 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 |
| **2007-0049** | **R0.35** | 0.49 | 30,000 | 225 | 23 | 0.035 | 0.17 | 30,000 | 225 | 23 | 0.035 | 0.17 |
| **2008-0056** | **R0.4** | 0.56 | 30,000 | 250 | 25 | 0.04 | 0.19 | 30,000 | 250 | 25 | 0.04 | 0.19 |
| **2009-0063** | **R0.45** | 0.63 | 30,000 | 275 | 28 | 0.045 | 0.22 | 30,000 | 275 | 28 | 0.045 | 0.22 |
| **2010-0070** | **R0.5** | 0.7 | 30,000 | 300 | 30 | 0.05 | 0.25 | 30,000 | 300 | 150 | 0.35 | 0.075 |
| **2012-0084** | **R0.6** | 0.84 | 27,500 | 275 | 36 | 0.06 | 0.26 | 25,000 | 250 | 125 | 0.42 | 0.09 |
| **2015-0105** | **R0.75** | 1.05 | 25,000 | 250 | 45 | 0.075 | 0.27 | 19,000 | 190 | 95 | 0.525 | 0.12 |
| **2020-0140** | **R1** | 1.4 | 20,000 | 200 | 60 | 0.1 | 0.3 | 12,500 | 125 | 60 | 0.7 | 0.15 |
| **2030-0210** | **R1.5** | 2.1 | 20,000 | 200 | 100 | 0.15 | 0.3 | 9,000 | 280 | 140 | 0.38 | 0.15 |
| **2040-0280** | **R2** | 2.8 | 18,000 | 180 | 90 | 0.175 | 0.32 | 7,200 | 280 | 140 | 0.5 | 0.2 |
| **2050-0350** | **R2.5** | 3.5 | 16,000 | 160 | 80 | 0.225 | 0.31 | 6,000 | 330 | 170 | 0.6 | 0.25 |
| **2060-0420** | **R3** | 4.2 | 15,000 | 150 | 75 | 0.3 | 0.3 | 5,500 | 280 | 140 | 0.65 | 0.28 |

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only. Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

※ Feed Rate2: Approach feed rate and contact time on the surface

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
・This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
・Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
・Tool setting length should achieve the least possible overhang.
・Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
・Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
・Use an inclined or helical approach (Recommended inclination angle: <5 degree).
・Decrease both spindle speed and feed rate proportionally.
・Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
・Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
・When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
・Remove chips to prevent heat generation and ignition during milling process.
・Protective gear, such as safety glasses and face guards are required when milling.
・Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

## Cemented Carbide Indexable Insert Mold UDCBF R0.5×Length of Cut 0.7 VM-40(90HRA)

| | Roughing | Finishing |
|---|---|---|
| Tool | UDCBF 2010-0070 | UDCBF 2010-0070 |
| Spindle Speed | 30,000 $min^{-1}$ | |
| Feed Rate | 300 mm/min | |
| Axial Depth $a_p$ | 0.05 mm | 0.028 mm |
| Radial Depth $a_e$ | 0.25 mm | 0.02 mm |
| Coolant | Air Blow (Nozzle) | |
| Cycle Time | 43 min | 2 h 17 min |
| Material Removal Amount | 86.3 $mm^3$ | 12.0 $mm^3$ |

One End Mill for both roughing and finishing processes.
Total 2 tools are used.

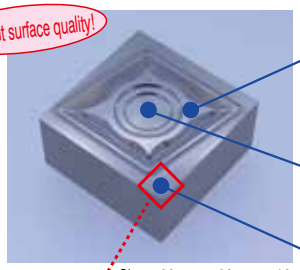
After roughing

After finishing

**Refer to page 583-587 for features and milling examples of UDC series.**

### Surface Roughness

Excellent surface quality!



Ra:0.051 μm
Rz:0.399 μm

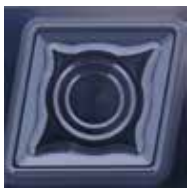
Ra:0.068 μm
Rz:0.520 μm

Ra:0.054 μm
Rz:0.408 μm

Size : 20 mm×20 mm×10 mm

No edge chipping!

### Work sample after finishing process



UDCBF Indexable Insert Mold Milling Video

Size **R0.1～R3** UDC

# UDCLBF

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Patented in Japan

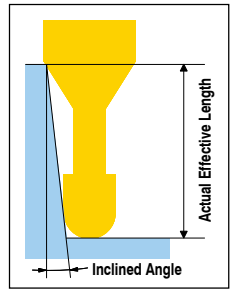
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

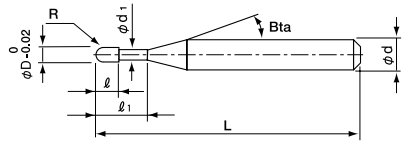
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ | | | ☆ | ◎ * |

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

## Features

**Long Neck Ball type End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials. Upgraded version of UDCLB.**
**New Diamond coating and flute design increase material removal amount.**
**Chip pocket designed on tool tip improves the surface finishing quality.**
**Special cutting edge treatment helps to avoid the edge chipping & level gap.**
**Recommended to use on semi-roughing & finishing process.**




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

Label Sample

#001 φD0.389 R0.000/−0.004

Diameter and Ball R accuracy measurements are printed on the label to support High Precision milling.

Total 61 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UDCLBF 2002-0030 | R0.1 | 0.3 | 0.14 | 0.18 | 16° | 50 | 4 | 47,500 | 0.30 | 0.31 | 0.32 | 0.32 | 0.34 |
| UDCLBF 2002-0050 | | 0.5 | | | | 50 | 4 | 47,500 | 0.51 | 0.52 | 0.54 | 0.55 | 0.59 |
| UDCLBF 2002-0075 | | 0.75 | | | | 50 | 4 | 47,500 | 0.77 | 0.79 | 0.81 | 0.84 | 0.89 |
| UDCLBF 2002-0100 | | 1 | | | | 50 | 4 | 47,500 | 1.02 | 1.05 | 1.09 | 1.12 | 1.20 |
| UDCLBF 2003-0050 | R0.15 | 0.5 | 0.21 | 0.28 | 16° | 50 | 4 | 47,500 | 0.51 | 0.52 | 0.53 | 0.55 | 0.58 |
| UDCLBF 2003-0075 | | 0.75 | | | | 50 | 4 | 47,500 | 0.76 | 0.78 | 0.81 | 0.83 | 0.88 |
| UDCLBF 2003-0100 | | 1 | | | | 50 | 4 | 47,500 | 1.02 | 1.05 | 1.08 | 1.11 | 1.19 |
| UDCLBF 2004-0050 | R0.2 | 0.5 | 0.28 | 0.36 | 16° | 50 | 4 | 43,300 | 0.54 | 0.55 | 0.56 | 0.58 | 0.61 |
| UDCLBF 2004-0100 | | 1 | | | | 50 | 4 | 43,300 | 1.06 | 1.08 | 1.12 | 1.15 | 1.22 |
| UDCLBF 2004-0150 | | 1.5 | | | | 50 | 4 | 43,300 | 1.57 | 1.62 | 1.67 | 1.72 | 1.83 |
| UDCLBF 2004-0200 | | 2 | | | | 50 | 4 | 43,300 | 2.09 | 2.15 | 2.22 | 2.29 | 2.44 |
| UDCLBF 2004-0250 | | 2.5 | | | | 50 | 4 | 43,300 | 2.60 | 2.68 | 2.77 | 2.86 | 3.06 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| UDCLBF 2006-0100 | R0.3 | 1 | 0.42 | 0.56 | 16° | 50 | 4 | 38,900 | 1.05 | 1.08 | 1.11 | 1.13 | 1.20 |
| UDCLBF 2006-0150 | | 1.5 | | | | 50 | 4 | 38,900 | 1.57 | 1.61 | 1.66 | 1.70 | 1.81 |
| UDCLBF 2006-0200 | | 2 | | | | 50 | 4 | 38,900 | 2.08 | 2.14 | 2.21 | 2.27 | 2.42 |
| UDCLBF 2006-0300 | | 3 | | | | 50 | 4 | 38,900 | 3.12 | 3.21 | 3.31 | 3.41 | 3.65 |
| UDCLBF 2006-0400 | | 4 | | | | 50 | 4 | 38,900 | 4.15 | 4.27 | 4.41 | 4.55 | 4.87 |
| UDCLBF 2006-0500 | | 5 | | | | 50 | 4 | 38,900 | 5.18 | 5.34 | 5.51 | 5.69 | 6.09 |
| UDCLBF 2006-0600 | | 6 | | | | 50 | 4 | 38,900 | 6.21 | 6.40 | 6.61 | 6.83 | 7.32 |
| UDCLBF 2008-0200 | R0.4 | 2 | 0.56 | 0.76 | 16° | 50 | 4 | 38,900 | 2.08 | 2.14 | 2.20 | 2.26 | 2.40 |
| UDCLBF 2008-0300 | | 3 | | | | 50 | 4 | 38,900 | 3.11 | 3.20 | 3.30 | 3.40 | 3.62 |
| UDCLBF 2008-0400 | | 4 | | | | 50 | 4 | 38,900 | 4.14 | 4.27 | 4.40 | 4.54 | 4.85 |
| UDCLBF 2008-0500 | | 5 | | | | 50 | 4 | 38,900 | 5.18 | 5.33 | 5.50 | 5.67 | 6.07 |
| UDCLBF 2008-0600 | | 6 | | | | 50 | 4 | 38,900 | 6.21 | 6.40 | 6.60 | 6.81 | 7.29 |
| UDCLBF 2008-0800 | | 8 | | | | 50 | 4 | 38,900 | 8.27 | 8.53 | 8.80 | 9.09 | 9.74 |
| UDCLBF 2010-0150 | R0.5 | 1.5 | 0.7 | 0.96 | 16° | 50 | 4 | 38,900 | 1.56 | 1.60 | 1.64 | 1.68 | 1.77 |
| UDCLBF 2010-0200 | | 2 | | | | 50 | 4 | 38,900 | 2.08 | 2.13 | 2.19 | 2.25 | 2.38 |
| UDCLBF 2010-0250 | | 2.5 | | | | 50 | 4 | 38,900 | 2.59 | 2.66 | 2.74 | 2.81 | 2.99 |
| UDCLBF 2010-0300 | | 3 | | | | 50 | 4 | 38,900 | 3.11 | 3.20 | 3.29 | 3.38 | 3.60 |
| UDCLBF 2010-0400 | | 4 | | | | 50 | 4 | 38,900 | 4.14 | 4.26 | 4.39 | 4.52 | 4.83 |
| UDCLBF 2010-0600 | | 6 | | | | 50 | 4 | 38,900 | 6.20 | 6.39 | 6.59 | 6.80 | 7.27 |
| UDCLBF 2010-0800 | | 8 | | | | 50 | 4 | 38,900 | 8.27 | 8.52 | 8.79 | 9.08 | 9.72 |
| UDCLBF 2010-1000 | | 10 | | | | 50 | 4 | 38,900 | 10.33 | 10.65 | 10.99 | 11.35 | 12.17 |
| UDCLBF 2015-0200 | R0.75 | 2 | 1.05 | 1.44 | 16° | 50 | 4 | 38,900 | 2.11 | 2.15 | 2.20 | 2.25 | 2.37 |
| UDCLBF 2015-0400 | | 4 | | | | 50 | 4 | 38,900 | 4.17 | 4.28 | 4.40 | 4.53 | 4.81 |
| UDCLBF 2015-0600 | | 6 | | | | 50 | 4 | 38,900 | 6.23 | 6.41 | 6.60 | 6.81 | 7.26 |
| UDCLBF 2015-0800 | | 8 | | | | 50 | 4 | 38,900 | 8.29 | 8.54 | 8.80 | 9.08 | 9.71 |
| UDCLBF 2015-1000 | | 10 | | | | 50 | 4 | 38,900 | 10.36 | 10.67 | 11.00 | 11.36 | 12.16 |
| UDCLBF 2015-1200 | | 12 | | | | 50 | 4 | 38,900 | 12.42 | 12.80 | 13.20 | 13.64 | 14.60 |
| UDCLBF 2020-0300 | R1 | 3 | 1.4 | 1.9 | 16° | 50 | 4 | 38,900 | 3.20 | 3.27 | 3.35 | 3.43 | 3.62 |
| UDCLBF 2020-0400 | | 4 | | | | 50 | 4 | 38,900 | 4.23 | 4.34 | 4.45 | 4.57 | 4.84 |
| UDCLBF 2020-0600 | | 6 | | | | 50 | 4 | 38,900 | 6.30 | 6.47 | 6.65 | 6.85 | 7.29 |
| UDCLBF 2020-0800 | | 8 | | | | 50 | 4 | 38,900 | 8.36 | 8.60 | 8.85 | 9.13 | 9.74 |
| UDCLBF 2020-1000 | | 10 | | | | 50 | 4 | 38,900 | 10.42 | 10.73 | 11.06 | 11.41 | 12.19 |
| UDCLBF 2020-1200 | | 12 | | | | 50 | 4 | 38,900 | 12.48 | 12.86 | 13.26 | 13.68 | 14.63 |
| UDCLBF 2020-1400 | | 14 | | | | 50 | 4 | 38,900 | 14.55 | 14.99 | 15.46 | 15.96 | 17.08 |
| UDCLBF 2020-1600 | | 16 | | | | 50 | 4 | 38,900 | 16.61 | 17.12 | 17.66 | 18.24 | 19.53 |
| UDCLBF 2020-1800 | | 18 | | | | 60 | 4 | 38,900 | 18.67 | 19.25 | 19.86 | 20.52 | No Interference |
| UDCLBF 2020-2000 | | 20 | | | | 60 | 4 | 38,900 | 20.74 | 21.38 | 22.06 | 22.79 | No Interference |
| UDCLBF 2030-0600 | R1.5 | 6 | 2.1 | 2.9 | 16° | 60 | 6 | 42,800 | 6.28 | 6.44 | 6.60 | 6.78 | 7.18 |
| UDCLBF 2030-0800 | | 8 | | | | 60 | 6 | 42,800 | 8.34 | 8.57 | 8.80 | 9.06 | 9.63 |
| UDCLBF 2030-1000 | | 10 | | | | 60 | 6 | 42,800 | 10.41 | 10.70 | 11.01 | 11.34 | 12.08 |
| UDCLBF 2030-1200 | | 12 | | | | 60 | 6 | 42,800 | 12.47 | 12.83 | 13.21 | 13.61 | 14.52 |
| UDCLBF 2030-1400 | | 14 | | | | 60 | 6 | 42,800 | 14.53 | 14.96 | 15.41 | 15.89 | 16.97 |
| UDCLBF 2040-0800 | R2 | 8 | 2.8 | 3.9 | 16° | 60 | 6 | 42,800 | 8.33 | 8.53 | 8.76 | 8.99 | 9.52 |
| UDCLBF 2040-1000 | | 10 | | | | 60 | 6 | 42,800 | 10.39 | 10.66 | 10.96 | 11.27 | 11.97 |
| UDCLBF 2040-1500 | | 15 | | | | 60 | 6 | 42,800 | 15.55 | 15.99 | 16.46 | 16.96 | 18.09 |
| UDCLBF 2050-1000 | R2.5 | 10 | 3.5 | 4.8 | 16° | 60 | 6 | 42,800 | 10.55 | 10.82 | 11.10 | 11.40 | 12.07 |
| UDCLBF 2050-1500 | | 15 | | | | 60 | 6 | 42,800 | 15.71 | 16.14 | 16.60 | 17.09 | No Interference |
| UDCLBF 2060-1000 | R3 | 10 | 4.2 | 5.7 | — | 60 | 6 | 42,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| UDCLBF 2060-1500 | | 15 | | | | 60 | 6 | 42,800 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for UDCLBF

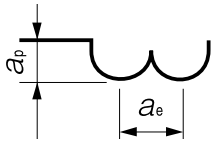
| WORK MATERIAL | | | CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS | | | | | CEMENTED CARBIDE(＜87HRA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2002-0030** | **R0.1** | 0.3 | 30,000 | 100 | 10 | 0.01 | 0.01 | 30,000 | 100 | 10 | 0.01 | 0.01 |
| **2002-0050** | | 0.5 | 30,000 | 30 | 10 | 0.005 | 0.008 | 30,000 | 30 | 10 | 0.005 | 0.008 |
| **2002-0075** | | 0.75 | 30,000 | 30 | 10 | 0.005 | 0.006 | 30,000 | 30 | 10 | 0.005 | 0.006 |
| **2002-0100** | | 1 | 30,000 | 25 | 10 | 0.005 | 0.005 | 30,000 | 25 | 10 | 0.005 | 0.005 |
| **2003-0050** | **R0.15** | 0.5 | 30,000 | 100 | 10 | 0.01 | 0.03 | 30,000 | 100 | 10 | 0.01 | 0.03 |
| **2003-0075** | | 0.75 | 30,000 | 80 | 10 | 0.01 | 0.02 | 30,000 | 80 | 10 | 0.01 | 0.02 |
| **2003-0100** | | 1 | 30,000 | 60 | 10 | 0.01 | 0.02 | 30,000 | 60 | 10 | 0.01 | 0.02 |
| **2004-0050** | **R0.2** | 0.5 | 30,000 | 150 | 15 | 0.02 | 0.08 | 30,000 | 150 | 15 | 0.02 | 0.08 |
| **2004-0100** | | 1 | 30,000 | 100 | 10 | 0.015 | 0.07 | 30,000 | 100 | 10 | 0.015 | 0.07 |
| **2004-0150** | | 1.5 | 30,000 | 60 | 10 | 0.01 | 0.06 | 30,000 | 60 | 10 | 0.01 | 0.06 |
| **2004-0200** | | 2 | 30,000 | 30 | 10 | 0.008 | 0.05 | 30,000 | 30 | 10 | 0.008 | 0.05 |
| **2004-0250** | | 2.5 | 30,000 | 15 | 10 | 0.006 | 0.03 | 30,000 | 15 | 10 | 0.006 | 0.03 |
| **2006-0100** | **R0.3** | 1 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 |
| **2006-0150** | | 1.5 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 |
| **2006-0200** | | 2 | 30,000 | 150 | 15 | 0.022 | 0.11 | 30,000 | 150 | 15 | 0.022 | 0.11 |
| **2006-0300** | | 3 | 30,000 | 75 | 10 | 0.01 | 0.08 | 30,000 | 75 | 10 | 0.01 | 0.08 |
| **2006-0400** | | 4 | 30,000 | 75 | 10 | 0.01 | 0.08 | 30,000 | 75 | 10 | 0.01 | 0.08 |
| **2006-0500** | | 5 | 30,000 | 75 | 10 | 0.01 | 0.06 | 30,000 | 75 | 10 | 0.01 | 0.06 |
| **2006-0600** | | 6 | 30,000 | 75 | 10 | 0.01 | 0.03 | 30,000 | 75 | 10 | 0.01 | 0.03 |
| **2008-0200** | **R0.4** | 2 | 30,000 | 250 | 25 | 0.04 | 0.19 | 30,000 | 250 | 25 | 0.04 | 0.19 |
| **2008-0300** | | 3 | 30,000 | 230 | 23 | 0.037 | 0.17 | 30,000 | 230 | 23 | 0.037 | 0.17 |
| **2008-0400** | | 4 | 30,000 | 210 | 21 | 0.035 | 0.16 | 30,000 | 210 | 21 | 0.035 | 0.16 |
| **2008-0500** | | 5 | 25,000 | 170 | 20 | 0.03 | 0.12 | 25,000 | 170 | 20 | 0.03 | 0.12 |
| **2008-0600** | | 6 | 20,000 | 130 | 20 | 0.025 | 0.08 | 20,000 | 130 | 20 | 0.025 | 0.08 |
| **2008-0800** | | 8 | 15,000 | 100 | 20 | 0.015 | 0.03 | 15,000 | 100 | 20 | 0.015 | 0.03 |
| **2010-0150** | **R0.5** | 1.5 | 30,000 | 300 | 30 | 0.05 | 0.25 | 30,000 | 300 | 150 | 0.35 | 0.075 |
| **2010-0200** | | 2 | 30,000 | 300 | 30 | 0.05 | 0.25 | 30,000 | 300 | 150 | 0.35 | 0.075 |
| **2010-0250** | | 2.5 | 30,000 | 300 | 30 | 0.05 | 0.25 | 30,000 | 300 | 150 | 0.35 | 0.075 |
| **2010-0300** | | 3 | 30,000 | 300 | 30 | 0.05 | 0.25 | 25,000 | 250 | 125 | 0.35 | 0.075 |
| **2010-0400** | | 4 | 30,000 | 300 | 30 | 0.05 | 0.25 | 25,000 | 250 | 125 | 0.2 | 0.1 |
| **2010-0600** | | 6 | 25,000 | 250 | 25 | 0.04 | 0.15 | 25,000 | 250 | 125 | 0.1 | 0.1 |
| **2010-0800** | | 8 | 20,000 | 200 | 25 | 0.025 | 0.07 | 20,000 | 200 | 100 | 0.03 | 0.08 |
| **2010-1000** | | 10 | 10,000 | 100 | 20 | 0.018 | 0.03 | 20,000 | 200 | 100 | 0.02 | 0.04 |
| **2015-0200** | **R0.75** | 2 | 25,000 | 250 | 45 | 0.075 | 0.27 | 18,000 | 180 | 90 | 0.52 | 0.12 |
| **2015-0400** | | 4 | 25,000 | 250 | 45 | 0.075 | 0.27 | 18,000 | 180 | 90 | 0.52 | 0.12 |
| **2015-0600** | | 6 | 25,000 | 250 | 45 | 0.075 | 0.27 | 18,000 | 180 | 90 | 0.4 | 0.12 |
| **2015-0800** | | 8 | 20,000 | 160 | 30 | 0.075 | 0.27 | 18,000 | 180 | 90 | 0.2 | 0.2 |
| **2015-1000** | | 10 | 20,000 | 130 | 30 | 0.05 | 0.15 | 18,000 | 180 | 90 | 0.075 | 0.25 |
| **2015-1200** | | 12 | 16,000 | 100 | 30 | 0.03 | 0.08 | 13,500 | 135 | 70 | 0.05 | 0.16 |
| **2020-0300** | **R1** | 3 | 20,000 | 200 | 60 | 0.1 | 0.3 | 12,500 | 125 | 60 | 0.7 | 0.15 |
| **2020-0400** | | 4 | 20,000 | 200 | 60 | 0.1 | 0.3 | 12,500 | 125 | 60 | 0.7 | 0.15 |
| **2020-0600** | | 6 | 20,000 | 200 | 60 | 0.1 | 0.3 | 12,500 | 125 | 60 | 0.7 | 0.15 |
| **2020-0800** | | 8 | 20,000 | 200 | 60 | 0.1 | 0.3 | 12,500 | 125 | 60 | 0.4 | 0.2 |
| **2020-1000** | | 10 | 20,000 | 200 | 60 | 0.1 | 0.3 | 12,500 | 125 | 60 | 0.25 | 0.25 |
| **2020-1200** | | 12 | 20,000 | 200 | 60 | 0.09 | 0.25 | 12,500 | 125 | 60 | 0.1 | 0.3 |
| **2020-1400** | | 14 | 20,000 | 200 | 60 | 0.07 | 0.15 | 12,500 | 125 | 60 | 0.1 | 0.3 |
| **2020-1600** | | 16 | 13,000 | 130 | 36 | 0.04 | 0.08 | 12,500 | 125 | 60 | 0.1 | 0.3 |
| **2020-1800** | | 18 | 10,000 | 100 | 30 | 0.025 | 0.05 | 10,000 | 100 | 50 | 0.04 | 0.1 |
| **2020-2000** | | 20 | 10,000 | 100 | 30 | 0.02 | 0.035 | 10,000 | 100 | 50 | 0.02 | 0.07 |

# Milling Conditions for UDCLBF

| WORK MATERIAL | | | CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS | | | | | CEMENTED CARBIDE(＜87HRA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2030-0600** | **R1.5** | 6 | 20,000 | 200 | 100 | 0.15 | 0.3 | 9,000 | 280 | 140 | 0.38 | 0.15 |
| **2030-0800** | | 8 | 20,000 | 200 | 100 | 0.15 | 0.3 | 9,000 | 280 | 140 | 0.38 | 0.15 |
| **2030-1000** | | 10 | 20,000 | 200 | 100 | 0.15 | 0.3 | 9,000 | 280 | 140 | 0.38 | 0.15 |
| **2030-1200** | | 12 | 20,000 | 200 | 100 | 0.15 | 0.3 | 9,000 | 280 | 140 | 0.38 | 0.15 |
| **2030-1400** | | 14 | 20,000 | 200 | 100 | 0.15 | 0.3 | 9,000 | 280 | 140 | 0.38 | 0.15 |
| **2040-0800** | **R2** | 8 | 18,000 | 180 | 90 | 0.175 | 0.32 | 7,200 | 280 | 140 | 0.5 | 0.2 |
| **2040-1000** | | 10 | 18,000 | 180 | 90 | 0.175 | 0.32 | 7,200 | 280 | 140 | 0.5 | 0.2 |
| **2040-1500** | | 15 | 18,000 | 180 | 90 | 0.175 | 0.32 | 7,200 | 280 | 140 | 0.5 | 0.2 |
| **2050-1000** | **R2.5** | 10 | 16,000 | 160 | 80 | 0.225 | 0.31 | 6,000 | 330 | 170 | 0.6 | 0.25 |
| **2050-1500** | | 15 | 16,000 | 160 | 80 | 0.225 | 0.31 | 6,000 | 330 | 170 | 0.6 | 0.25 |
| **2060-1000** | **R3** | 10 | 15,000 | 150 | 75 | 0.3 | 0.3 | 5,500 | 280 | 140 | 0.65 | 0.28 |
| **2060-1500** | | 15 | 15,000 | 150 | 75 | 0.3 | 0.3 | 5,500 | 280 | 140 | 0.65 | 0.28 |

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials.
These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

※ Feed Rate 2: Approach feed rate and contact time on the surface.




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

**Refer to page 583-587 for features and milling examples of UDC series.**

Size φ0.3～φ2 UDC

# UDCLRSF

MG UDC 0° R R ±0.01 Shank Dia 0/-0.005

Patented in Japan

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ | | | ☆ | ◎ * |

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

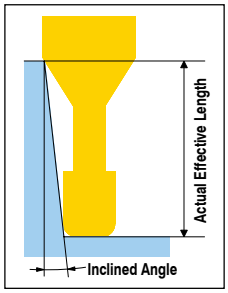
Total 52 models

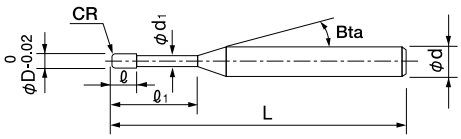
Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| UDCLRSF 2003-003006 | 0.3 | R0.03 | 0.6 | 0.15 | 0.28 | 16° | 50 | 4 | 54,600 |
| UDCLRSF 2003-005006 | | R0.05 | 0.6 | | | | 50 | 4 | 54,600 |
| UDCLRSF 2005-003005 | 0.5 | R0.03 | 0.5 | 0.25 | 0.46 | 16° | 50 | 4 | 52,000 |
| UDCLRSF 2005-003010 | | | 1 | | | | 50 | 4 | 52,000 |
| UDCLRSF 2005-003015 | | | 1.5 | | | | 50 | 4 | 52,000 |
| UDCLRSF 2005-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 52,000 |
| UDCLRSF 2005-005010 | | | 1 | | | | 50 | 4 | 52,000 |
| UDCLRSF 2005-005015 | | | 1.5 | | | | 50 | 4 | 52,000 |
| UDCLRSF 2008-003008 | 0.8 | R0.03 | 0.8 | 0.4 | 0.76 | 16° | 50 | 4 | 46,700 |
| UDCLRSF 2008-003016 | | | 1.6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-003024 | | | 2.4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-005008 | | R0.05 | 0.8 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-005016 | | | 1.6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-005024 | | | 2.4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-010008 | | R0.1 | 0.8 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-010016 | | | 1.6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2008-010024 | | | 2.4 | | | | 50 | 4 | 46,700 |

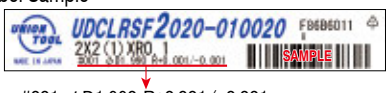
## Features

Long Neck Radius End Mills for milling Cemented Carbide & Hard Brittle (Non-Metallic) Materials.
Upgraded version of UDCLRS.
Improved Diamond coating and optimum cutting geometries will "deep cuts" the material with offering long tool life.
Special cutting edge treatment helps to avoid the edge chipping & level gap on the work piece.
Recommended to use on semi-roughing & finishing process.




Label Sample




#001 φD1.990 R+0.001/−0.001

Diameter and Corner R accuracy measurements are printed on the label to support High Precision milling.

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

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30' | 1° | 1° 30' | 2° | 3° |
| UDCLRSF 2003-003006 | 0.3 | R0.03 | 0.6 | 0.61 | 0.63 | 0.65 | 0.67 | 0.72 |
| UDCLRSF 2003-005006 | | R0.05 | 0.6 | 0.61 | 0.63 | 0.65 | 0.67 | 0.72 |
| UDCLRSF 2005-003005 | 0.5 | R0.03 | 0.5 | 0.55 | 0.56 | 0.58 | 0.60 | 0.64 |
| UDCLRSF 2005-003010 | | | 1 | 1.06 | 1.10 | 1.13 | 1.17 | 1.25 |
| UDCLRSF 2005-003015 | | | 1.5 | 1.58 | 1.63 | 1.68 | 1.74 | 1.87 |
| UDCLRSF 2005-005005 | | R0.05 | 0.5 | 0.55 | 0.56 | 0.58 | 0.60 | 0.64 |
| UDCLRSF 2005-005010 | | | 1 | 1.06 | 1.09 | 1.13 | 1.17 | 1.25 |
| UDCLRSF 2005-005015 | | | 1.5 | 1.58 | 1.63 | 1.68 | 1.74 | 1.86 |
| UDCLRSF 2008-003008 | 0.8 | R0.03 | 0.8 | 0.86 | 0.88 | 0.91 | 0.94 | 1.01 |
| UDCLRSF 2008-003016 | | | 1.6 | 1.68 | 1.73 | 1.79 | 1.85 | 1.99 |
| UDCLRSF 2008-003024 | | | 2.4 | 2.51 | 2.59 | 2.67 | 2.76 | 2.97 |
| UDCLRSF 2008-005008 | | R0.05 | 0.8 | 0.85 | 0.88 | 0.91 | 0.94 | 1.01 |
| UDCLRSF 2008-005016 | | | 1.6 | 1.68 | 1.73 | 1.79 | 1.85 | 1.98 |
| UDCLRSF 2008-005024 | | | 2.4 | 2.50 | 2.58 | 2.67 | 2.76 | 2.96 |
| UDCLRSF 2008-010008 | | R0.1 | 0.8 | 0.85 | 0.88 | 0.90 | 0.93 | 0.99 |
| UDCLRSF 2008-010016 | | | 1.6 | 1.68 | 1.73 | 1.78 | 1.84 | 1.97 |
| UDCLRSF 2008-010024 | | | 2.4 | 2.50 | 2.58 | 2.66 | 2.75 | 2.95 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| UDCLRSF 2010-003010 | 1 | R0.03 | 1 | 0.5 | 0.96 | 16° | 50 | 4 | 46,700 |
| UDCLRSF 2010-003020 | | | 2 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-003040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-003060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-005010 | | R0.05 | 1 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-005020 | | | 2 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-005040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-005060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-010010 | | R0.1 | 1 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-010020 | | | 2 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-010040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2010-010060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-003015 | 1.5 | R0.03 | 1.5 | 0.75 | 1.44 | 16° | 50 | 4 | 46,700 |
| UDCLRSF 2015-003030 | | | 3 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-005015 | | R0.05 | 1.5 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-005030 | | | 3 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-010015 | | R0.1 | 1.5 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-010030 | | | 3 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-010040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2015-010060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-003020 | 2 | R0.03 | 2 | 1 | 1.9 | 16° | 50 | 4 | 46,700 |
| UDCLRSF 2020-003040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-003060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-003080 | | | 8 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-003100 | | | 10 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-005020 | | R0.05 | 2 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-005040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-005060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-005080 | | | 8 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-005100 | | | 10 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-010020 | | R0.1 | 2 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-010040 | | | 4 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-010060 | | | 6 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-010080 | | | 8 | | | | 50 | 4 | 46,700 |
| UDCLRSF 2020-010100 | | | 10 | | | | 50 | 4 | 46,700 |

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30' | 1° | 1° 30' | 2° | 3° |
| UDCLRSF 2010-003010 | 1 | R0.03 | 1 | 1.06 | 1.10 | 1.13 | 1.17 | 1.25 |
| UDCLRSF 2010-003020 | | | 2 | 2.09 | 2.16 | 2.23 | 2.31 | 2.48 |
| UDCLRSF 2010-003040 | | | 4 | 4.16 | 4.29 | 4.43 | 4.59 | 4.93 |
| UDCLRSF 2010-003060 | | | 6 | 6.22 | 6.42 | 6.63 | 6.86 | 7.37 |
| UDCLRSF 2010-005010 | | R0.05 | 1 | 1.06 | 1.09 | 1.13 | 1.17 | 1.25 |
| UDCLRSF 2010-005020 | | | 2 | 2.09 | 2.16 | 2.23 | 2.31 | 2.47 |
| UDCLRSF 2010-005040 | | | 4 | 4.15 | 4.29 | 4.43 | 4.58 | 4.92 |
| UDCLRSF 2010-005060 | | | 6 | 6.22 | 6.42 | 6.63 | 6.86 | 7.37 |
| UDCLRSF 2010-010010 | | R0.1 | 1 | 1.06 | 1.09 | 1.12 | 1.16 | 1.24 |
| UDCLRSF 2010-010020 | | | 2 | 2.09 | 2.16 | 2.22 | 2.30 | 2.46 |
| UDCLRSF 2010-010040 | | | 4 | 4.15 | 4.28 | 4.43 | 4.58 | 4.91 |
| UDCLRSF 2010-010060 | | | 6 | 6.22 | 6.41 | 6.63 | 6.85 | 7.36 |
| UDCLRSF 2015-003015 | 1.5 | R0.03 | 1.5 | 1.61 | 1.66 | 1.72 | 1.78 | 1.91 |
| UDCLRSF 2015-003030 | | | 3 | 3.16 | 3.26 | 3.37 | 3.49 | 3.74 |
| UDCLRSF 2015-005015 | | R0.05 | 1.5 | 1.61 | 1.66 | 1.72 | 1.78 | 1.90 |
| UDCLRSF 2015-005030 | | | 3 | 3.16 | 3.26 | 3.37 | 3.48 | 3.74 |
| UDCLRSF 2015-010015 | | R0.1 | 1.5 | 1.61 | 1.66 | 1.71 | 1.77 | 1.89 |
| UDCLRSF 2015-010030 | | | 3 | 3.16 | 3.26 | 3.36 | 3.48 | 3.73 |
| UDCLRSF 2015-010040 | | | 4 | 4.19 | 4.32 | 4.46 | 4.62 | 4.95 |
| UDCLRSF 2015-010060 | | | 6 | 6.25 | 6.45 | 6.66 | 6.89 | 7.40 |
| UDCLRSF 2020-003020 | 2 | R0.03 | 2 | 2.20 | 2.27 | 2.35 | 2.43 | 2.61 |
| UDCLRSF 2020-003040 | | | 4 | 4.26 | 4.40 | 4.55 | 4.70 | 5.05 |
| UDCLRSF 2020-003060 | | | 6 | 6.33 | 6.53 | 6.75 | 6.98 | 7.50 |
| UDCLRSF 2020-003080 | | | 8 | 8.39 | 8.66 | 8.95 | 9.26 | 9.95 |
| UDCLRSF 2020-003100 | | | 10 | 10.45 | 10.79 | 11.15 | 11.54 | 12.40 |
| UDCLRSF 2020-005020 | | R0.05 | 2 | 2.20 | 2.27 | 2.34 | 2.42 | 2.60 |
| UDCLRSF 2020-005040 | | | 4 | 4.26 | 4.40 | 4.55 | 4.70 | 5.05 |
| UDCLRSF 2020-005060 | | | 6 | 6.33 | 6.53 | 6.75 | 6.98 | 7.50 |
| UDCLRSF 2020-005080 | | | 8 | 8.39 | 8.66 | 8.95 | 9.26 | 9.94 |
| UDCLRSF 2020-005100 | | | 10 | 10.45 | 10.79 | 11.15 | 11.53 | 12.39 |
| UDCLRSF 2020-010020 | | R0.1 | 2 | 2.20 | 2.27 | 2.34 | 2.42 | 2.59 |
| UDCLRSF 2020-010040 | | | 4 | 4.26 | 4.40 | 4.54 | 4.69 | 5.04 |
| UDCLRSF 2020-010060 | | | 6 | 6.32 | 6.53 | 6.74 | 6.97 | 7.49 |
| UDCLRSF 2020-010080 | | | 8 | 8.39 | 8.66 | 8.94 | 9.25 | 9.93 |
| UDCLRSF 2020-010100 | | | 10 | 10.45 | 10.79 | 11.14 | 11.53 | 12.38 |

## Milling Conditions for UDCLRSF

| WORK MATERIAL | CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Spindle Speed (min⁻¹) | Z-Level Milling | | | | Flat Milling | | | Side Milling | | | Slotting | |
| | | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2003-003006** | 30,000 | 220 | 50 | 0.015 | 0.2 | 220 | 0.015 | 0.2 | 110 | 0.075 | 0.006 | 110 | 0.015 |
| **2003-005006** | 30,000 | 220 | 50 | 0.02 | 0.2 | 220 | 0.02 | 0.2 | 110 | 0.075 | 0.006 | 110 | 0.02 |
| **2005-003005** | 30,000 | 190 | 90 | 0.02 | 0.4 | 190 | 0.02 | 0.4 | 180 | 0.25 | 0.01 | 190 | 0.02 |
| **2005-003010** | 30,000 | 190 | 90 | 0.02 | 0.4 | 190 | 0.02 | 0.4 | 180 | 0.125 | 0.01 | 190 | 0.02 |
| **2005-003015** | 30,000 | 140 | 65 | 0.015 | 0.3 | 140 | 0.015 | 0.3 | 130 | 0.125 | 0.007 | 140 | 0.015 |
| **2005-005005** | 30,000 | 190 | 125 | 0.02 | 0.4 | 190 | 0.02 | 0.4 | 180 | 0.25 | 0.01 | 190 | 0.02 |
| **2005-005010** | 30,000 | 190 | 125 | 0.02 | 0.4 | 190 | 0.02 | 0.4 | 180 | 0.125 | 0.01 | 190 | 0.02 |
| **2005-005015** | 30,000 | 140 | 65 | 0.015 | 0.3 | 140 | 0.015 | 0.3 | 130 | 0.125 | 0.007 | 140 | 0.015 |
| **2008-003008** | 30,000 | 190 | 90 | 0.02 | 0.6 | 190 | 0.02 | 0.6 | 300 | 0.4 | 0.016 | 190 | 0.02 |
| **2008-003016** | 30,000 | 190 | 90 | 0.02 | 0.6 | 190 | 0.02 | 0.6 | 300 | 0.2 | 0.01 | 190 | 0.02 |
| **2008-003024** | 30,000 | 175 | 80 | 0.018 | 0.5 | 175 | 0.018 | 0.5 | 275 | 0.2 | 0.007 | 175 | 0.018 |
| **2008-005008** | 30,000 | 190 | 150 | 0.025 | 0.6 | 190 | 0.025 | 0.6 | 300 | 0.4 | 0.016 | 190 | 0.025 |
| **2008-005016** | 30,000 | 190 | 150 | 0.025 | 0.6 | 190 | 0.025 | 0.6 | 300 | 0.2 | 0.01 | 190 | 0.025 |
| **2008-005024** | 30,000 | 175 | 80 | 0.023 | 0.5 | 175 | 0.023 | 0.5 | 275 | 0.2 | 0.007 | 175 | 0.023 |
| **2008-010008** | 30,000 | 190 | 150 | 0.03 | 0.6 | 190 | 0.03 | 0.6 | 300 | 0.4 | 0.016 | 190 | 0.03 |
| **2008-010016** | 30,000 | 190 | 150 | 0.03 | 0.6 | 190 | 0.03 | 0.6 | 300 | 0.2 | 0.01 | 190 | 0.03 |
| **2008-010024** | 30,000 | 175 | 80 | 0.028 | 0.5 | 175 | 0.028 | 0.5 | 275 | 0.2 | 0.007 | 175 | 0.028 |
| **2010-003010** | 30,000 | 190 | 90 | 0.02 | 0.8 | 190 | 0.02 | 0.8 | 375 | 0.5 | 0.02 | 190 | 0.02 |
| **2010-003020** | 30,000 | 190 | 90 | 0.02 | 0.8 | 190 | 0.02 | 0.8 | 375 | 0.25 | 0.01 | 190 | 0.02 |
| **2010-003040** | 30,000 | 190 | 90 | 0.016 | 0.6 | 190 | 0.016 | 0.6 | 375 | 0.25 | 0.005 | 190 | 0.016 |
| **2010-003060** | 25,000 | 155 | 75 | 0.01 | 0.5 | 155 | 0.01 | 0.5 | 300 | 0.25 | 0.005 | 155 | 0.01 |
| **2010-005010** | 30,000 | 190 | 185 | 0.025 | 0.8 | 190 | 0.025 | 0.8 | 375 | 0.5 | 0.02 | 190 | 0.025 |
| **2010-005020** | 30,000 | 190 | 185 | 0.025 | 0.8 | 190 | 0.025 | 0.8 | 375 | 0.25 | 0.01 | 190 | 0.025 |
| **2010-005040** | 30,000 | 190 | 185 | 0.02 | 0.6 | 190 | 0.02 | 0.6 | 375 | 0.25 | 0.005 | 190 | 0.02 |
| **2010-005060** | 25,000 | 155 | 150 | 0.012 | 0.5 | 155 | 0.012 | 0.5 | 300 | 0.25 | 0.005 | 155 | 0.012 |
| **2010-010010** | 30,000 | 190 | 185 | 0.03 | 0.8 | 190 | 0.03 | 0.8 | 375 | 0.5 | 0.02 | 190 | 0.03 |
| **2010-010020** | 30,000 | 190 | 185 | 0.03 | 0.8 | 190 | 0.03 | 0.8 | 375 | 0.25 | 0.01 | 190 | 0.03 |
| **2010-010040** | 30,000 | 190 | 185 | 0.025 | 0.6 | 190 | 0.025 | 0.6 | 375 | 0.25 | 0.005 | 190 | 0.025 |
| **2010-010060** | 25,000 | 155 | 150 | 0.015 | 0.5 | 155 | 0.015 | 0.5 | 300 | 0.25 | 0.005 | 155 | 0.015 |
| **2015-003015** | 25,000 | 190 | 90 | 0.03 | 1.3 | 190 | 0.03 | 1.3 | 375 | 0.75 | 0.02 | 190 | 0.03 |
| **2015-003030** | 25,000 | 190 | 90 | 0.03 | 1.3 | 190 | 0.03 | 1.3 | 375 | 0.375 | 0.01 | 190 | 0.03 |
| **2015-005015** | 25,000 | 190 | 125 | 0.04 | 1.3 | 190 | 0.04 | 1.3 | 375 | 0.75 | 0.02 | 190 | 0.04 |
| **2015-005030** | 25,000 | 190 | 125 | 0.04 | 1.3 | 190 | 0.04 | 1.3 | 375 | 0.375 | 0.01 | 190 | 0.04 |
| **2015-010015** | 25,000 | 190 | 150 | 0.045 | 1.3 | 190 | 0.045 | 1.3 | 375 | 0.75 | 0.02 | 190 | 0.045 |
| **2015-010030** | 25,000 | 190 | 150 | 0.045 | 1.3 | 190 | 0.045 | 1.3 | 375 | 0.375 | 0.01 | 190 | 0.045 |
| **2015-010040** | 25,000 | 190 | 150 | 0.043 | 1.2 | 190 | 0.043 | 1.2 | 350 | 0.375 | 0.008 | 190 | 0.043 |
| **2015-010060** | 25,000 | 190 | 150 | 0.04 | 1 | 190 | 0.04 | 1 | 350 | 0.375 | 0.005 | 190 | 0.04 |

# Milling Conditions for UDCLRSF

| WORK MATERIAL | CEMENTED CARBIDE (<87HRA) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Spindle Speed (min$^{-1}$) | Z-Level Milling | | | | Flat Milling | | | Side Milling | | | Slotting | |
| | | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2003-003006** | 21,000 | 300 | 50 | 0.015 | 0.2 | 300 | 0.015 | 0.2 | 200 | 0.075 | 0.003 | 300 | 0.015 |
| **2003-005006** | 21,000 | 300 | 50 | 0.02 | 0.2 | 300 | 0.02 | 0.2 | 200 | 0.075 | 0.003 | 300 | 0.02 |
| **2005-003005** | 16,000 | 500 | 160 | 0.02 | 0.4 | 500 | 0.02 | 0.4 | 800 | 0.25 | 0.005 | 500 | 0.02 |
| **2005-003010** | 16,000 | 500 | 160 | 0.02 | 0.4 | 500 | 0.02 | 0.4 | 400 | 0.125 | 0.005 | 500 | 0.02 |
| **2005-003015** | 16,000 | 375 | 120 | 0.014 | 0.3 | 375 | 0.014 | 0.3 | 300 | 0.125 | 0.005 | 375 | 0.014 |
| **2005-005005** | 16,000 | 500 | 160 | 0.025 | 0.4 | 500 | 0.025 | 0.4 | 800 | 0.25 | 0.005 | 500 | 0.025 |
| **2005-005010** | 16,000 | 500 | 160 | 0.025 | 0.4 | 500 | 0.025 | 0.4 | 400 | 0.125 | 0.005 | 500 | 0.025 |
| **2005-005015** | 16,000 | 375 | 120 | 0.017 | 0.3 | 375 | 0.017 | 0.3 | 300 | 0.125 | 0.005 | 375 | 0.017 |
| **2008-003008** | 13,000 | 390 | 130 | 0.02 | 0.6 | 390 | 0.02 | 0.6 | 1,200 | 0.4 | 0.008 | 390 | 0.02 |
| **2008-003016** | 13,000 | 390 | 130 | 0.02 | 0.6 | 390 | 0.02 | 0.6 | 600 | 0.2 | 0.008 | 390 | 0.02 |
| **2008-003024** | 13,000 | 350 | 120 | 0.014 | 0.5 | 350 | 0.014 | 0.5 | 540 | 0.2 | 0.006 | 350 | 0.014 |
| **2008-005008** | 13,000 | 390 | 130 | 0.025 | 0.6 | 390 | 0.025 | 0.6 | 1,200 | 0.4 | 0.008 | 390 | 0.025 |
| **2008-005016** | 13,000 | 390 | 130 | 0.025 | 0.6 | 390 | 0.025 | 0.6 | 600 | 0.2 | 0.008 | 390 | 0.025 |
| **2008-005024** | 13,000 | 350 | 120 | 0.017 | 0.5 | 350 | 0.017 | 0.5 | 540 | 0.2 | 0.006 | 350 | 0.017 |
| **2008-010008** | 13,000 | 390 | 130 | 0.03 | 0.6 | 390 | 0.03 | 0.6 | 1,200 | 0.4 | 0.008 | 390 | 0.03 |
| **2008-010016** | 13,000 | 390 | 130 | 0.03 | 0.6 | 390 | 0.03 | 0.6 | 600 | 0.2 | 0.008 | 390 | 0.03 |
| **2008-010024** | 13,000 | 350 | 120 | 0.02 | 0.5 | 350 | 0.02 | 0.5 | 540 | 0.2 | 0.006 | 350 | 0.02 |
| **2010-003010** | 12,000 | 360 | 120 | 0.02 | 0.8 | 360 | 0.02 | 0.8 | 1,440 | 0.5 | 0.01 | 360 | 0.02 |
| **2010-003020** | 12,000 | 360 | 120 | 0.02 | 0.8 | 360 | 0.02 | 0.8 | 720 | 0.25 | 0.01 | 360 | 0.02 |
| **2010-003040** | 10,000 | 300 | 100 | 0.012 | 0.7 | 300 | 0.012 | 0.7 | 600 | 0.25 | 0.008 | 300 | 0.012 |
| **2010-003060** | 10,000 | 300 | 100 | 0.008 | 0.7 | 300 | 0.008 | 0.7 | 600 | 0.25 | 0.006 | 300 | 0.008 |
| **2010-005010** | 12,000 | 360 | 120 | 0.025 | 0.8 | 360 | 0.025 | 0.8 | 1,440 | 0.5 | 0.01 | 360 | 0.025 |
| **2010-005020** | 12,000 | 360 | 120 | 0.025 | 0.8 | 360 | 0.025 | 0.8 | 720 | 0.25 | 0.01 | 360 | 0.025 |
| **2010-005040** | 10,000 | 300 | 100 | 0.015 | 0.7 | 300 | 0.015 | 0.7 | 600 | 0.25 | 0.008 | 300 | 0.015 |
| **2010-005060** | 10,000 | 300 | 100 | 0.01 | 0.7 | 300 | 0.01 | 0.7 | 600 | 0.25 | 0.006 | 300 | 0.01 |
| **2010-010010** | 12,000 | 360 | 120 | 0.03 | 0.8 | 360 | 0.03 | 0.8 | 1,440 | 0.5 | 0.01 | 360 | 0.03 |
| **2010-010020** | 12,000 | 360 | 120 | 0.03 | 0.8 | 360 | 0.03 | 0.8 | 720 | 0.25 | 0.01 | 360 | 0.03 |
| **2010-010040** | 10,000 | 300 | 100 | 0.02 | 0.7 | 300 | 0.02 | 0.7 | 600 | 0.25 | 0.008 | 300 | 0.02 |
| **2010-010060** | 10,000 | 300 | 100 | 0.012 | 0.7 | 300 | 0.012 | 0.7 | 600 | 0.25 | 0.006 | 300 | 0.012 |
| **2015-003015** | 11,000 | 330 | 110 | 0.03 | 1.3 | 330 | 0.03 | 1.3 | 1,440 | 0.75 | 0.01 | 330 | 0.03 |
| **2015-003030** | 11,000 | 330 | 110 | 0.03 | 1.3 | 330 | 0.03 | 1.3 | 720 | 0.375 | 0.01 | 330 | 0.03 |
| **2015-005015** | 11,000 | 330 | 110 | 0.04 | 1.3 | 330 | 0.04 | 1.3 | 1,440 | 0.75 | 0.01 | 330 | 0.04 |
| **2015-005030** | 11,000 | 330 | 110 | 0.04 | 1.3 | 330 | 0.04 | 1.3 | 720 | 0.375 | 0.01 | 330 | 0.04 |
| **2015-010015** | 11,000 | 330 | 110 | 0.045 | 1.3 | 330 | 0.045 | 1.3 | 1,440 | 0.75 | 0.01 | 330 | 0.045 |
| **2015-010030** | 11,000 | 330 | 110 | 0.045 | 1.3 | 330 | 0.045 | 1.3 | 720 | 0.375 | 0.01 | 330 | 0.045 |
| **2015-010040** | 11,000 | 330 | 110 | 0.045 | 1.1 | 330 | 0.045 | 1.1 | 720 | 0.375 | 0.01 | 330 | 0.045 |
| **2015-010060** | 11,000 | 330 | 110 | 0.03 | 1.1 | 330 | 0.03 | 1.1 | 720 | 0.375 | 0.009 | 330 | 0.03 |

## Milling Conditions for UDCLRSF

| WORK MATERIAL | CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Spindle Speed (min$^{-1}$) | Z-Level Milling | | | | Flat Milling | | | Side Milling | | | Slotting | |
| | | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2020-003020** | 20,000 | 190 | 90 | 0.04 | 1.8 | 190 | 0.04 | 1.8 | 375 | 1 | 0.02 | 190 | 0.04 |
| **2020-003040** | 20,000 | 190 | 90 | 0.04 | 1.8 | 190 | 0.04 | 1.8 | 375 | 0.5 | 0.01 | 190 | 0.04 |
| **2020-003060** | 20,000 | 190 | 90 | 0.037 | 1.7 | 190 | 0.037 | 1.7 | 325 | 0.5 | 0.007 | 190 | 0.037 |
| **2020-003080** | 20,000 | 190 | 90 | 0.03 | 1.5 | 190 | 0.03 | 1.5 | 325 | 0.5 | 0.005 | 190 | 0.03 |
| **2020-003100** | 20,000 | 190 | 90 | 0.025 | 1.3 | 190 | 0.025 | 1.3 | 300 | 0.5 | 0.005 | 190 | 0.025 |
| **2020-005020** | 20,000 | 190 | 90 | 0.05 | 1.8 | 190 | 0.05 | 1.8 | 375 | 1 | 0.02 | 190 | 0.05 |
| **2020-005040** | 20,000 | 190 | 90 | 0.05 | 1.8 | 190 | 0.05 | 1.8 | 375 | 0.5 | 0.01 | 190 | 0.05 |
| **2020-005060** | 20,000 | 190 | 90 | 0.045 | 1.7 | 190 | 0.045 | 1.7 | 325 | 0.5 | 0.007 | 190 | 0.045 |
| **2020-005080** | 20,000 | 190 | 90 | 0.04 | 1.5 | 190 | 0.04 | 1.5 | 325 | 0.5 | 0.005 | 190 | 0.04 |
| **2020-005100** | 20,000 | 190 | 90 | 0.028 | 1.3 | 190 | 0.028 | 1.3 | 300 | 0.5 | 0.005 | 190 | 0.028 |
| **2020-010020** | 20,000 | 190 | 125 | 0.06 | 1.8 | 190 | 0.06 | 1.8 | 375 | 1 | 0.02 | 190 | 0.06 |
| **2020-010040** | 20,000 | 190 | 125 | 0.06 | 1.8 | 190 | 0.06 | 1.8 | 375 | 0.5 | 0.01 | 190 | 0.06 |
| **2020-010060** | 20,000 | 190 | 125 | 0.055 | 1.7 | 190 | 0.055 | 1.7 | 325 | 0.5 | 0.007 | 190 | 0.055 |
| **2020-010080** | 20,000 | 190 | 125 | 0.045 | 1.5 | 190 | 0.045 | 1.5 | 325 | 0.5 | 0.005 | 190 | 0.045 |
| **2020-010100** | 20,000 | 190 | 125 | 0.033 | 1.3 | 190 | 0.033 | 1.3 | 300 | 0.5 | 0.005 | 190 | 0.033 |

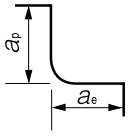
These milling parameters are based on VF-20, VM-40, VU-70 (TAS standard) and are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

※Feed Rate 2: Approach feed rate and contact time on the surface.

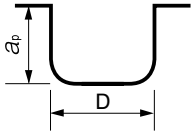
## Milling Conditions for UDCLRSF

| WORK MATERIAL | CEMENTED CARBIDE (<87HRA) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Spindle Speed (min$^{-1}$) | Z-Level Milling | | | | Flat Milling | | | Side Milling | | | Slotting | |
| | | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2020-003020** | 10,000 | 300 | 100 | 0.04 | 1.8 | 300 | 0.04 | 1.8 | 1,440 | 1 | 0.01 | 300 | 0.04 |
| **2020-003040** | 10,000 | 300 | 100 | 0.04 | 1.8 | 300 | 0.04 | 1.8 | 1,440 | 1 | 0.01 | 300 | 0.04 |
| **2020-003060** | 10,000 | 300 | 100 | 0.036 | 1.6 | 300 | 0.036 | 1.6 | 1,440 | 0.5 | 0.01 | 300 | 0.036 |
| **2020-003080** | 10,000 | 300 | 100 | 0.023 | 1.6 | 300 | 0.023 | 1.6 | 1,440 | 0.5 | 0.009 | 300 | 0.023 |
| **2020-003100** | 10,000 | 300 | 100 | 0.018 | 1.6 | 300 | 0.018 | 1.6 | 1,440 | 0.5 | 0.009 | 300 | 0.018 |
| **2020-005020** | 10,000 | 300 | 100 | 0.05 | 1.8 | 300 | 0.05 | 1.8 | 1,440 | 1 | 0.01 | 300 | 0.05 |
| **2020-005040** | 10,000 | 300 | 100 | 0.05 | 1.8 | 300 | 0.05 | 1.8 | 1,440 | 1 | 0.01 | 300 | 0.05 |
| **2020-005060** | 10,000 | 300 | 100 | 0.045 | 1.6 | 300 | 0.045 | 1.6 | 1,440 | 0.5 | 0.01 | 300 | 0.045 |
| **2020-005080** | 10,000 | 300 | 100 | 0.028 | 1.6 | 300 | 0.028 | 1.6 | 1,440 | 0.5 | 0.009 | 300 | 0.028 |
| **2020-005100** | 10,000 | 300 | 100 | 0.02 | 1.6 | 300 | 0.02 | 1.6 | 1,440 | 0.5 | 0.009 | 300 | 0.02 |
| **2020-010020** | 10,000 | 300 | 100 | 0.06 | 1.8 | 300 | 0.06 | 1.8 | 1,440 | 1 | 0.01 | 300 | 0.06 |
| **2020-010040** | 10,000 | 300 | 100 | 0.06 | 1.8 | 300 | 0.06 | 1.8 | 1,440 | 1 | 0.01 | 300 | 0.06 |
| **2020-010060** | 10,000 | 300 | 100 | 0.054 | 1.6 | 300 | 0.054 | 1.6 | 1,440 | 0.5 | 0.01 | 300 | 0.054 |
| **2020-010080** | 10,000 | 300 | 100 | 0.034 | 1.6 | 300 | 0.034 | 1.6 | 1,440 | 0.5 | 0.009 | 300 | 0.034 |
| **2020-010100** | 10,000 | 300 | 100 | 0.023 | 1.6 | 300 | 0.023 | 1.6 | 1,440 | 0.5 | 0.009 | 300 | 0.023 |

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Does not require to be slowed down in the approach sequence when slotting and side milling.
- Use an inclined or helical approach when Z-level milling (Recommended inclination angle: <1 degree).
- For flat and side milling, set the axial depth (ap) and radial depth (ae) to allow for the uncut material of the corner radius.
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.




Z-Level / Side / Flat Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

Refer to page 583-587 for features and milling examples of UDC series.

Size **R0.1～R3** UDC

# UDCB

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

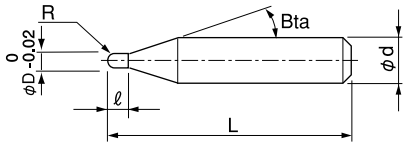
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ *1 | | | ☆ | ◎ *2 |

*1 DCB/DCLB series are highly recommended for Glass Filled Plastic milling.
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

## Features

**Ball type End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials.**
**Developed to give improved hardness and durability, new Diamond coating also has outstanding adhesion to the cutting tool.**
**By combining the new coating with optimum cutting geometries, the tool "deep cuts" the work piece .**
**Leaves a burr and pit free surface finish on semi-roughing & finishing process.**




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

Label Sample

#001 φD1.983 R0.000/−0.005

Diameter and Ball R accuracy measurements are printed on the label to support High Precision milling.

Total 14 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **UDCB 2002-0014** | R0.1 | 0.14 | 16° | 50 | 4 | 39,160 |
| **UDCB 2003-0021** | R0.15 | 0.21 | 16° | 50 | 4 | 39,160 |
| **UDCB 2004-0028** | R0.2 | 0.28 | 16° | 50 | 4 | 35,660 |
| **UDCB 2005-0035** | R0.25 | 0.35 | 16° | 50 | 4 | 35,660 |
| **UDCB 2006-0042** | R0.3 | 0.42 | 16° | 50 | 4 | 32,000 |
| **UDCB 2007-0049** | R0.35 | 0.49 | 16° | 50 | 4 | 32,000 |
| **UDCB 2008-0056** | R0.4 | 0.56 | 16° | 50 | 4 | 32,000 |
| **UDCB 2009-0063** | R0.45 | 0.63 | 16° | 50 | 4 | 32,000 |
| **UDCB 2010-0070** | R0.5 | 0.7 | 16° | 50 | 4 | 32,000 |
| **UDCB 2020-0140** | R1 | 1.4 | 16° | 50 | 4 | 32,000 |
| **UDCB 2030-0210** | R1.5 | 2.1 | 16° | 60 | 6 | 35,160 |
| **UDCB 2040-0280** | R2 | 2.8 | 16° | 60 | 6 | 35,160 |
| **UDCB 2050-0350** | R2.5 | 3.5 | 16° | 60 | 6 | 35,160 |
| **UDCB 2060-0420** | R3 | 4.2 | — | 60 | 6 | 35,160 |

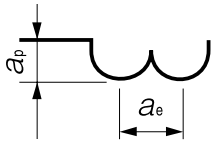
## Milling Conditions for UDCB

| WORK MATERIAL | | | CEMENTED CARBIDE(≧87HRA) | | | | | CEMENTED CARBIDE(＜87HRA) | | | | | HARD BRITTLE MATERIALS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2002-0014** | **R0.1** | 0.14 | 30,000 | 100 | 10 | 0.01 | 0.01 | 30,000 | 100 | 10 | 0.01 | 0.01 | 30,000 | 100 | 10 | 0.01 | 0.01 |
| **2003-0021** | **R0.15** | 0.21 | 30,000 | 125 | 13 | 0.015 | 0.03 | 30,000 | 125 | 13 | 0.015 | 0.03 | 30,000 | 125 | 13 | 0.015 | 0.03 |
| **2004-0028** | **R0.2** | 0.28 | 30,000 | 150 | 15 | 0.02 | 0.08 | 30,000 | 150 | 15 | 0.02 | 0.08 | 30,000 | 150 | 15 | 0.02 | 0.08 |
| **2005-0035** | **R0.25** | 0.35 | 30,000 | 175 | 18 | 0.025 | 0.11 | 30,000 | 175 | 18 | 0.025 | 0.11 | 30,000 | 175 | 18 | 0.025 | 0.11 |
| **2006-0042** | **R0.3** | 0.42 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 |
| **2007-0049** | **R0.35** | 0.49 | 30,000 | 225 | 23 | 0.035 | 0.17 | 30,000 | 225 | 23 | 0.035 | 0.17 | 30,000 | 225 | 23 | 0.035 | 0.17 |
| **2008-0056** | **R0.4** | 0.56 | 30,000 | 250 | 25 | 0.04 | 0.19 | 30,000 | 250 | 25 | 0.04 | 0.19 | 30,000 | 250 | 25 | 0.04 | 0.19 |
| **2009-0063** | **R0.45** | 0.63 | 30,000 | 275 | 28 | 0.045 | 0.22 | 30,000 | 275 | 28 | 0.045 | 0.22 | 30,000 | 275 | 28 | 0.045 | 0.22 |
| **2010-0070** | **R0.5** | 0.7 | 30,000 | 300 | 30 | 0.05 | 0.25 | 20,000 | 400 | 200 | 0.35 | 0.075 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2020-0140** | **R1** | 1.4 | 30,000 | 300 | 100 | 0.1 | 0.3 | 16,500 | 420 | 210 | 0.25 | 0.1 | 24,000 | 240 | 100 | 0.1 | 0.3 |
| **2030-0210** | **R1.5** | 2.1 | 27,500 | 275 | 140 | 0.125 | 0.33 | 11,000 | 280 | 140 | 0.38 | 0.15 | 24,000 | 240 | 120 | 0.125 | 0.33 |
| **2040-0280** | **R2** | 2.8 | 24,000 | 240 | 120 | 0.15 | 0.35 | 8,250 | 300 | 150 | 0.5 | 0.2 | 24,000 | 240 | 120 | 0.15 | 0.35 |
| **2050-0350** | **R2.5** | 3.5 | 22,000 | 220 | 110 | 0.175 | 0.37 | 6,600 | 330 | 160 | 0.6 | 0.25 | 22,000 | 220 | 110 | 0.175 | 0.37 |
| **2060-0420** | **R3** | 4.2 | 20,000 | 200 | 100 | 0.2 | 0.4 | 5,500 | 280 | 140 | 0.65 | 0.28 | 20,000 | 200 | 100 | 0.2 | 0.4 |

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials.
These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials. For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

※ Feed Rate2: Approach feed rate and contact time on the surface

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

**Refer to page 583-587 for features and milling examples of UDC series.**

## Cemented Carbide Hexalobular milled with UDCB R0.5 x Length of Cut 0.7 VF-20（92.5HRA）

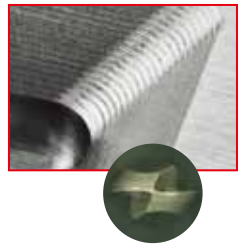
One R0.5 ball end mill removed 91 $mm^3$ of material

Work size: $\phi$9 x Depth 2.2 mm

| | |
|---|---|
| Spindle Speed | 30,000 $min^{-1}$ |
| Feed Rate | 300 mm/min |
| Axial Depth $a_p$ | 0.05 mm |
| Radial Depth $a_e$ | 0.3 mm（Bottom Surface $a_e$=0.05 mm） |
| Coolant | Oil Mist |
| Cycle Time | 39 min |
| Material Removal Amount | 91.7 $mm^3$ 2.35 $mm^3$/min |

## Cemented Carbide Pyramid milled with UDCB R0.5 x Length of Cut 0.7 VM-40（90HRA）

Clean cutter traces ! Equal surface condition !



Work size: 6.6 mm x Depth 1.85 mm

| | |
|---|---|
| Spindle Speed | 30,000 $min^{-1}$ |
| Feed Rate | 300 mm/min |
| Axial Depth $a_p$ | 0.05 mm |
| Radial Depth $a_e$ | 0.25 mm（Bottom Surface $a_e$=0.05 mm） |
| Coolant | Oil Mist |
| Cycle Time | 24 min |
| Material Removal Amount | 41.3 $mm^3$ 1.72 $mm^3$/min |

**UDCB Series**
**VM-40(90HRA)**
**Pyramid Milling Video**

**UDCB Series**
**VF-20(92.5HRA)**
**Hexalobular Milling Video**

Versatile coating !

## Alumina / Zirconia Hexalobular milled with UDCB R0.5 x Length of Cut 0.7

Alumina $Al_2O_3$

Zirconia $ZrO_2$

| | |
|---|---|
| Tool | UDCB 2010-0070 (R0.5 × 0.7) |
| Work Material | Alumina $Al_2O_3$ / Zirconia $ZrO_2$ |
| Spindle Speed | 30,000 $min^{-1}$ |
| Feed Rate | 300 mm/min |
| Axial Depth $a_p$ | 0.05 mm |
| Radial Depth $a_e$ | 0.05 mm |
| Coolant | Air Blow (Nozzle) |
| Cycle Time | 98 min |
| Material Removal Amount | 88.4 $mm^3$ 0.9 $mm^3$/min |

Size : $\phi$ 9 mm x Depth 2.2 mm

Size **R0.1～R3** UDC

# UDCLB

MG | UDC | 0° | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ *1 | | | ☆ | ◎ *2 |

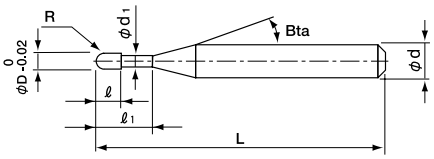
*1 DCB/DCLB series are highly recommended for Glass Filled Plastic milling.
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

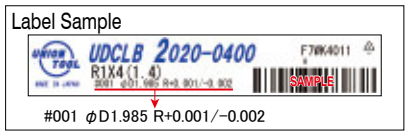
Total 37 models

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **UDCLB 2002-0030** | R0.1 | 0.3 | 0.14 | 0.18 | 16° | 50 | 4 | 39,580 |
| **UDCLB 2002-0050** | | 0.5 | | | | 50 | 4 | 39,580 |
| **UDCLB 2002-0075** | | 0.75 | | | | 50 | 4 | 39,580 |
| **UDCLB 2002-0100** | | 1 | | | | 50 | 4 | 39,580 |
| **UDCLB 2004-0050** | R0.2 | 0.5 | 0.28 | 0.36 | 16° | 50 | 4 | 36,080 |
| **UDCLB 2004-0100** | | 1 | | | | 50 | 4 | 36,080 |
| **UDCLB 2004-0150** | | 1.5 | | | | 50 | 4 | 36,080 |
| **UDCLB 2004-0200** | | 2 | | | | 50 | 4 | 36,080 |
| **UDCLB 2006-0100** | R0.3 | 1 | 0.42 | 0.56 | 16° | 50 | 4 | 32,410 |
| **UDCLB 2006-0150** | | 1.5 | | | | 50 | 4 | 32,410 |
| **UDCLB 2006-0200** | | 2 | | | | 50 | 4 | 32,410 |
| **UDCLB 2006-0300** | | 3 | | | | 50 | 4 | 32,410 |
| **UDCLB 2008-0200** | R0.4 | 2 | 0.56 | 0.76 | 16° | 50 | 4 | 32,410 |
| **UDCLB 2008-0300** | | 3 | | | | 50 | 4 | 32,410 |
| **UDCLB 2008-0400** | | 4 | | | | 50 | 4 | 32,410 |
| **UDCLB 2010-0200** | R0.5 | 2 | 0.7 | 0.96 | 16° | 50 | 4 | 32,410 |
| **UDCLB 2010-0250** | | 2.5 | | | | 50 | 4 | 32,410 |
| **UDCLB 2010-0300** | | 3 | | | | 50 | 4 | 32,410 |
| **UDCLB 2010-0400** | | 4 | | | | 50 | 4 | 32,410 |
| **UDCLB 2010-0500** | | 5 | | | | 50 | 4 | 32,410 |
| **UDCLB 2020-0300** | R1 | 3 | 1.4 | 1.9 | 16° | 50 | 4 | 32,410 |
| **UDCLB 2020-0400** | | 4 | | | | 50 | 4 | 32,410 |
| **UDCLB 2020-0600** | | 6 | | | | 50 | 4 | 32,410 |
| **UDCLB 2020-0800** | | 8 | | | | 50 | 4 | 32,410 |
| **UDCLB 2020-1000** | | 10 | | | | 50 | 4 | 32,410 |
| **UDCLB 2030-0600** | R1.5 | 6 | 2.1 | 2.9 | 16° | 60 | 6 | 35,580 |
| **UDCLB 2030-0800** | | 8 | | | | 60 | 6 | 35,580 |
| **UDCLB 2030-1000** | | 10 | | | | 60 | 6 | 35,580 |
| **UDCLB 2030-1200** | | 12 | | | | 60 | 6 | 35,580 |
| **UDCLB 2030-1400** | | 14 | | | | 60 | 6 | 35,580 |
| **UDCLB 2040-0800** | R2 | 8 | 2.8 | 3.9 | 16° | 60 | 6 | 35,580 |
| **UDCLB 2040-1000** | | 10 | | | | 60 | 6 | 35,580 |
| **UDCLB 2040-1500** | | 15 | | | | 60 | 6 | 35,580 |
| **UDCLB 2050-1000** | R2.5 | 10 | 3.5 | 4.8 | 16° | 60 | 6 | 35,580 |
| **UDCLB 2050-1500** | | 15 | | | | 60 | 6 | 35,580 |
| **UDCLB 2060-1000** | R3 | 10 | 4.2 | 5.7 | — | 60 | 6 | 35,580 |
| **UDCLB 2060-1500** | | 15 | | | | 60 | 6 | 35,580 |

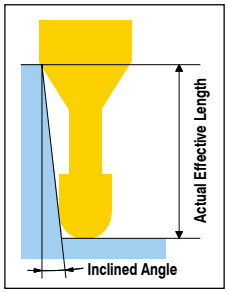
## Features

**Long Neck Ball type End Mills for milling Cemented Carbide and Hard Brittle (Non-Metallic) Materials.**
**Developed to give improved hardness and durability, new Diamond coating also has outstanding adhesion to the cutting tool.**
**By combining the new coating with optimum cutting geometries, the tool "deep cuts" the work piece.**
**Leaves a burr and pit free surface finish on semi-roughing & finishing process.**




Diameter and Ball R accuracy measurements are printed on the label to support High Precision milling.




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

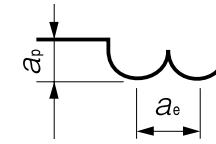
Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|
| | | | 30′ | 1° | 1°30′ | 2° | 3° |
| UDCLB 2002-0030 | R0.1 | 0.3 | 0.30 | 0.31 | 0.32 | 0.32 | 0.34 |
| UDCLB 2002-0050 | | 0.5 | 0.51 | 0.52 | 0.54 | 0.55 | 0.59 |
| UDCLB 2002-0075 | | 0.75 | 0.77 | 0.79 | 0.81 | 0.84 | 0.89 |
| UDCLB 2002-0100 | | 1 | 1.02 | 1.05 | 1.09 | 1.12 | 1.20 |
| UDCLB 2004-0050 | R0.2 | 0.5 | 0.54 | 0.55 | 0.56 | 0.58 | 0.61 |
| UDCLB 2004-0100 | | 1 | 1.06 | 1.08 | 1.12 | 1.15 | 1.22 |
| UDCLB 2004-0150 | | 1.5 | 1.57 | 1.62 | 1.67 | 1.72 | 1.83 |
| UDCLB 2004-0200 | | 2 | 2.09 | 2.15 | 2.22 | 2.29 | 2.44 |
| UDCLB 2006-0100 | R0.3 | 1 | 1.05 | 1.08 | 1.11 | 1.13 | 1.20 |
| UDCLB 2006-0150 | | 1.5 | 1.57 | 1.61 | 1.66 | 1.70 | 1.81 |
| UDCLB 2006-0200 | | 2 | 2.08 | 2.14 | 2.21 | 2.27 | 2.42 |
| UDCLB 2006-0300 | | 3 | 3.12 | 3.21 | 3.31 | 3.41 | 3.65 |
| UDCLB 2008-0200 | R0.4 | 2 | 2.08 | 2.14 | 2.20 | 2.26 | 2.40 |
| UDCLB 2008-0300 | | 3 | 3.11 | 3.20 | 3.30 | 3.40 | 3.62 |
| UDCLB 2008-0400 | | 4 | 4.14 | 4.27 | 4.40 | 4.54 | 4.85 |
| UDCLB 2010-0200 | R0.5 | 2 | 2.08 | 2.13 | 2.19 | 2.25 | 2.38 |
| UDCLB 2010-0250 | | 2.5 | 2.59 | 2.66 | 2.74 | 2.81 | 2.99 |
| UDCLB 2010-0300 | | 3 | 3.11 | 3.20 | 3.29 | 3.38 | 3.60 |
| UDCLB 2010-0400 | | 4 | 4.14 | 4.26 | 4.39 | 4.52 | 4.83 |
| UDCLB 2010-0500 | | 5 | 5.17 | 5.32 | 5.49 | 5.66 | 6.05 |
| UDCLB 2020-0300 | R1 | 3 | 3.20 | 3.27 | 3.35 | 3.43 | 3.62 |
| UDCLB 2020-0400 | | 4 | 4.23 | 4.34 | 4.45 | 4.57 | 4.84 |
| UDCLB 2020-0600 | | 6 | 6.30 | 6.47 | 6.65 | 6.85 | 7.29 |
| UDCLB 2020-0800 | | 8 | 8.36 | 8.60 | 8.85 | 9.13 | 9.74 |
| UDCLB 2020-1000 | | 10 | 10.42 | 10.73 | 11.06 | 11.41 | 12.19 |
| UDCLB 2030-0600 | R1.5 | 6 | 6.28 | 6.44 | 6.60 | 6.78 | 7.18 |
| UDCLB 2030-0800 | | 8 | 8.34 | 8.57 | 8.80 | 9.06 | 9.63 |
| UDCLB 2030-1000 | | 10 | 10.41 | 10.70 | 11.01 | 11.34 | 12.08 |
| UDCLB 2030-1200 | | 12 | 12.47 | 12.83 | 13.21 | 13.61 | 14.52 |
| UDCLB 2030-1400 | | 14 | 14.53 | 14.96 | 15.41 | 15.89 | 16.97 |
| UDCLB 2040-0800 | R2 | 8 | 8.33 | 8.53 | 8.76 | 8.99 | 9.52 |
| UDCLB 2040-1000 | | 10 | 10.39 | 10.66 | 10.96 | 11.27 | 11.97 |
| UDCLB 2040-1500 | | 15 | 15.55 | 15.99 | 16.46 | 16.96 | 18.09 |
| UDCLB 2050-1000 | R2.5 | 10 | 10.55 | 10.82 | 11.10 | 11.40 | 12.07 |
| UDCLB 2050-1500 | | 15 | 15.71 | 16.14 | 16.60 | 17.09 | No Interference |
| UDCLB 2060-1000 | R3 | 10 | No Interference | No Interference | No Interference | No Interference | No Interference |
| UDCLB 2060-1500 | | 15 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for UDCLB

| WORK MATERIAL | | | CEMENTED CARBIDE (≧87HRA) | | | | | CEMENTED CARBIDE (＜87HRA) | | | | | HARD BRITTLE MATERIALS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2002-0030** | **R0.1** | 0.3 | 30,000 | 100 | 10 | 0.01 | 0.01 | 30,000 | 100 | 10 | 0.01 | 0.01 | 30,000 | 100 | 10 | 0.01 | 0.01 |
| **2002-0050** | | 0.5 | 30,000 | 30 | 10 | 0.005 | 0.008 | 30,000 | 30 | 10 | 0.005 | 0.008 | 30,000 | 30 | 10 | 0.005 | 0.008 |
| **2002-0075** | | 0.75 | 30,000 | 30 | 10 | 0.005 | 0.006 | 30,000 | 30 | 10 | 0.005 | 0.006 | 30,000 | 30 | 10 | 0.005 | 0.006 |
| **2002-0100** | | 1 | 30,000 | 25 | 10 | 0.005 | 0.005 | 30,000 | 25 | 10 | 0.005 | 0.005 | 30,000 | 25 | 10 | 0.005 | 0.005 |
| **2004-0050** | **R0.2** | 0.5 | 30,000 | 150 | 15 | 0.02 | 0.08 | 30,000 | 150 | 15 | 0.02 | 0.08 | 30,000 | 150 | 15 | 0.02 | 0.08 |
| **2004-0100** | | 1 | 30,000 | 100 | 10 | 0.015 | 0.07 | 30,000 | 100 | 10 | 0.015 | 0.07 | 30,000 | 100 | 10 | 0.015 | 0.07 |
| **2004-0150** | | 1.5 | 30,000 | 60 | 10 | 0.01 | 0.06 | 30,000 | 60 | 10 | 0.01 | 0.06 | 30,000 | 60 | 10 | 0.01 | 0.06 |
| **2004-0200** | | 2 | 30,000 | 30 | 10 | 0.008 | 0.05 | 30,000 | 30 | 10 | 0.008 | 0.05 | 30,000 | 30 | 10 | 0.008 | 0.05 |
| **2006-0100** | **R0.3** | 1 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 |
| **2006-0150** | | 1.5 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 | 30,000 | 200 | 20 | 0.03 | 0.14 |
| **2006-0200** | | 2 | 30,000 | 150 | 15 | 0.022 | 0.11 | 30,000 | 150 | 15 | 0.022 | 0.11 | 30,000 | 150 | 15 | 0.022 | 0.11 |
| **2006-0300** | | 3 | 30,000 | 75 | 10 | 0.01 | 0.08 | 30,000 | 75 | 10 | 0.01 | 0.08 | 30,000 | 75 | 10 | 0.01 | 0.08 |
| **2008-0200** | **R0.4** | 2 | 30,000 | 250 | 25 | 0.04 | 0.19 | 30,000 | 250 | 25 | 0.04 | 0.19 | 30,000 | 250 | 25 | 0.04 | 0.19 |
| **2008-0300** | | 3 | 30,000 | 230 | 23 | 0.037 | 0.17 | 30,000 | 230 | 23 | 0.037 | 0.17 | 30,000 | 230 | 23 | 0.037 | 0.17 |
| **2008-0400** | | 4 | 30,000 | 210 | 21 | 0.035 | 0.16 | 30,000 | 210 | 21 | 0.035 | 0.16 | 30,000 | 210 | 21 | 0.035 | 0.16 |
| **2010-0200** | **R0.5** | 2 | 30,000 | 300 | 30 | 0.05 | 0.25 | 20,000 | 400 | 200 | 0.35 | 0.075 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2010-0250** | | 2.5 | 30,000 | 300 | 30 | 0.05 | 0.25 | 20,000 | 400 | 200 | 0.35 | 0.075 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2010-0300** | | 3 | 30,000 | 300 | 30 | 0.05 | 0.25 | 20,000 | 400 | 200 | 0.35 | 0.075 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2010-0400** | | 4 | 30,000 | 300 | 30 | 0.05 | 0.25 | 20,000 | 400 | 200 | 0.3 | 0.07 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2010-0500** | | 5 | 30,000 | 300 | 30 | 0.05 | 0.25 | 20,000 | 400 | 200 | 0.3 | 0.07 | 30,000 | 300 | 30 | 0.05 | 0.25 |
| **2020-0300** | **R1** | 3 | 30,000 | 300 | 100 | 0.1 | 0.3 | 16,500 | 420 | 210 | 0.25 | 0.1 | 24,000 | 240 | 100 | 0.1 | 0.3 |
| **2020-0400** | | 4 | 30,000 | 300 | 100 | 0.1 | 0.3 | 16,500 | 420 | 210 | 0.25 | 0.1 | 24,000 | 240 | 100 | 0.1 | 0.3 |
| **2020-0600** | | 6 | 30,000 | 300 | 100 | 0.1 | 0.3 | 16,500 | 420 | 210 | 0.25 | 0.1 | 24,000 | 240 | 100 | 0.1 | 0.3 |
| **2020-0800** | | 8 | 30,000 | 300 | 100 | 0.1 | 0.3 | 16,500 | 420 | 210 | 0.25 | 0.1 | 24,000 | 240 | 100 | 0.1 | 0.3 |
| **2020-1000** | | 10 | 30,000 | 300 | 100 | 0.1 | 0.3 | 16,500 | 420 | 210 | 0.25 | 0.1 | 24,000 | 240 | 100 | 0.1 | 0.3 |
| **2030-0600** | **R1.5** | 6 | 27,500 | 275 | 140 | 0.125 | 0.33 | 11,000 | 280 | 140 | 0.38 | 0.15 | 24,000 | 240 | 120 | 0.125 | 0.33 |
| **2030-0800** | | 8 | 27,500 | 275 | 140 | 0.125 | 0.33 | 11,000 | 280 | 140 | 0.38 | 0.15 | 24,000 | 240 | 120 | 0.125 | 0.33 |
| **2030-1000** | | 10 | 27,500 | 275 | 140 | 0.125 | 0.33 | 11,000 | 280 | 140 | 0.3 | 0.15 | 24,000 | 240 | 120 | 0.125 | 0.33 |
| **2030-1200** | | 12 | 27,500 | 220 | 110 | 0.125 | 0.33 | 11,000 | 280 | 140 | 0.3 | 0.15 | 24,000 | 200 | 100 | 0.125 | 0.33 |
| **2030-1400** | | 14 | 27,500 | 220 | 110 | 0.125 | 0.33 | 11,000 | 280 | 140 | 0.3 | 0.15 | 24,000 | 200 | 100 | 0.125 | 0.33 |
| **2040-0800** | **R2** | 8 | 24,000 | 240 | 120 | 0.15 | 0.35 | 8,250 | 300 | 150 | 0.5 | 0.2 | 24,000 | 240 | 120 | 0.15 | 0.35 |
| **2040-1000** | | 10 | 24,000 | 240 | 120 | 0.15 | 0.35 | 8,250 | 300 | 150 | 0.5 | 0.2 | 24,000 | 240 | 120 | 0.15 | 0.35 |
| **2040-1500** | | 15 | 24,000 | 240 | 120 | 0.15 | 0.35 | 8,250 | 300 | 150 | 0.5 | 0.2 | 24,000 | 240 | 120 | 0.15 | 0.35 |
| **2050-1000** | **R2.5** | 10 | 22,000 | 220 | 110 | 0.175 | 0.37 | 6,600 | 330 | 160 | 0.6 | 0.25 | 22,000 | 220 | 110 | 0.175 | 0.37 |
| **2050-1500** | | 15 | 22,000 | 220 | 110 | 0.175 | 0.37 | 6,600 | 330 | 160 | 0.6 | 0.25 | 22,000 | 220 | 110 | 0.175 | 0.37 |
| **2060-1000** | **R3** | 10 | 20,000 | 200 | 100 | 0.2 | 0.4 | 5,500 | 280 | 140 | 0.65 | 0.28 | 20,000 | 200 | 100 | 0.2 | 0.4 |
| **2060-1500** | | 15 | 20,000 | 200 | 100 | 0.2 | 0.4 | 5,500 | 280 | 140 | 0.65 | 0.28 | 20,000 | 200 | 100 | 0.2 | 0.4 |

These milling parameters are based on VF-20, VM-40, VC-70, VU-70 (TAS standard) for Cemented Carbide, and Alumina for Hard Brittle Materials. These are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials. For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

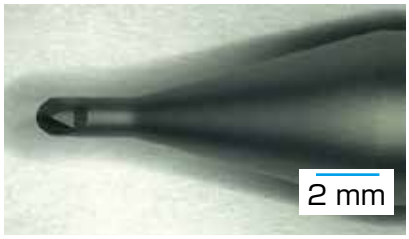
※ Feed Rate 2: Approach feed rate and contact time on the surface.

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Use an inclined or helical approach (Recommended inclination angle: <5 degree).
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

## Cemented Carbide Hexalobular milled with UDCLB R0.5 x Effective Length 2　VF-20（92.5HRA）

Size: ϕ9 x Depth 3.5 mm

| | |
|---|---|
| Tool | UDCLB 2010-0200（R0.5 x 2 mm） |
| Spindle Speed | n=30,000 min$^{-1}$ |
| Feed Rate | Vf=300 mm/min |
| Axial Depth $a_p$ | 0.05 mm |
| Radial Depth $a_e$ | 0.30 mm（Bottom Surface 0.05 mm） |
| Coolant | Air Blow |
| Cycle Time | 64.5 min |
| Material Removal Amount | 164.6 mm$^3$<br>2.57 mm$^3$/min |




**UDCLB Hexalobular Milling Video**

## Cemented Carbide Hexalobular milled with UDCLB R0.5　VF-20（92.5HRA）

Size:
ϕ9 x Depth 6 mm

| | |
|---|---|
| Tool | UDCLB 2010-0200（R0.5 x 2 mm）<br>UDCLB 2010-0500（R0.5 x 5 mm） |
| Spindle Speed | n=30,000 min$^{-1}$ |
| Feed Rate | Vf=300 mm/min |
| Milling Amount | 1. R0.5 x 2 Roughing（～Depth 3.5 mm）<br>$a_p$=0.05 mm $a_e$ =0.3 mm<br>2. R0.5 x 5 Roughing（～Depth 6 mm）<br>$a_p$=0.05 mm $a_e$ =0.25 mm<br>3. R0.5 x 5 Finishing<br>$a_p$=0.03 mm $a_e$ =0.005 mm |
| Coolant | Air Blow |
| Cycle Time | 156 min |
| Material Removal Amount | 274.4 mm$^3$ |

Tool #1 milled depth 3.5 mm.

Tool #2 milled 131.9 mm$^3$ in 76.5 minutes.

Refer to page 583-587 for features and milling examples of UDC series.

Size φ0.3～φ2 UDC

# UDCLRS

MG | UDC | 0° | R | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ *1 | | | ☆ | ◎ *2 |

*1 UDCLRSF series are highly recommended for Glass Filled Plastic milling.
*2 Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

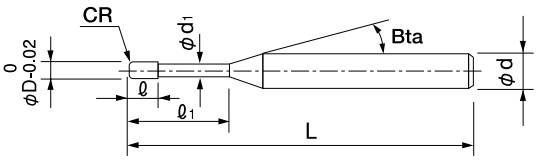
Total 30 models

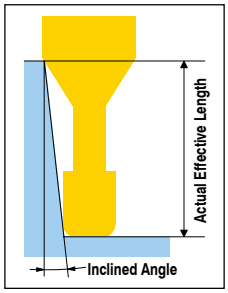
Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| UDCLRS 2003-003-006 | 0.3 | R0.03 | 0.6 | 0.15 | 0.28 | 16° | 50 | 4 | 45,500 |
| UDCLRS 2003-005-006 | | R0.05 | 0.6 | | | | 50 | 4 | 45,500 |
| UDCLRS 2005-003-005 | 0.5 | R0.03 | 0.5 | 0.25 | 0.46 | 16° | 50 | 4 | 43,300 |
| UDCLRS 2005-003-010 | | | 1 | | | | 50 | 4 | 43,300 |
| UDCLRS 2005-005-005 | | R0.05 | 0.5 | | | | 50 | 4 | 43,300 |
| UDCLRS 2005-005-010 | | | 1 | | | | 50 | 4 | 43,300 |
| UDCLRS 2008-003-008 | 0.8 | R0.03 | 0.8 | 0.4 | 0.76 | 16° | 50 | 4 | 38,900 |
| UDCLRS 2008-003-016 | | | 1.6 | | | | 50 | 4 | 38,900 |
| UDCLRS 2008-005-008 | | R0.05 | 0.8 | | | | 50 | 4 | 38,900 |
| UDCLRS 2008-005-016 | | | 1.6 | | | | 50 | 4 | 38,900 |
| UDCLRS 2008-010-008 | | R0.1 | 0.8 | | | | 50 | 4 | 38,900 |
| UDCLRS 2008-010-016 | | | 1.6 | | | | 50 | 4 | 38,900 |
| UDCLRS 2010-003-010 | 1 | R0.03 | 1 | 0.5 | 0.96 | 16° | 50 | 4 | 38,900 |
| UDCLRS 2010-003-020 | | | 2 | | | | 50 | 4 | 38,900 |
| UDCLRS 2010-005-010 | | R0.05 | 1 | | | | 50 | 4 | 38,900 |
| UDCLRS 2010-005-020 | | | 2 | | | | 50 | 4 | 38,900 |
| UDCLRS 2010-010-010 | | R0.1 | 1 | | | | 50 | 4 | 38,900 |
| UDCLRS 2010-010-020 | | | 2 | | | | 50 | 4 | 38,900 |
| UDCLRS 2015-003-015 | 1.5 | R0.03 | 1.5 | 0.75 | 1.44 | 16° | 50 | 4 | 38,900 |
| UDCLRS 2015-003-030 | | | 3 | | | | 50 | 4 | 38,900 |
| UDCLRS 2015-005-015 | | R0.05 | 1.5 | | | | 50 | 4 | 38,900 |
| UDCLRS 2015-005-030 | | | 3 | | | | 50 | 4 | 38,900 |
| UDCLRS 2015-010-015 | | R0.1 | 1.5 | | | | 50 | 4 | 38,900 |
| UDCLRS 2015-010-030 | | | 3 | | | | 50 | 4 | 38,900 |
| UDCLRS 2020-003-020 | 2 | R0.03 | 2 | 1 | 1.9 | 16° | 50 | 4 | 38,900 |
| UDCLRS 2020-003-040 | | | 4 | | | | 50 | 4 | 38,900 |
| UDCLRS 2020-005-020 | | R0.05 | 2 | | | | 50 | 4 | 38,900 |
| UDCLRS 2020-005-040 | | | 4 | | | | 50 | 4 | 38,900 |
| UDCLRS 2020-010-020 | | R0.1 | 2 | | | | 50 | 4 | 38,900 |
| UDCLRS 2020-010-040 | | | 4 | | | | 50 | 4 | 38,900 |

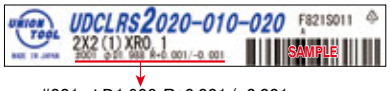
## Features

**UDC offers excellent drilling performance on Cemented Carbide and Hard Brittle (Non-Metallic) Materials.**
**Developed to give improved hardness and durability, the new Diamond coating also has outstanding adhesion to the cutting tool.**
**By combining the new coating with optimum cutting geometries, the tool "deep cuts" the work piece.**
**Leaves a burr and pit free surface finish whether roughing, semi-finishing or finishing.**




Label Sample




#001 φD1.988 R+0.001/−0.001

Diameter and Corner R accuracy measurements are printed on the label to support High Precision milling.

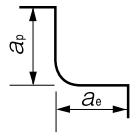
The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Unit (mm)

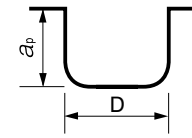
| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30' | 1° | 1° 30' | 2° | 3° |
| UDCLRS 2003-003-006 | 0.3 | R0.03 | 0.6 | 0.61 | 0.63 | 0.65 | 0.67 | 0.72 |
| UDCLRS 2003-005-006 | | R0.05 | 0.6 | 0.61 | 0.63 | 0.65 | 0.67 | 0.72 |
| UDCLRS 2005-003-005 | 0.5 | R0.03 | 0.5 | 0.55 | 0.56 | 0.58 | 0.60 | 0.64 |
| UDCLRS 2005-003-010 | | | 1 | 1.06 | 1.10 | 1.13 | 1.17 | 1.25 |
| UDCLRS 2005-005-005 | | R0.05 | 0.5 | 0.55 | 0.56 | 0.58 | 0.60 | 0.64 |
| UDCLRS 2005-005-010 | | | 1 | 1.06 | 1.09 | 1.13 | 1.17 | 1.25 |
| UDCLRS 2008-003-008 | 0.8 | R0.03 | 0.8 | 0.86 | 0.88 | 0.91 | 0.94 | 1.01 |
| UDCLRS 2008-003-016 | | | 1.6 | 1.68 | 1.73 | 1.79 | 1.85 | 1.99 |
| UDCLRS 2008-005-008 | | R0.05 | 0.8 | 0.85 | 0.88 | 0.91 | 0.94 | 1.01 |
| UDCLRS 2008-005-016 | | | 1.6 | 1.68 | 1.73 | 1.79 | 1.85 | 1.98 |
| UDCLRS 2008-010-008 | | R0.1 | 0.8 | 0.85 | 0.88 | 0.90 | 0.93 | 0.99 |
| UDCLRS 2008-010-016 | | | 1.6 | 1.68 | 1.73 | 1.78 | 1.84 | 1.97 |
| UDCLRS 2010-003-010 | 1 | R0.03 | 1 | 1.06 | 1.10 | 1.13 | 1.17 | 1.25 |
| UDCLRS 2010-003-020 | | | 2 | 2.09 | 2.16 | 2.23 | 2.31 | 2.48 |
| UDCLRS 2010-005-010 | | R0.05 | 1 | 1.06 | 1.09 | 1.13 | 1.17 | 1.25 |
| UDCLRS 2010-005-020 | | | 2 | 2.09 | 2.16 | 2.23 | 2.31 | 2.47 |
| UDCLRS 2010-010-010 | | R0.1 | 1 | 1.06 | 1.09 | 1.12 | 1.16 | 1.24 |
| UDCLRS 2010-010-020 | | | 2 | 2.09 | 2.16 | 2.22 | 2.30 | 2.46 |
| UDCLRS 2015-003-015 | 1.5 | R0.03 | 1.5 | 1.61 | 1.66 | 1.72 | 1.78 | 1.91 |
| UDCLRS 2015-003-030 | | | 3 | 3.16 | 3.26 | 3.37 | 3.49 | 3.74 |
| UDCLRS 2015-005-015 | | R0.05 | 1.5 | 1.61 | 1.66 | 1.72 | 1.78 | 1.90 |
| UDCLRS 2015-005-030 | | | 3 | 3.16 | 3.26 | 3.37 | 3.48 | 3.74 |
| UDCLRS 2015-010-015 | | R0.1 | 1.5 | 1.61 | 1.66 | 1.71 | 1.77 | 1.89 |
| UDCLRS 2015-010-030 | | | 3 | 3.16 | 3.26 | 3.36 | 3.48 | 3.73 |
| UDCLRS 2020-003-020 | 2 | R0.03 | 2 | 2.20 | 2.27 | 2.35 | 2.43 | 2.61 |
| UDCLRS 2020-003-040 | | | 4 | 4.26 | 4.40 | 4.55 | 4.70 | 5.05 |
| UDCLRS 2020-005-020 | | R0.05 | 2 | 2.20 | 2.27 | 2.34 | 2.42 | 2.60 |
| UDCLRS 2020-005-040 | | | 4 | 4.26 | 4.40 | 4.55 | 4.70 | 5.05 |
| UDCLRS 2020-010-020 | | R0.1 | 2 | 2.20 | 2.27 | 2.34 | 2.42 | 2.59 |
| UDCLRS 2020-010-040 | | | 4 | 4.26 | 4.40 | 4.54 | 4.69 | 5.04 |

## Milling Conditions for UDCLRS

| WORK MATERIAL | | CEMENTED CARBIDE(≧87HRA) / HARD BRITTLE MATERIALS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Spindle Speed (min⁻¹) | Z-Level Milling | | | | Flat Milling | | | Side Milling | | | Slotting | |
| | | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2003-003-006** | 30,000 | 220 | 50 | 0.01 | 0.2 | 220 | 0.01 | 0.2 | 110 | 0.05 | 0.001 | 110 | 0.01 |
| **2003-005-006** | 30,000 | 220 | 50 | 0.01 | 0.2 | 220 | 0.01 | 0.2 | 110 | 0.05 | 0.001 | 110 | 0.01 |
| **2005-003-005** | 30,000 | 185 | 90 | 0.01 | 0.4 | 185 | 0.01 | 0.4 | 375 | 0.25 | 0.005 | 375 | 0.01 |
| **2005-003-010** | 30,000 | 185 | 90 | 0.01 | 0.4 | 185 | 0.01 | 0.4 | 180 | 0.125 | 0.005 | 375 | 0.01 |
| **2005-005-005** | 30,000 | 375 | 125 | 0.01 | 0.4 | 375 | 0.01 | 0.4 | 375 | 0.25 | 0.005 | 375 | 0.01 |
| **2005-005-010** | 30,000 | 375 | 125 | 0.01 | 0.4 | 375 | 0.01 | 0.4 | 180 | 0.125 | 0.005 | 375 | 0.01 |
| **2008-003-008** | 30,000 | 185 | 90 | 0.01 | 0.6 | 185 | 0.01 | 0.6 | 600 | 0.4 | 0.008 | 375 | 0.01 |
| **2008-003-016** | 30,000 | 185 | 90 | 0.01 | 0.6 | 185 | 0.01 | 0.6 | 300 | 0.2 | 0.008 | 375 | 0.01 |
| **2008-005-008** | 30,000 | 375 | 150 | 0.01 | 0.6 | 375 | 0.01 | 0.6 | 600 | 0.4 | 0.008 | 375 | 0.01 |
| **2008-005-016** | 30,000 | 375 | 150 | 0.01 | 0.6 | 375 | 0.01 | 0.6 | 300 | 0.2 | 0.008 | 375 | 0.01 |
| **2008-010-008** | 30,000 | 375 | 150 | 0.01 | 0.6 | 375 | 0.01 | 0.6 | 600 | 0.4 | 0.008 | 375 | 0.01 |
| **2008-010-016** | 30,000 | 375 | 150 | 0.01 | 0.6 | 375 | 0.01 | 0.6 | 300 | 0.2 | 0.008 | 375 | 0.01 |
| **2010-003-010** | 30,000 | 185 | 90 | 0.01 | 0.8 | 185 | 0.01 | 0.8 | 750 | 0.5 | 0.01 | 375 | 0.01 |
| **2010-003-020** | 30,000 | 185 | 90 | 0.01 | 0.8 | 185 | 0.01 | 0.8 | 375 | 0.25 | 0.01 | 375 | 0.01 |
| **2010-005-010** | 30,000 | 375 | 185 | 0.01 | 0.8 | 375 | 0.01 | 0.8 | 750 | 0.5 | 0.01 | 375 | 0.01 |
| **2010-005-020** | 30,000 | 375 | 185 | 0.01 | 0.8 | 375 | 0.01 | 0.8 | 375 | 0.25 | 0.01 | 375 | 0.01 |
| **2010-010-010** | 30,000 | 375 | 185 | 0.01 | 0.8 | 375 | 0.01 | 0.8 | 750 | 0.5 | 0.01 | 375 | 0.01 |
| **2010-010-020** | 30,000 | 375 | 185 | 0.01 | 0.8 | 375 | 0.01 | 0.8 | 375 | 0.25 | 0.01 | 375 | 0.01 |
| **2015-003-015** | 25,000 | 185 | 90 | 0.01 | 1.3 | 185 | 0.01 | 1.3 | 750 | 0.75 | 0.01 | 375 | 0.015 |
| **2015-003-030** | 25,000 | 185 | 90 | 0.01 | 1.3 | 185 | 0.01 | 1.3 | 375 | 0.375 | 0.01 | 375 | 0.015 |
| **2015-005-015** | 25,000 | 375 | 125 | 0.015 | 1.3 | 375 | 0.015 | 1.3 | 750 | 0.75 | 0.01 | 375 | 0.015 |
| **2015-005-030** | 25,000 | 375 | 125 | 0.015 | 1.3 | 375 | 0.015 | 1.3 | 375 | 0.375 | 0.01 | 375 | 0.015 |
| **2015-010-015** | 25,000 | 375 | 150 | 0.015 | 1.3 | 375 | 0.015 | 1.3 | 750 | 0.75 | 0.01 | 375 | 0.015 |
| **2015-010-030** | 25,000 | 375 | 150 | 0.015 | 1.3 | 375 | 0.015 | 1.3 | 375 | 0.375 | 0.01 | 375 | 0.015 |
| **2020-003-020** | 20,000 | 185 | 90 | 0.01 | 1.8 | 185 | 0.01 | 1.8 | 750 | 1 | 0.01 | 375 | 0.02 |
| **2020-003-040** | 20,000 | 185 | 90 | 0.01 | 1.8 | 185 | 0.01 | 1.8 | 375 | 0.5 | 0.01 | 375 | 0.02 |
| **2020-005-020** | 20,000 | 375 | 90 | 0.02 | 1.8 | 375 | 0.02 | 1.8 | 750 | 1 | 0.01 | 375 | 0.02 |
| **2020-005-040** | 20,000 | 375 | 90 | 0.02 | 1.8 | 375 | 0.02 | 1.8 | 375 | 0.5 | 0.01 | 375 | 0.02 |
| **2020-010-020** | 20,000 | 375 | 125 | 0.02 | 1.8 | 375 | 0.02 | 1.8 | 750 | 1 | 0.01 | 375 | 0.02 |
| **2020-010-040** | 20,000 | 375 | 125 | 0.02 | 1.8 | 375 | 0.02 | 1.8 | 375 | 0.5 | 0.01 | 375 | 0.02 |




Z-Level / Side / Flat Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

## Milling Conditions for UDCLRS

| WORK MATERIAL | CEMENTED CARBIDE (<87HRA) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Spindle Speed (min$^{-1}$) | Z-Level Milling | | | | Flat Milling | | | Side Milling | | | Slotting | |
| | | Feed Rate (mm/min) | ※Feed Rate 2 (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2003-003-006** | 21,000 | 220 | 50 | 0.01 | 0.2 | 220 | 0.01 | 0.2 | 200 | 0.075 | 0.003 | 200 | 0.01 |
| **2003-005-006** | 21,000 | 220 | 50 | 0.01 | 0.2 | 220 | 0.01 | 0.2 | 200 | 0.075 | 0.003 | 200 | 0.01 |
| **2005-003-005** | 20,000 | 275 | 135 | 0.02 | 0.4 | 275 | 0.02 | 0.4 | 800 | 0.25 | 0.005 | 550 | 0.02 |
| **2005-003-010** | 20,000 | 275 | 135 | 0.02 | 0.4 | 275 | 0.02 | 0.4 | 400 | 0.125 | 0.005 | 550 | 0.02 |
| **2005-005-005** | 20,000 | 550 | 180 | 0.02 | 0.4 | 550 | 0.02 | 0.4 | 800 | 0.25 | 0.005 | 550 | 0.02 |
| **2005-005-010** | 20,000 | 550 | 180 | 0.02 | 0.4 | 550 | 0.02 | 0.4 | 400 | 0.125 | 0.005 | 550 | 0.02 |
| **2008-003-008** | 19,000 | 290 | 145 | 0.02 | 0.6 | 290 | 0.02 | 0.6 | 1,200 | 0.4 | 0.008 | 580 | 0.025 |
| **2008-003-016** | 19,000 | 290 | 145 | 0.02 | 0.6 | 290 | 0.02 | 0.6 | 600 | 0.2 | 0.008 | 580 | 0.025 |
| **2008-005-008** | 19,000 | 580 | 190 | 0.025 | 0.6 | 580 | 0.025 | 0.6 | 1,200 | 0.4 | 0.008 | 580 | 0.025 |
| **2008-005-016** | 19,000 | 580 | 190 | 0.025 | 0.6 | 580 | 0.025 | 0.6 | 600 | 0.2 | 0.008 | 580 | 0.025 |
| **2008-010-008** | 19,000 | 580 | 190 | 0.025 | 0.6 | 580 | 0.025 | 0.6 | 1,200 | 0.4 | 0.008 | 580 | 0.025 |
| **2008-010-016** | 19,000 | 580 | 190 | 0.025 | 0.6 | 580 | 0.025 | 0.6 | 600 | 0.2 | 0.008 | 580 | 0.025 |
| **2010-003-010** | 18,250 | 300 | 150 | 0.02 | 0.8 | 300 | 0.02 | 0.8 | 1,440 | 0.5 | 0.01 | 600 | 0.025 |
| **2010-003-020** | 18,250 | 300 | 150 | 0.02 | 0.8 | 300 | 0.02 | 0.8 | 720 | 0.25 | 0.01 | 600 | 0.025 |
| **2010-005-010** | 18,250 | 600 | 200 | 0.025 | 0.8 | 600 | 0.025 | 0.8 | 1,440 | 0.5 | 0.01 | 600 | 0.025 |
| **2010-005-020** | 18,250 | 600 | 200 | 0.025 | 0.8 | 600 | 0.025 | 0.8 | 720 | 0.25 | 0.01 | 600 | 0.025 |
| **2010-010-010** | 18,250 | 600 | 200 | 0.025 | 0.8 | 600 | 0.025 | 0.8 | 1,440 | 0.5 | 0.01 | 600 | 0.025 |
| **2010-010-020** | 18,250 | 600 | 200 | 0.025 | 0.8 | 600 | 0.025 | 0.8 | 720 | 0.25 | 0.01 | 600 | 0.025 |
| **2015-003-015** | 16,500 | 325 | 160 | 0.02 | 1.3 | 325 | 0.02 | 1.3 | 1,440 | 0.75 | 0.01 | 650 | 0.035 |
| **2015-003-030** | 16,500 | 325 | 160 | 0.02 | 1.3 | 325 | 0.02 | 1.3 | 720 | 0.375 | 0.01 | 650 | 0.035 |
| **2015-005-015** | 16,500 | 650 | 210 | 0.035 | 1.3 | 650 | 0.035 | 1.3 | 1,440 | 0.75 | 0.01 | 650 | 0.035 |
| **2015-005-030** | 16,500 | 650 | 210 | 0.035 | 1.3 | 650 | 0.035 | 1.3 | 720 | 0.375 | 0.01 | 650 | 0.035 |
| **2015-010-015** | 16,500 | 650 | 210 | 0.035 | 1.3 | 650 | 0.035 | 1.3 | 1,440 | 0.75 | 0.01 | 650 | 0.035 |
| **2015-010-030** | 16,500 | 650 | 210 | 0.035 | 1.3 | 650 | 0.035 | 1.3 | 720 | 0.375 | 0.01 | 650 | 0.035 |
| **2020-003-020** | 15,000 | 360 | 180 | 0.02 | 1.8 | 360 | 0.02 | 1.8 | 1,440 | 1 | 0.01 | 720 | 0.05 |
| **2020-003-040** | 15,000 | 360 | 180 | 0.02 | 1.8 | 360 | 0.02 | 1.8 | 1,440 | 1 | 0.01 | 720 | 0.05 |
| **2020-005-020** | 15,000 | 720 | 240 | 0.05 | 1.8 | 720 | 0.05 | 1.8 | 1,440 | 1 | 0.01 | 720 | 0.05 |
| **2020-005-040** | 15,000 | 720 | 240 | 0.05 | 1.8 | 720 | 0.05 | 1.8 | 1,440 | 1 | 0.01 | 720 | 0.05 |
| **2020-010-020** | 15,000 | 720 | 240 | 0.05 | 1.8 | 720 | 0.05 | 1.8 | 1,440 | 1 | 0.01 | 720 | 0.05 |
| **2020-010-040** | 15,000 | 720 | 240 | 0.05 | 1.8 | 720 | 0.05 | 1.8 | 1,440 | 1 | 0.01 | 720 | 0.05 |

These milling parameters are based on VF-20, VM-40, VU-70 (TAS standard) and are for reference only.
Tool life may differ depending on the type of Cemented Carbide / Hard Brittle Materials.
For best result, fine parameter adjustments may be required, depending on the materials of Cemented Carbide / Hard Brittle Materials; milling shape and strategy; machine rigidity and spindle capability.

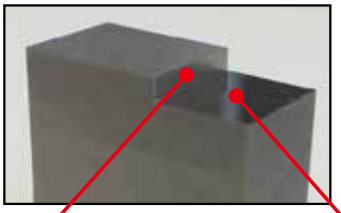
※Feed Rate 2: Approach feed rate and contact time on the surface.

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Does not require to be slowed down in the approach sequence when slotting and side milling.
- Use an inclined or helical approach when Z-level milling (Recommended inclination angle: <1 degree).
- For flat and side milling, set the axial depth (ap) and radial depth (ae) to allow for the uncut material of the corner radius.
- Decrease both spindle speed and feed rate proportionally.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

**Refer to page 583-587 for features and milling examples of UDC series.**

## Cemented Carbide Milling Example UDCLRS 2020-005-020 (ϕ2 × CR0.05 × 2) VM-40 (90HRA)

### Work sample after finishing



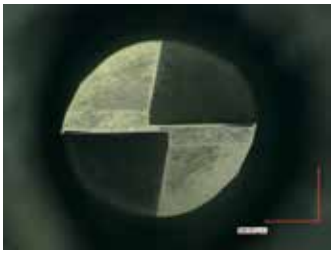
Ra : 0.069 μm
Rz : 0.535 μm
Cut-off length : 0.25 mm

Ra : 0.010 μm (10 nm)
Rz : 0.078 μm (78 nm)
Cut-off length: 0.08 mm

### Bottom Surface Quality

Mirror surface finish
with zero pits!

### After Finishing



UDCLRS
Side Milling Video

| Milling Conditions | Roughing Parameter | Finishing Parameter |
|---|---|---|
| Spindle Speed | 20,000 $min^{-1}$ | 20,000 $min^{-1}$ |
| XY Feed Rate | 750 mm/min | 100 mm/min |
| Axial Depth $a_p$ | 0.9 mm | 0.01 mm Bottom Surface<br>0.9 mm Side |
| Radial Depth $a_e$ | 0.01 mm | 0.01 mm |
| Coolant | Air Blow | Oil Mist |
| Milling Size | 10 mm × 8 mm × 1.8 mm | 0.01 mm Bottom Surface<br>0.05 mm Side<br>(0.01 mm × 5 Times) |
| Milling Distance | 16 m | — |
| Material Removal Volume | 144 $mm^3$ | — |

* One End Mill was used for both the roughing and finishing processes.

Overhang : 15 mm

Size φ0.3～φ7 UDC

# UDCMX

MG | UDC | 30° | X Thinning | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ◎ | | | ☆ | ◎ * |

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses and etc.

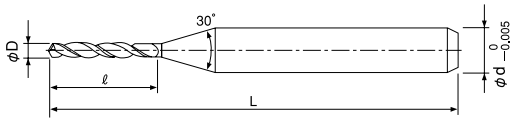
## Features

**UDC offers excellent drilling performance on Cemented Carbide and Hard Brittle (Non-Metallic) Materials.**
**By combining the new coating with optimum tool geometry, the tool improves hole quality and longer tool life.**
**Makes mechanical drilling cost competitive!**

Label Sample

#001 φD5.999

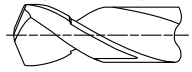
Measured diameter is printed on the label.




**Point Angle : 130°**
**Diameter Tolerance : 0/-0.02 (D ≦ 3.5)**
**0/-0.025 (D ≧ 4)**

**Under-cut type**

Enlarged tip drawing



Total 35 models

Unit (mm)

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ | Cemented Carbide Spindle Speed (min⁻¹) | Cemented Carbide Feed Rate (mm/min) | Cemented Carbide Peck Amount (mm) |
|---|---|---|---|---|---|---|---|---|
| **UDCMX 2030-030** | 0.3 | 3 | 38 | 3 | 18,000 | 28,750 | 5 | 0.05 |
| **UDCMX 2040-040** | 0.4 | 4 | 38 | 3 | 18,000 | 20,000 | 5 | 0.05 |
| **UDCMX 2050-050** | 0.5 | 5 | 38 | 3 | 18,000 | 15,000 | 5 | 0.05 |
| **UDCMX 2060-060** | 0.6 | 6 | 38 | 3 | 18,000 | 11,500 | 5 | 0.05 |
| **UDCMX 2070-070** | 0.7 | 7 | 38 | 3 | 18,000 | 9,000 | 5 | 0.05 |
| **UDCMX 2080-080** | 0.8 | 8 | 38 | 3 | 18,000 | 7,300 | 7.5 | 0.05 |
| **UDCMX 2090-090** | 0.9 | 9 | 38 | 3 | 18,000 | 6,000 | 7.5 | 0.05 |
| **UDCMX 2100-100** | 1 | 10 | 38 | 3 | 18,000 | 5,000 | 7.5 | 0.05 |
| **UDCMX 2110-100** | 1.1 | 10 | 38 | 3 | 18,000 | 4,500 | 7.2 | 0.06 |
| **UDCMX 2120-100** | 1.2 | 10 | 38 | 3 | 18,000 | 4,100 | 6.8 | 0.07 |
| **UDCMX 2130-100** | 1.3 | 10 | 38 | 3 | 18,000 | 3,750 | 6.5 | 0.08 |
| **UDCMX 2140-100** | 1.4 | 10 | 38 | 3 | 18,000 | 3,450 | 6.2 | 0.09 |

Next Page ➡

Unit (mm)

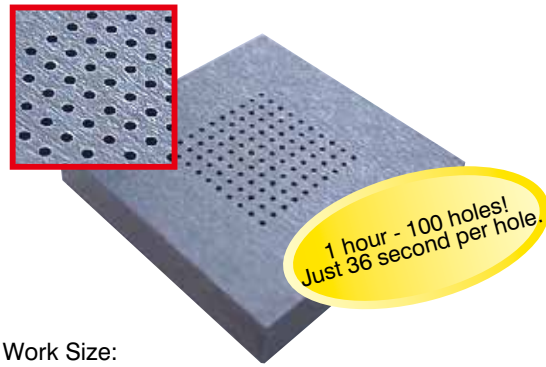
| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ | Cemented Carbide | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Peck Amount (mm) |
| **UDCMX 2150-100** | 1.5 | 10 | 38 | 3 | 18,000 | 3,200 | 6 | 0.1 |
| **UDCMX 2160-100** | 1.6 | 10 | 38 | 3 | 18,000 | 3,000 | 6 | 0.1 |
| **UDCMX 2170-100** | 1.7 | 10 | 38 | 3 | 18,000 | 2,850 | 5.8 | 0.1 |
| **UDCMX 2180-100** | 1.8 | 10 | 38 | 3 | 18,000 | 2,700 | 5.5 | 0.1 |
| **UDCMX 2190-100** | 1.9 | 10 | 38 | 3 | 18,000 | 2,550 | 5.3 | 0.1 |
| **UDCMX 2200-100** | 2 | 10 | 38 | 3 | 18,000 | 2,400 | 5 | 0.15 |
| **UDCMX 2210-100** | 2.1 | 10 | 38 | 3 | 18,000 | 2,300 | 5 | 0.15 |
| **UDCMX 2220-100** | 2.2 | 10 | 38 | 3 | 18,000 | 2,225 | 5 | 0.15 |
| **UDCMX 2230-100** | 2.3 | 10 | 38 | 3 | 18,000 | 2,150 | 5 | 0.15 |
| **UDCMX 2240-100** | 2.4 | 10 | 38 | 3 | 18,000 | 2,075 | 5 | 0.15 |
| **UDCMX 2250-100** | 2.5 | 10 | 38 | 3 | 18,000 | 2,000 | 5 | 0.2 |
| **UDCMX 2300-100** | 3 | 10 | 38 | 3 | 18,000 | 1,100 | 3.7 | 0.25 |
| **UDCMX 2330-120** | 3.3 | 12 | 50 | 4 | 20,000 | 1,000 | 3.4 | 0.3 |
| **UDCMX 2350-120** | 3.5 | 12 | 50 | 4 | 20,000 | 910 | 3.3 | 0.35 |
| **UDCMX 2400-160** | 4 | 16 | 60 | 6 | 35,500 | 4,000 | 6.9 | Single-Shot |
| **UDCMX 2420-160** | 4.2 | 16 | 60 | 6 | 35,500 | 4,000 | 7.3 | Single-Shot |
| **UDCMX 2450-200** | 4.5 | 20 | 60 | 6 | 35,500 | 4,000 | 7.8 | Single-Shot |
| **UDCMX 2500-200** | 5 | 20 | 60 | 6 | 35,500 | 4,000 | 8.7 | Single-Shot |
| **UDCMX 2550-250** | 5.5 | 25 | 80 | 6 | 38,000 | 4,000 | 9.6 | Single-Shot |
| **UDCMX 2600-250** | 6 | 25 | 80 | 6 | 38,000 | 4,000 | 10.5 | Single-Shot |
| **UDCMX 2650-250** | 6.5 | 25 | 80 | 8 | 48,000 | 4,000 | 11.5 | Single-Shot |
| **UDCMX 2680-250** | 6.8 | 25 | 80 | 8 | 52,000 | 4,000 | 12 | Single-Shot |
| **UDCMX 2700-250** | 7 | 25 | 80 | 8 | 52,000 | 4,000 | 12.4 | Single-Shot |

These milling parameters are based on VM-40 (TAS standard) and are for reference only.
Tool life may differ depending on the type of Cemented Carbide material.
For best results, fine parameter adjustments may be required, depending on the Carbide material; milling shape and strategy; machine rigidity and spindle capability.

Note:
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Recommend shallower drilling than flute length to promote good chip evacuation.
- Recommend using peck drilling cycle, but single-shot drilling may extend the tool life in some cases.
- Recommend air blow.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.
- Peck drilling is required depending on the hole quality & hole-edge chipping.
- We recommend to avoid operating the machine unattended when using large size tools with high MRR (Material Removal Rate) per hole. Rapid tool wear, sudden tool damage or breakage might occur depending on the processing environment.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.

# Drilling Cemented Carbide - Stunning!

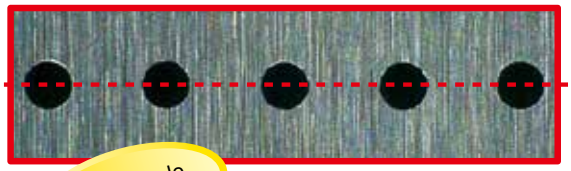
## Cemented Carbide One-shot drilled with UDCMX $\phi$0.4 x 4 mm VM-40 (90HRA)




Work Size:
20 mm × 20 mm × 3 mm

| | |
|---|---|
| Tool | UDCMX 2040-040 |
| Spindle Speed | 20,000 min$^{-1}$ |
| Feed Rate | 5 mm/min |
| Peck Amount | One-shot |
| Coolant | Air Blow (Nozzle) |
| Hole Specification | Blind Hole (Depth 2.8 mm x 100 holes) |
| Hole Pitch | 1 mm |
| Cycle Time | 36 sec per hole |

Hole Quality after drilling 100 holes



UDCMX Drilling Video

Size M2～M8 UDC

# UDCT

MG UDC Shank Dia 0/-0.005

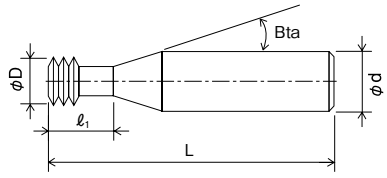
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | ○ | | | ☆ | ◎ * |

* Hard Brittle (Non-Metallic) Materials: Ceramics (Alumina, Zirconia, etc.), Glasses etc.

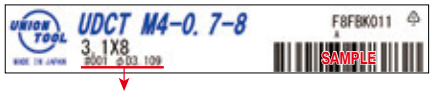
## Features

**Thread Mills for Cemented Carbide and Hard Brittle (Non-Metallic) Materials.**
**Direct milling offers higher efficiency and precision comparing to EDM and grinding process.**
**Developed to give improved hardness and durability, UDC also has outstanding adhesion to the tool.**
**UDC series End Mills and Drills are recommended to drill holes before threading.**




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

Label Sample




#001 φD3.109

Measured diameter is printed on the label.

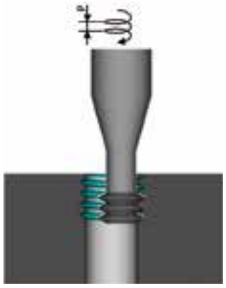
Total 10 models

Unit (mm)

| Model Number | Thread Diameter M | Pitch P | Tool Diameter φD | Number of Flutes | Effective Length ℓ1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| **UDCT M2-0.4-4** | M2 | 0.4 | 1.5 | 2 | 4 | 16° | 50 | 4 | 38,900 |
| **UDCT M2.5-0.45-5** | M2.5 | 0.45 | 1.9 | 2 | 5 | 16° | 50 | 4 | 38,900 |
| **UDCT M3-0.5-6** | M3 | 0.5 | 2.4 | 2 | 6 | 16° | 50 | 4 | 38,900 |
| **UDCT M4-0.7-8** | M4 | 0.7 | 3.1 | 2 | 8 | 16° | 50 | 4 | 38,900 |
| **UDCT M5-0.8-10** | M5 | 0.8 | 3.9 | 2 | 10 | 16° | 60 | 6 | 42,800 |
| **UDCT M5-0.8-15** | | | | | 15 | | 60 | 6 | 42,800 |
| **UDCT M6-1-12** | M6 | 1 | 4.6 | 2 | 12 | 16° | 60 | 6 | 42,800 |
| **UDCT M6-1-18** | | | | | 18 | | 60 | 6 | 42,800 |
| **UDCT M8-1.25-16** | M8 | 1.25 | 5.9 | 2 | 16 | 16° | 60 | 6 | 42,800 |
| **UDCT M8-1.25-24** | | | | | 24 | | 60 | 6 | 42,800 |

## Milling Conditions for UDCT

| WORK MATERIAL | | | | | CEMENTED CARBIDE | | |
|---|---|---|---|---|---|---|---|
| Model Number | Thread Diameter M | Pitch P | Tool Diameter φD | Effective Length ℓ1 | Recommended Pilot Hole Diameter (mm) | Spindle Speed ($mm^{-1}$) | Feed Rate (mm/min) |
| **M2-0.4-4** | M2 | 0.4 | 1.5 | 4 | φ1.6 | 20,000 | 3 |
| **M2.5-0.45-5** | M2.5 | 0.45 | 1.9 | 5 | φ2.1 | 20,000 | 3 |
| **M3-0.5-6** | M3 | 0.5 | 2.4 | 6 | φ2.5 | 20,000 | 3 |
| **M4-0.7-8** | M4 | 0.7 | 3.1 | 8 | φ3.3 | 10,050 | 30 |
| **M5-0.8-10** | M5 | 0.8 | 3.9 | 10 | φ4.2 | 8,000 | 30 |
| **M5-0.8-15** | | | | 15 | | | |
| **M6-1-12** | M6 | 1 | 4.6 | 12 | φ5 | 6,800 | 30 |
| **M6-1-18** | | | | 18 | | | |
| **M8-1.25-16** | M8 | 1.25 | 5.9 | 16 | φ6.8 | 3,500 | 20 |
| **M8-1.25-24** | | | | 24 | | | |



* Revised and reduced the spindle speed and feed rate for better tool life.
* These milling parameters are based on VM-40 (TAS standard) and are for reference only.
Tool life may differ depending on the type of Cemented Carbide material.
For best results, fine parameter adjustments may be required, depending on the Carbide material; milling shape and strategy; machine rigidity and spindle capability.

Note:
- This application requires a high cutting force. A machine with poor rigidity and high vibration is not recommended.
- Use a machine equipped with helical interpolating functions.
- Allow sufficient machine and spindle warm-up time for stability and to remove any expansion of the main spindle before running the program.
- Tool setting length should achieve the least possible overhang.
- Avoid contact with the coated area of the shank. This will prevent tip vibration and tool jamming in the collet / holder.
- Run-out and vibration should be checked dynamically at the tool point while mounted in the machine and both should achieve the lowest level possible.
- Decrease both spindle speed and feed rate proportionally.
- The feed rate is measured at the center of the tool.
- The radial cutting depth is recommended to cut all at once. Do not cut several times.
- Adjust turning radius amount to meet required internal thread precision.
- Air blow is highly recommended for longer tool life. Both oil mist and oil coolant are alternatives.
- Recommend water soluble coolant for Hard Brittle (Non-Metallic) Materials.
- When milling some work pieces, heavier chips may be created. To evacuate these chips it is important to accurately position the coolant nozzle on the milling part.
- Remove chips to prevent heat generation and ignition during milling process.
- Protective gear, such as safety glasses and face guards are required when milling.
- Chips / dust generated while milling can have adverse affects on the machine parts if they are not properly evacuated. Take steps to assure proper evacuation.

## "Direct Drilling & Thread Milling" on Cemented Carbide!!

**Cemented Carbide UDCMX φ2.5 (Hole Before Threading) + UDCT M3 (Thread Milling) VM-40 (90HRA)**

After drilling Holes before threading

After thread milling

Work Size:
20 mm × 20 mm ×10 mm

| | Hole Before Threading | Thread Milling |
|---|---|---|
| Tool | UDCMX 2250-100 | UDCT M3-0.5-6 |
| Spindle Speed | 2,000 $min^{-1}$ | 20,000 $min^{-1}$ |
| Feed Rate | 5 mm/min | 3 mm/min |
| Peck Amount | 0.5 mm | — |
| Coolant | Air Blow (Nozzle) | |
| Hole Specification | Blind Hole Depth 8 mm x 16 holes | Depth 6 mm x 16 holes |
| Cycle Time | 2 min 2 sec per hole | 9 min 15 sec per hole |

### New standard for Cemented Carbide Processing

- Cracks are minimized.
- Time and cost savings comparing to EDM process.
- Highly precise thread geometry generated by single path threading.

Size **R0.05～R1**

# CBN-LBSF

CBN | 20° | R ±0.002 | Shank Dia 0/-0.004 | Back Taper Geometry

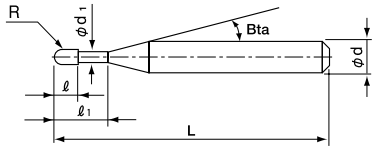
Patent pending

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ ～68HRC | | | | | | | | | | |

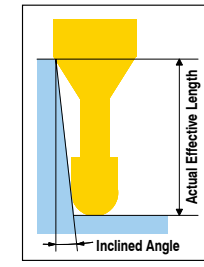
## Features

**Optimized CBN material for milling the ultra-hard materials, with excellent wear resistance and chipping resistance offers long tool life.**
**Improved milling surface by the original flute design.**
**For higher precision and better surface finish.**
**Highly precision shank diameter tolerance, 0/-0.004 mm.**
**Ball radius accuracy ± 0.002 mm based on Nominal Radius.**
**※ Based on Nominal Radius : Directly input the catalogue ball radius rate into the CAM for higher precision milling.**



Ball R accuracy measurements are printed on the label to support High Precision milling.

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




Total 36 models

*Shank taper angle Bta is only for reference.

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CBN-LBSF 2001-003** | R0.05 | 0.3 | 0.07 | 0.09 | 15° | 50 | 4 | 46,700 | 0.30 | 0.30 | 0.30 | 0.30 | 0.33 |
| **CBN-LBSF 2001-005** | | 0.5 | | | | 50 | 4 | 48,600 | 0.50 | 0.50 | 0.51 | 0.53 | 0.57 |
| **CBN-LBSF 20015-0045** | R0.075 | 0.45 | 0.1 | 0.14 | 15° | 50 | 4 | 46,700 | 0.45 | 0.45 | 0.46 | 0.48 | 0.51 |
| **CBN-LBSF 20015-0075** | | 0.75 | | | | 50 | 4 | 48,600 | 0.75 | 0.76 | 0.78 | 0.81 | 0.88 |
| **CBN-LBSF 2002-003** | R0.1 | 0.3 | 0.13 | 0.19 | 15° | 50 | 4 | 35,000 | 0.30 | 0.30 | 0.30 | 0.30 | 0.32 |
| **CBN-LBSF 2002-006** | | 0.6 | | | | 50 | 4 | 35,000 | 0.60 | 0.60 | 0.62 | 0.64 | 0.69 |

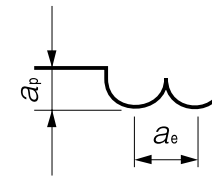
Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CBN-LBSF 2003-005 | R0.15 | 0.5 | 0.22 | 0.28 | 15° | 50 | 4 | 33,900 | 0.51 | 0.53 | 0.54 | 0.56 | 0.60 |
| CBN-LBSF 2003-0075 | | 0.75 | | | | 50 | 4 | 34,400 | 0.77 | 0.79 | 0.82 | 0.85 | 0.91 |
| CBN-LBSF 2003-009 | | 0.9 | | | | 50 | 4 | 35,000 | 0.91 | 0.94 | 0.97 | 1.01 | 1.08 |
| CBN-LBSF 2004-0075 | R0.2 | 0.75 | 0.32 | 0.38 | 15° | 50 | 4 | 30,600 | 0.77 | 0.79 | 0.81 | 0.84 | 0.90 |
| CBN-LBSF 2004-010 | | 1 | | | | 50 | 4 | 31,200 | 1.03 | 1.06 | 1.09 | 1.13 | 1.21 |
| CBN-LBSF 2004-012 | | 1.2 | | | | 50 | 4 | 31,700 | 1.22 | 1.26 | 1.30 | 1.35 | 1.44 |
| CBN-LBSF 2005-010 | R0.25 | 1 | 0.4 | 0.48 | 15° | 50 | 4 | 31,200 | 1.01 | 1.04 | 1.07 | 1.11 | 1.18 |
| CBN-LBSF 2005-015 | | 1.5 | | | | 50 | 4 | 32,200 | 1.53 | 1.58 | 1.63 | 1.68 | 1.80 |
| CBN-LBSF 2006-010 | R0.3 | 1 | 0.48 | 0.58 | 15° | 50 | 4 | 28,700 | 1.01 | 1.04 | 1.07 | 1.10 | 1.17 |
| CBN-LBSF 2006-015 | | 1.5 | | | | 50 | 4 | 29,300 | 1.53 | 1.57 | 1.62 | 1.68 | 1.79 |
| CBN-LBSF 2006-020 | | 2 | | | | 50 | 4 | 29,300 | 2.05 | 2.11 | 2.18 | 2.25 | 2.41 |
| CBN-LBSF 2008-020 | R0.4 | 2 | 0.6 | 0.78 | 15° | 50 | 4 | 29,300 | 2.04 | 2.10 | 2.17 | 2.24 | 2.39 |
| CBN-LBSF 2008-040 | | 4 | | | | 50 | 4 | 31,240 | 4.11 | 4.24 | 4.38 | 4.54 | 4.88 |
| CBN-LBSF 2010-015 | R0.5 | 1.5 | 0.7 | 0.98 | 15° | 50 | 4 | 28,700 | 1.53 | 1.57 | 1.61 | 1.66 | 1.76 |
| CBN-LBSF 2010-020 | | 2 | | | | 50 | 4 | 28,700 | 2.05 | 2.11 | 2.17 | 2.23 | 2.38 |
| CBN-LBSF 2010-025 | | 2.5 | | | | 50 | 4 | 29,300 | 2.57 | 2.64 | 2.72 | 2.81 | 3.00 |
| CBN-LBSF 2010-030 | | 3 | | | | 50 | 4 | 29,300 | 3.09 | 3.18 | 3.28 | 3.38 | 3.62 |
| CBN-LBSF 2010-040 | | 4 | | | | 50 | 4 | 31,200 | 4.12 | 4.25 | 4.38 | 4.53 | 4.87 |
| CBN-LBSF 2010-060 | | 6 | | | | 50 | 4 | 31,200 | 6.19 | 6.39 | 6.60 | 6.83 | 7.35 |
| CBN-LBSF 2015-025 | R0.75 | 2.5 | 0.9 | 1.46 | 15° | 50 | 4 | 30,000 | 2.60 | 2.67 | 2.74 | 2.81 | 2.99 |
| CBN-LBSF 2015-030 | | 3 | | | | 50 | 4 | 30,000 | 3.12 | 3.20 | 3.29 | 3.39 | 3.61 |
| CBN-LBSF 2015-038 | | 3.8 | | | | 50 | 4 | 30,500 | 3.94 | 4.06 | 4.18 | 4.31 | 4.61 |
| CBN-LBSF 2015-060 | | 6 | | | | 50 | 4 | 30,500 | 6.22 | 6.41 | 6.62 | 6.84 | 7.34 |
| CBN-LBSF 2015-080 | | 8 | | | | 50 | 4 | 33,200 | 8.28 | 8.55 | 8.83 | 9.14 | 9.83 |
| CBN-LBSF 2020-030 | R1 | 3 | 1.2 | 1.97 | 15° | 50 | 4 | 30,500 | 3.09 | 3.16 | 3.24 | 3.33 | 3.53 |
| CBN-LBSF 2020-040 | | 4 | | | | 50 | 4 | 30,500 | 4.12 | 4.23 | 4.35 | 4.48 | 4.77 |
| CBN-LBSF 2020-050 | | 5 | | | | 50 | 4 | 30,500 | 5.16 | 5.30 | 5.46 | 5.63 | 6.01 |
| CBN-LBSF 2020-060 | | 6 | | | | 50 | 4 | 32,200 | 6.19 | 6.37 | 6.57 | 6.78 | 7.26 |
| CBN-LBSF 2020-080 | | 8 | | | | 50 | 4 | 33,200 | 8.26 | 8.51 | 8.79 | 9.08 | 9.74 |
| CBN-LBSF 2020-100 | | 10 | | | | 50 | 4 | 33,600 | 10.32 | 10.65 | 11.00 | 11.38 | 12.23 |

## Milling Conditions for CBN-LBSF

| WORK MATERIAL | | | HEAT-TREATED STEELS / HARDENED STEELS STAVAX / ELMAX / HAP10 / HAP72 (~68HRC) | | | |
|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2001-003** | **R0.05** | 0.3 | 30,000 | 70 | 0.003MAX | 0.006MAX |
| **2001-005** | | 0.5 | 30,000 | 70 | 0.002MAX | 0.006MAX |
| **20015-0045** | **R0.075** | 0.45 | 30,000 | 150 | 0.004MAX | 0.008MAX |
| **20015-0075** | | 0.75 | 30,000 | 125 | 0.004MAX | 0.008MAX |
| **2002-003** | **R0.1** | 0.3 | 30,000 | 240 | 0.005MAX | 0.01 MAX |
| **2002-006** | | 0.6 | 30,000 | 200 | 0.005MAX | 0.01 MAX |
| **2003-005** | **R0.15** | 0.5 | 30,000 | 300 | 0.005MAX | 0.01 MAX |
| **2003-0075** | | 0.75 | 30,000 | 250 | 0.005MAX | 0.01 MAX |
| **2003-009** | | 0.9 | 30,000 | 250 | 0.005MAX | 0.01 MAX |
| **2004-0075** | **R0.2** | 0.75 | 30,000 | 360 | 0.005MAX | 0.01 MAX |
| **2004-010** | | 1 | 30,000 | 300 | 0.005MAX | 0.01 MAX |
| **2004-012** | | 1.2 | 30,000 | 300 | 0.005MAX | 0.01 MAX |
| **2005-010** | **R0.25** | 1 | 30,000 | 420 | 0.005MAX | 0.01 MAX |
| **2005-015** | | 1.5 | 30,000 | 350 | 0.005MAX | 0.01 MAX |
| **2006-010** | **R0.3** | 1 | 30,000 | 500 | 0.01 MAX | 0.015MAX |
| **2006-015** | | 1.5 | 30,000 | 500 | 0.01 MAX | 0.015MAX |
| **2006-020** | | 2 | 30,000 | 350 | 0.01 MAX | 0.015MAX |
| **2008-020** | **R0.4** | 2 | 30,000 | 620 | 0.01 MAX | 0.015MAX |
| **2008-040** | | 4 | 30,000 | 420 | 0.01 MAX | 0.015MAX |
| **2010-015** | **R0.5** | 1.5 | 30,000 | 750 | 0.01 MAX | 0.02 MAX |
| **2010-020** | | 2 | 30,000 | 750 | 0.01 MAX | 0.02 MAX |
| **2010-025** | | 2.5 | 30,000 | 750 | 0.01 MAX | 0.02 MAX |
| **2010-030** | | 3 | 30,000 | 500 | 0.01 MAX | 0.02 MAX |
| **2010-040** | | 4 | 30,000 | 500 | 0.01 MAX | 0.02 MAX |
| **2010-060** | | 6 | 30,000 | 330 | 0.01 MAX | 0.02 MAX |
| **2015-025** | **R0.75** | 2.5 | 20,000 | 750 | 0.01 MAX | 0.02 MAX |
| **2015-030** | | 3 | 20,000 | 750 | 0.01 MAX | 0.02 MAX |
| **2015-038** | | 3.8 | 20,000 | 750 | 0.01 MAX | 0.02 MAX |
| **2015-060** | | 6 | 20,000 | 500 | 0.01 MAX | 0.02 MAX |
| **2015-080** | | 8 | 20,000 | 500 | 0.01 MAX | 0.02 MAX |
| **2020-030** | **R1** | 3 | 15,000 | 750 | 0.01 MAX | 0.025MAX |
| **2020-040** | | 4 | 15,000 | 750 | 0.01 MAX | 0.025MAX |
| **2020-050** | | 5 | 15,000 | 750 | 0.01 MAX | 0.025MAX |
| **2020-060** | | 6 | 15,000 | 500 | 0.01 MAX | 0.025MAX |
| **2020-080** | | 8 | 15,000 | 500 | 0.01 MAX | 0.025MAX |
| **2020-100** | | 10 | 15,000 | 500 | 0.01 MAX | 0.025MAX |

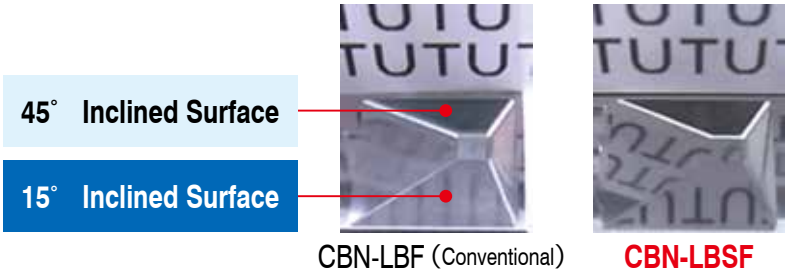



$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Recommend oil mist to avoid tool damage.

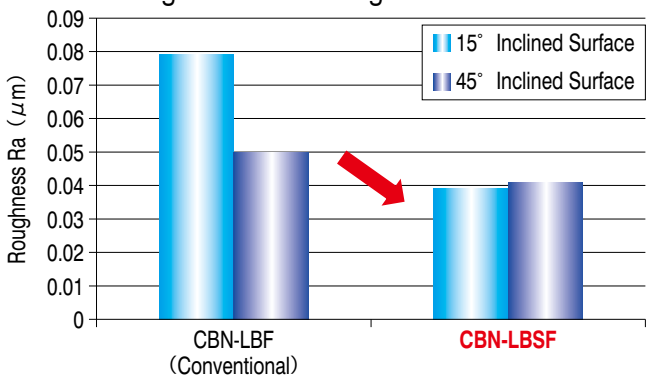
## Milling Example of Inclined Surface
## CBN-LBSF R0.3 × Effective Length 1.5

ELMAX（60.5HRC）




Work Size：9 × 9 × Depth 1.5 mm
Coolant：Oil Mist

Surface roughness after milling

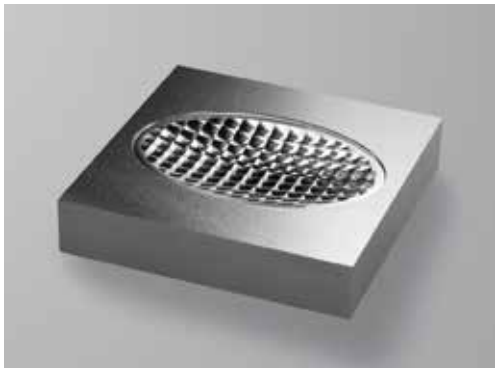



| | |
|---|---|
| Tool | CBN-LBSF 2006-015 |
| Milling Process | Finishing |
| Milling Method | Contour spiral milling |
| Spindle Speed | 30,000 $min^{-1}$ |
| Feed Rate | 550 mm/min |
| Allowance | 0.005 mm |
| Cusp Height | 0.0001 mm |
| Cycle Time | 21.5 min |

**Greatly improved surface finish compared with the conventional CBN-LBF series.**

## Milling example of lens application CBN-LBSF R0.3・R1

HAP10（64HRC）



Work Size：100 × 100 × 20 mm
Coolant：Oil Mist
Oil Coolant

| No. | Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Allowance (mm) | Cycle Time (h:m) |
|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | HGB 2040-0600 (R2 x Length of Cut 6) | 9,480 | 2,400 | 0.18 | 0.75 | 0.08 | 1:01 |
| 2 | Lens part / Semi-roughing | | 9,480 | 2,400 | 0.18 | 0.375 | 0.05 | 0:06 |
| 3 | Periphery / Semi-roughing | HGB 2020-0300 (R1 x Length of Cut 3) | 14,700 | 2,160 | 0.1 | 0.35 | 0.05 | 0:07 |
| 4 | Periphery / Semi-finishing 1 | | 14,700 | 2,160 | 0.1 | 0.1 | 0.02 | 0:03 |
| 5 | Lens part / Semi-finishing 1 | | 14,700 | 2,160 | 0.03 | 0.1 | 0.02 | 0:36 |
| 6 | Periphery / Semi-finishing 2 | HGB 2010-0150 (R0.5 x Length of Cut 1.5) | 21,000 | 1,750 | 0.04 | 0.04 | 0.005 | 0:15 |
| 7 | Lens part / Semi-finishing 2 | HGB 2020-0300 (R1 x Length of Cut 3) | 14,700 | 2,160 | 0.015 | 0.05 | 0.005 | 1:13 |
| 8 | Periphery / Finishing | CBN-LBSF 2006-010 (R0.3 x Effective Length 1) | 30,000 | 600 | 0.01 | 0.01 | 0 | 2:56 |
| 9 | Lens part / Finishing | CBN-LBSF 2020-030 (R1 x Effective Length 3) | 24,000 | 750 | 0.005 | 0.018 | 0 | 4:52 |
| | | | | | | | Total | 11:09 |

Size **R0.05～R1**

# CBN-LBF

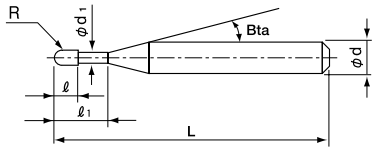
CBN | 0° | R ±0.003 | Shank Dia 0/-0.004 | Back Taper Geometry

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ ～68HRC | | | | | | | | | | |

## Features

**Optimized CBN material for milling ultra-hard materials and cutting edge geometry offer highly precision milling and long tool life.**
**Excellent wear resistance and chipping resistance maintain outstanding surface roughness and precision throughout the long cycle time.**
**High precision shank diameter tolerance, 0/-0.004 mm.**
**CBN-LBF : Ball radius accuracy ± 0.003 mm based on Nominal Radius.**
**※ Based on Nominal Radius : Directly input the catalogue ball radius rate into the CAM for higher precision milling.**

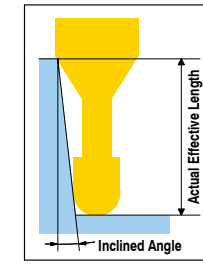



Label Sample

#001 φD0.600 R+0.003/0.000

Diameter and Ball R accuracy measurements are printed on the label to support High Precision milling.

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




Total 58 models

*Shank taper angle Bta is only for reference.

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30° | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CBN-LBF 2001-003 | R0.05 | 0.3 | 0.08 | 0.09 | 15° | 50 | 4 | 42,400 | 0.30 | 0.30 | 0.30 | 0.30 | 0.33 |
| CBN-LBF 2001-005 | | 0.5 | | | | 50 | 4 | 44,100 | 0.50 | 0.50 | 0.51 | 0.53 | 0.57 |
| CBN-LBF 20015-0045 | R0.075 | 0.45 | 0.15 | 0.14 | 15° | 50 | 4 | 42,400 | 0.45 | 0.45 | 0.46 | 0.48 | 0.51 |
| CBN-LBF 20015-0075 | | 0.75 | | | | 50 | 4 | 44,100 | 0.75 | 0.76 | 0.78 | 0.81 | 0.88 |
| CBN-LBF 2002-003 | R0.1 | 0.3 | 0.16 | 0.19 | 15° | 50 | 4 | 28,800 | 0.30 | 0.30 | 0.30 | 0.30 | 0.32 |
| CBN-LBF 2002-006 | | 0.6 | | | | 50 | 4 | 31,700 | 0.60 | 0.60 | 0.62 | 0.64 | 0.69 |
| CBN-LBF 2002-010 | | 1 | | | | 50 | 4 | 33,300 | 1.00 | 1.03 | 1.06 | 1.10 | 1.19 |
| CBN-LBF 2003-005 | R0.15 | 0.5 | 0.24 | 0.28 | 15° | 50 | 4 | 28,800 | 0.51 | 0.53 | 0.54 | 0.56 | 0.60 |
| CBN-LBF 2003-0075 | | 0.75 | | | | 50 | 4 | 28,800 | 0.77 | 0.79 | 0.82 | 0.85 | 0.91 |
| CBN-LBF 2003-009 | | 0.9 | | | | 50 | 4 | 31,700 | 0.91 | 0.94 | 0.96 | 1.00 | 1.06 |
| CBN-LBF 2003-015 | | 1.5 | | | | 50 | 4 | 33,300 | 1.53 | 1.58 | 1.63 | 1.68 | 1.80 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CBN-LBF 2004-005 | R0.2 | 0.5 | 0.32 | 0.38 | 15° | 50 | 4 | 27,700 | 0.51 | 0.52 | 0.54 | 0.55 | 0.58 |
| CBN-LBF 2004-0075 | | 0.75 | | | | 50 | 4 | 27,700 | 0.77 | 0.79 | 0.81 | 0.84 | 0.90 |
| CBN-LBF 2004-010 | | 1 | | | | 50 | 4 | 27,700 | 1.03 | 1.06 | 1.09 | 1.13 | 1.21 |
| CBN-LBF 2004-012 | | 1.2 | | | | 50 | 4 | 28,800 | 1.22 | 1.25 | 1.29 | 1.33 | 1.42 |
| CBN-LBF 2004-020 | | 2 | | | | 50 | 4 | 30,600 | 2.04 | 2.10 | 2.17 | 2.24 | 2.40 |
| CBN-LBF 2004-030 | | 3 | | | | 50 | 4 | 33,300 | 3.07 | 3.17 | 3.27 | 3.38 | 3.62 |
| CBN-LBF 2005-010 | R0.25 | 1 | 0.4 | 0.48 | 15° | 50 | 4 | 27,700 | 1.02 | 1.05 | 1.08 | 1.12 | 1.19 |
| CBN-LBF 2005-015 | | 1.5 | | | | 50 | 4 | 28,800 | 1.53 | 1.57 | 1.62 | 1.66 | 1.78 |
| CBN-LBF 2005-025 | | 2.5 | | | | 50 | 4 | 30,600 | 2.56 | 2.63 | 2.72 | 2.80 | 3.00 |
| CBN-LBF 2005-035 | | 3.5 | | | | 50 | 4 | 32,200 | 3.59 | 3.70 | 3.82 | 3.94 | 4.22 |
| CBN-LBF 2006-010 | R0.3 | 1 | 0.48 | 0.58 | 15° | 50 | 4 | 26,600 | 1.02 | 1.05 | 1.08 | 1.11 | 1.18 |
| CBN-LBF 2006-015 | | 1.5 | | | | 50 | 4 | 26,600 | 1.52 | 1.57 | 1.61 | 1.66 | 1.76 |
| CBN-LBF 2006-030 | | 3 | | | | 50 | 4 | 28,400 | 3.07 | 3.16 | 3.26 | 3.37 | 3.60 |
| CBN-LBF 2006-040 | | 4 | | | | 50 | 4 | 28,400 | 4.10 | 4.23 | 4.36 | 4.50 | 4.82 |
| CBN-LBF 2006-050 | | 5 | | | | 50 | 4 | 28,800 | 5.13 | 5.29 | 5.46 | 5.64 | 6.05 |
| CBN-LBF 2006-060 | | 6 | | | | 50 | 4 | 31,600 | 6.17 | 6.36 | 6.56 | 6.78 | 7.27 |
| CBN-LBF 2008-020 | R0.4 | 2 | 0.6 | 0.78 | 15° | 50 | 4 | 26,600 | 2.04 | 2.09 | 2.15 | 2.21 | 2.35 |
| CBN-LBF 2008-040 | | 4 | | | | 50 | 4 | 28,400 | 4.10 | 4.22 | 4.35 | 4.49 | 4.80 |
| CBN-LBF 2008-060 | | 6 | | | | 50 | 4 | 31,100 | 6.16 | 6.35 | 6.55 | 6.77 | 7.25 |
| CBN-LBF 2010-015 | R0.5 | 1.5 | 0.7 | 0.98 | 15° | 50 | 4 | 26,600 | 1.53 | 1.57 | 1.61 | 1.66 | 1.76 |
| CBN-LBF 2010-020 | | 2 | | | | 50 | 4 | 26,600 | 2.05 | 2.11 | 2.17 | 2.23 | 2.38 |
| CBN-LBF 2010-025 | | 2.5 | | | | 50 | 4 | 26,600 | 2.56 | 2.63 | 2.70 | 2.78 | 2.96 |
| CBN-LBF 2010-040 | | 4 | | | | 50 | 4 | 28,400 | 4.11 | 4.23 | 4.35 | 4.49 | 4.79 |
| CBN-LBF 2010-050 | | 5 | | | | 50 | 4 | 28,400 | 5.14 | 5.29 | 5.45 | 5.63 | 6.02 |
| CBN-LBF 2010-060 | | 6 | | | | 50 | 4 | 28,400 | 6.17 | 6.36 | 6.55 | 6.77 | 7.24 |
| CBN-LBF 2010-080 | | 8 | | | | 50 | 4 | 28,800 | 8.23 | 8.49 | 8.76 | 9.04 | 9.69 |
| CBN-LBF 2010-100 | | 10 | | | | 50 | 4 | 29,500 | 10.30 | 10.62 | 10.96 | 11.32 | 12.13 |
| CBN-LBF 2012-024 | R0.6 | 2.4 | 0.8 | 1.18 | 15° | 50 | 4 | 27,700 | 2.46 | 2.53 | 2.60 | 2.68 | 2.85 |
| CBN-LBF 2012-030 | | 3 | | | | 50 | 4 | 27,700 | 3.08 | 3.17 | 3.27 | 3.37 | 3.60 |
| CBN-LBF 2012-060 | | 6 | | | | 50 | 4 | 32,200 | 6.18 | 6.38 | 6.59 | 6.82 | 7.33 |
| CBN-LBF 2015-030 | R0.75 | 3 | 0.9 | 1.46 | 15° | 50 | 4 | 27,700 | 3.12 | 3.20 | 3.29 | 3.39 | 3.61 |
| CBN-LBF 2015-040 | | 4 | | | | 50 | 4 | 27,700 | 4.15 | 4.27 | 4.40 | 4.54 | 4.85 |
| CBN-LBF 2015-060 | | 6 | | | | 50 | 4 | 27,700 | 6.22 | 6.41 | 6.62 | 6.84 | 7.34 |
| CBN-LBF 2015-080 | | 8 | | | | 50 | 4 | 30,600 | 8.28 | 8.55 | 8.83 | 9.14 | 9.83 |
| CBN-LBF 2015-100 | | 10 | | | | 50 | 4 | 32,200 | 10.35 | 10.69 | 11.05 | 11.44 | 12.31 |
| CBN-LBF 2015-120 | | 12 | | | | 50 | 4 | 32,200 | 12.42 | 12.83 | 13.27 | 13.74 | 14.80 |
| CBN-LBF 2015-150 | | 15 | | | | 50 | 4 | 32,200 | 15.52 | 16.04 | 16.59 | 17.19 | 18.53 |
| CBN-LBF 2020-040 | R1 | 4 | 1.2 | 1.97 | 15° | 50 | 4 | 27,700 | 4.12 | 4.23 | 4.35 | 4.48 | 4.77 |
| CBN-LBF 2020-050 | | 5 | | | | 50 | 4 | 27,700 | 5.16 | 5.30 | 5.46 | 5.63 | 6.01 |
| CBN-LBF 2020-060 | | 6 | | | | 50 | 4 | 27,700 | 6.19 | 6.37 | 6.57 | 6.78 | 7.26 |
| CBN-LBF 2020-080 | | 8 | | | | 50 | 4 | 30,600 | 8.26 | 8.51 | 8.79 | 9.08 | 9.74 |
| CBN-LBF 2020-100 | | 10 | | | | 50 | 4 | 30,600 | 10.32 | 10.65 | 11.00 | 11.38 | 12.23 |
| CBN-LBF 2020-120 | | 12 | | | | 50 | 4 | 32,200 | 12.39 | 12.79 | 13.22 | 13.68 | 14.72 |
| CBN-LBF 2020-140 | | 14 | | | | 50 | 4 | 32,700 | 14.46 | 14.93 | 15.44 | 15.98 | 17.20 |
| CBN-LBF 2020-160 | | 16 | | | | 50 | 4 | 32,700 | 16.53 | 17.07 | 17.65 | 18.28 | 19.69 |
| CBN-LBF 2020-180 | | 18 | | | | 50 | 4 | 32,700 | 18.59 | 19.21 | 19.87 | 20.58 | No Interference |
| CBN-LBF 2020-200 | | 20 | | | | 50 | 4 | 32,700 | 20.66 | 21.35 | 22.09 | 22.88 | No Interference |

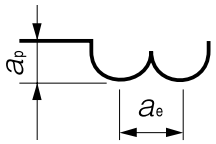
## Milling Conditions for CBN-LBF

| WORK MATERIAL | | | HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC) | | | | HARDENED STEELS SKD11 (~62HRC) | | | | HARDENED STEELS HAP10 / HAP72 (~68HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2001-003** | **R0.05** | 0.3 | 30,000 | 200 | 0.005 | 0.005 | 30,000 | 150 | 0.003 | 0.005 | 30,000 | 100 | 0.002 | 0.005 |
| **2001-005** | | 0.5 | 30,000 | 150 | 0.003 | 0.005 | 30,000 | 120 | 0.003 | 0.005 | 30,000 | 90 | 0.002 | 0.005 |
| **20015-0045** | **R0.075** | 0.45 | 30,000 | 350 | 0.005 | 0.005 | 30,000 | 270 | 0.004 | 0.005 | 30,000 | 200 | 0.003 | 0.005 |
| **20015-0075** | | 0.75 | 30,000 | 220 | 0.004 | 0.005 | 30,000 | 160 | 0.004 | 0.005 | 30,000 | 100 | 0.003 | 0.005 |
| **2002-003** | **R0.1** | 0.3 | 30,000 | 660 | 0.005 | 0.005 | 30,000 | 550 | 0.005 | 0.005 | 30,000 | 440 | 0.005 | 0.005 |
| **2002-006** | | 0.6 | 30,000 | 500 | 0.005 | 0.005 | 30,000 | 400 | 0.005 | 0.005 | 30,000 | 300 | 0.005 | 0.005 |
| **2002-010** | | 1 | 30,000 | 290 | 0.005 | 0.005 | 30,000 | 200 | 0.005 | 0.005 | 30,000 | 120 | 0.005 | 0.005 |
| **2003-005** | **R0.15** | 0.5 | 30,000 | 1,000 | 0.005 | 0.005 | 30,000 | 950 | 0.005 | 0.005 | 30,000 | 620 | 0.005 | 0.005 |
| **2003-0075** | | 0.75 | 30,000 | 850 | 0.005 | 0.005 | 30,000 | 800 | 0.005 | 0.005 | 30,000 | 500 | 0.005 | 0.005 |
| **2003-009** | | 0.9 | 30,000 | 760 | 0.005 | 0.005 | 30,000 | 600 | 0.005 | 0.005 | 30,000 | 430 | 0.005 | 0.005 |
| **2003-015** | | 1.5 | 30,000 | 460 | 0.005 | 0.005 | 30,000 | 320 | 0.005 | 0.005 | 30,000 | 190 | 0.005 | 0.005 |
| **2004-005** | **R0.2** | 0.5 | 30,000 | 1,580 | 0.005 | 0.01 | 30,000 | 1,330 | 0.005 | 0.01 | 30,000 | 860 | 0.005 | 0.005 |
| **2004-0075** | | 0.75 | 30,000 | 1,390 | 0.005 | 0.01 | 30,000 | 1,140 | 0.005 | 0.01 | 30,000 | 800 | 0.005 | 0.005 |
| **2004-010** | | 1 | 30,000 | 1,200 | 0.005 | 0.01 | 30,000 | 950 | 0.005 | 0.01 | 30,000 | 730 | 0.005 | 0.005 |
| **2004-012** | | 1.2 | 30,000 | 1,050 | 0.005 | 0.01 | 30,000 | 800 | 0.005 | 0.01 | 30,000 | 620 | 0.005 | 0.005 |
| **2004-020** | | 2 | 30,000 | 600 | 0.005 | 0.01 | 30,000 | 450 | 0.005 | 0.01 | 30,000 | 330 | 0.005 | 0.005 |
| **2004-030** | | 3 | 20,000 | 400 | 0.005 | 0.005 | 20,000 | 300 | 0.005 | 0.005 | 20,000 | 190 | 0.003 | 0.003 |
| **2005-010** | **R0.25** | 1 | 30,000 | 1,600 | 0.01 | 0.01 | 30,000 | 1,300 | 0.01 | 0.01 | 30,000 | 920 | 0.005 | 0.01 |
| **2005-015** | | 1.5 | 30,000 | 1,300 | 0.01 | 0.01 | 30,000 | 1,000 | 0.01 | 0.01 | 30,000 | 760 | 0.005 | 0.01 |
| **2005-025** | | 2.5 | 30,000 | 800 | 0.01 | 0.01 | 30,000 | 700 | 0.01 | 0.01 | 30,000 | 480 | 0.005 | 0.01 |
| **2005-035** | | 3.5 | 22,000 | 550 | 0.01 | 0.01 | 22,000 | 500 | 0.005 | 0.01 | 22,000 | 330 | 0.005 | 0.005 |
| **2006-010** | **R0.3** | 1 | 30,000 | 2,400 | 0.02 | 0.03 | 30,000 | 1,900 | 0.02 | 0.03 | 30,000 | 1,080 | 0.01 | 0.02 |
| **2006-015** | | 1.5 | 30,000 | 2,000 | 0.02 | 0.03 | 30,000 | 1,500 | 0.02 | 0.03 | 30,000 | 1,000 | 0.01 | 0.02 |
| **2006-030** | | 3 | 26,000 | 1,100 | 0.02 | 0.02 | 26,000 | 900 | 0.02 | 0.02 | 26,000 | 760 | 0.01 | 0.01 |
| **2006-040** | | 4 | 22,000 | 750 | 0.01 | 0.02 | 22,000 | 650 | 0.01 | 0.02 | 22,000 | 570 | 0.005 | 0.01 |
| **2006-050** | | 5 | 18,000 | 550 | 0.01 | 0.01 | 18,000 | 450 | 0.01 | 0.01 | 18,000 | 410 | 0.005 | 0.005 |
| **2006-060** | | 6 | 12,000 | 350 | 0.005 | 0.01 | 12,000 | 290 | 0.005 | 0.005 | 12,000 | 260 | 0.003 | 0.003 |
| **2008-020** | **R0.4** | 2 | 30,000 | 2,500 | 0.02 | 0.03 | 30,000 | 2,100 | 0.02 | 0.03 | 30,000 | 1,700 | 0.01 | 0.02 |
| **2008-040** | | 4 | 25,000 | 1,500 | 0.02 | 0.02 | 25,000 | 1,350 | 0.02 | 0.02 | 25,000 | 1,200 | 0.01 | 0.01 |
| **2008-060** | | 6 | 18,000 | 1,000 | 0.01 | 0.02 | 18,000 | 800 | 0.01 | 0.02 | 18,000 | 750 | 0.005 | 0.01 |
| **2010-015** | **R0.5** | 1.5 | 30,000 | 3,700 | 0.04 | 0.05 | 30,000 | 3,400 | 0.03 | 0.04 | 30,000 | 2,300 | 0.025 | 0.03 |
| **2010-020** | | 2 | 30,000 | 3,500 | 0.04 | 0.04 | 30,000 | 3,200 | 0.03 | 0.04 | 30,000 | 2,200 | 0.02 | 0.03 |
| **2010-025** | | 2.5 | 30,000 | 3,300 | 0.04 | 0.04 | 30,000 | 3,000 | 0.03 | 0.04 | 30,000 | 2,100 | 0.02 | 0.03 |
| **2010-040** | | 4 | 27,000 | 2,700 | 0.03 | 0.04 | 27,000 | 2,300 | 0.03 | 0.03 | 27,000 | 1,800 | 0.02 | 0.02 |
| **2010-050** | | 5 | 23,000 | 2,200 | 0.03 | 0.03 | 23,000 | 1,800 | 0.03 | 0.03 | 23,000 | 1,450 | 0.02 | 0.02 |
| **2010-060** | | 6 | 20,000 | 1,900 | 0.02 | 0.03 | 20,000 | 1,500 | 0.02 | 0.03 | 20,000 | 1,200 | 0.01 | 0.02 |
| **2010-080** | | 8 | 14,000 | 1,300 | 0.01 | 0.02 | 14,000 | 1,000 | 0.01 | 0.02 | 14,000 | 800 | 0.01 | 0.01 |
| **2010-100** | | 10 | 9,000 | 800 | 0.01 | 0.02 | 9,000 | 600 | 0.01 | 0.01 | 9,000 | 490 | 0.005 | 0.005 |

## Milling Conditions for CBN-LBF

| WORK MATERIAL | | | HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC) | | | | HARDENED STEELS SKD11 (~62HRC) | | | | HARDENED STEELS HAP10 / HAP72 (~68HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2012-024** | **R0.6** | 2.4 | 30,000 | 3,000 | 0.05 | 0.05 | 29,500 | 2,550 | 0.035 | 0.04 | 29,000 | 2,100 | 0.02 | 0.03 |
| **2012-030** | | 3 | 30,000 | 2,750 | 0.05 | 0.05 | 29,000 | 2,350 | 0.035 | 0.035 | 28,000 | 2,000 | 0.02 | 0.025 |
| **2012-060** | | 6 | 23,500 | 2,000 | 0.03 | 0.03 | 23,500 | 1,650 | 0.025 | 0.025 | 23,500 | 1,300 | 0.02 | 0.02 |
| **2015-030** | **R0.75** | 3 | 30,000 | 3,000 | 0.07 | 0.07 | 28,500 | 2,550 | 0.045 | 0.05 | 27,000 | 2,100 | 0.02 | 0.03 |
| **2015-040** | | 4 | 28,500 | 2,750 | 0.06 | 0.06 | 27,250 | 2,300 | 0.04 | 0.04 | 26,000 | 1,900 | 0.02 | 0.025 |
| **2015-060** | | 6 | 26,000 | 2,200 | 0.04 | 0.045 | 25,500 | 1,900 | 0.03 | 0.03 | 25,000 | 1,650 | 0.02 | 0.02 |
| **2015-080** | | 8 | 24,000 | 2,000 | 0.025 | 0.03 | 24,000 | 1,700 | 0.02 | 0.025 | 24,000 | 1,400 | 0.015 | 0.02 |
| **2015-100** | | 10 | 16,000 | 1,300 | 0.02 | 0.02 | 16,000 | 1,100 | 0.015 | 0.018 | 16,000 | 900 | 0.01 | 0.015 |
| **2015-120** | | 12 | 12,000 | 1,000 | 0.016 | 0.018 | 12,000 | 880 | 0.012 | 0.016 | 12,000 | 730 | 0.008 | 0.012 |
| **2015-150** | | 15 | 6,000 | 600 | 0.01 | 0.015 | 6,000 | 550 | 0.008 | 0.012 | 6,000 | 490 | 0.005 | 0.008 |
| **2020-040** | **R1** | 4 | 30,000 | 3,000 | 0.1 | 0.1 | 27,000 | 2,550 | 0.06 | 0.065 | 24,000 | 2,100 | 0.02 | 0.03 |
| **2020-050** | | 5 | 28,000 | 2,750 | 0.08 | 0.08 | 26,000 | 2,300 | 0.05 | 0.05 | 24,000 | 1,900 | 0.02 | 0.025 |
| **2020-060** | | 6 | 27,000 | 2,500 | 0.05 | 0.06 | 25,500 | 2,050 | 0.035 | 0.04 | 24,000 | 1,650 | 0.015 | 0.025 |
| **2020-080** | | 8 | 25,000 | 2,200 | 0.035 | 0.045 | 24,500 | 1,800 | 0.025 | 0.03 | 24,000 | 1,400 | 0.015 | 0.02 |
| **2020-100** | | 10 | 24,000 | 2,000 | 0.02 | 0.03 | 24,000 | 1,600 | 0.015 | 0.025 | 24,000 | 1,200 | 0.01 | 0.02 |
| **2020-120** | | 12 | 19,500 | 1,600 | 0.017 | 0.025 | 19,500 | 1,300 | 0.013 | 0.021 | 19,500 | 1,000 | 0.009 | 0.017 |
| **2020-140** | | 14 | 15,000 | 1,250 | 0.015 | 0.02 | 15,000 | 1,050 | 0.012 | 0.018 | 15,000 | 850 | 0.008 | 0.015 |
| **2020-160** | | 16 | 11,500 | 990 | 0.013 | 0.017 | 11,500 | 860 | 0.011 | 0.015 | 11,500 | 730 | 0.007 | 0.013 |
| **2020-180** | | 18 | 8,000 | 740 | 0.012 | 0.013 | 8,000 | 670 | 0.009 | 0.013 | 8,000 | 610 | 0.006 | 0.012 |
| **2020-200** | | 20 | 4,500 | 490 | 0.01 | 0.01 | 4,500 | 490 | 0.008 | 0.01 | 4,500 | 490 | 0.005 | 0.01 |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

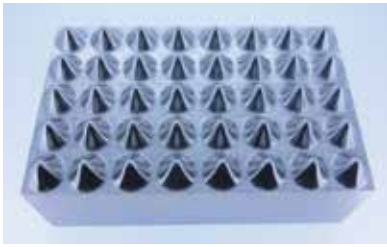



Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine' s maximum spindle speed.
・Recommend oil mist to avoid tool damage.

*** Refer to page 588 for tool geometry.**

## Milling example of convex shape for consecutive finishing CBN-LBF R0.3 × Effective Length 1.5

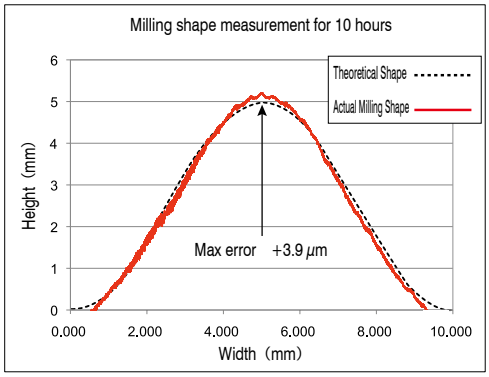
STAVAX (52HRC)



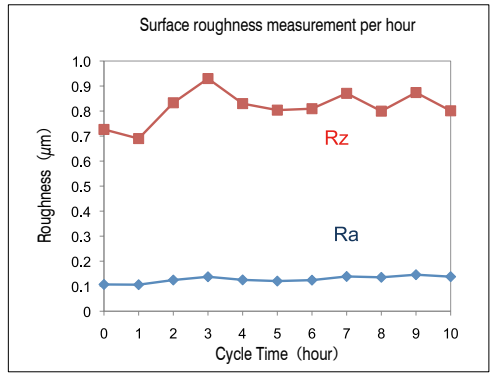
Work Size : 80 × 50 × 30 mm
Coolant : Oil Mist

Tool damage after 10 hours of milling.

| No | Milling Process | Milling Method | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Cycle Time |
|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | Contour milling | CFB 3030-0450 (R1.5 × Length of cut 4.5) | 16,000 | 1,500 | 0.6 | 1.2 | 0:28:44 |
| 2 | Semi-finishing | Contour spiral milling | CFB 3030-0450 (R1.5 × Length of cut 4.5) | 28,600 | 2,300 | 0.004 (Cusp Height) | 0.15 | 0:35:48 |
| 3 | Semi-finishing | Contour spiral milling | CSEB 2020-0300 (R1 × Length of cut 3) | 16,000 | 1,300 | 0.004 (Cusp Height) | 0.05 | 2:18:42 |
| 4 | Semi-finishing | Contour spiral milling | CSELB 2006-010 (R0.3 × Effective Length 1) | 30,000 | 1,300 | 0.001 (Cusp Height) | 0.06 | 3:44:47 |
| 5 | Finishing | Contour spiral milling | CBN-LBF 2006-015 (R0.3 × Effective Length 1.5) | 30,000 | 800 | 0.0001 (Cusp Height) | 0.015 | 9:48:02 |
| | | | | | | | Total | 16:56:03 |




Excellent finishing shape for 10 hours of milling.

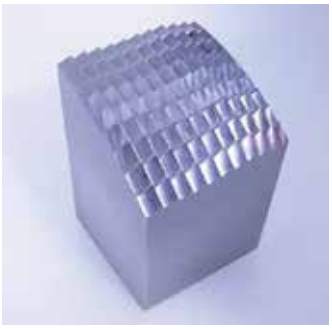



Constant surface roughness throughout the long cycle time.

CBN-LBF Convex shape for Consecutive Finishing Milling Video

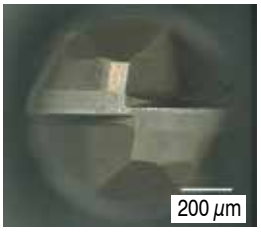
## Finishing of reflector mold
## CBN-LBF R0.4 × Effective Length 2

STAVAX (52HRC)



Work Size : 35 × 35 × 50 mm
Coolant : Air Blow
(For finishing : Oil Mist)

### Tool damage after milling 10 hours




**Less tool damage and uniform milling surface**

CBN-LBF Reflector Mold for Finishing Milling Video

| No | Milling Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Cycle Time |
|---|---|---|---|---|---|---|---|
| 1 | Roughing | HRRS 4060-10-18S (φ6 × CR1 × Effective Length 18) | 3,500 | 2,500 | 0.2 | 2 | 0:18:00 |
| 2 | Semi-roughing | HRRS 4060-10-18S (φ6 × CR1 × Effective Length 18) | 9,000 | 2,500 | 0.05 | 0.1 | 0:13:35 |
| 3 | Semi-roughing | HRRS 4020-03-06S (φ2 × CR0.3 × Effective Length 6) | 3,500 | 1,000 | 0.04 | 1 | 0:33:55 |
| 4 | Semi-finishing | HSB 2030-0800 (R1.5 × Length of Cut 8) | 12,000 | 2,500 | 0.02 | 0.07 | 0:12:24 |
| 5 | Semi-finishing | HSB 2015-0200 (R0.75 × Length of Cut 2) | 7,000 | 1,000 | 0.04 | 0.07 | 0:20:50 |
| 6 | Semi-finishing | HSB 2015-0200 (R0.75 × Length of Cut 2) | 7,000 | 700 | 0.05 | 0.05 | 0:18:08 |
| 7 | Semi-finishing | HSB 2010-0250 (R0.5 × Length of Cut 2.5) | 8,000 | 500 | 0.02 | 0.03 | 0:23:24 |
| 8 | Semi-finishing | HSB 2010-0250 (R0.5 × Length of Cut 2.5) | 15,000 | 1,200 | 0.02 | 0.03 | 1:30:33 |
| 9 | Finishing | CBN-LBF 2008-020 (R0.4 × Effective Length 2) | 26,000 | 800 | 0.01 | 0.004 | 10:12:54 |
| | | | | | | Total | 14:03:43 |

Size φ0.2～φ2

# CBN-RSF

Patent pending NEW

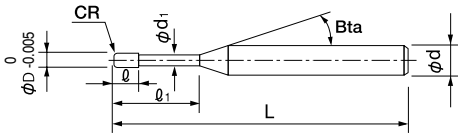
CBN | 0° | R | R ±0.002 CR≦0.02 | R ±0.003 CR≧0.05 | Shank Dia 0/-0.004 | Back Taper Geometry

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

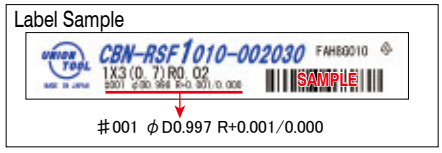
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | ◎ | ◎ ～65HRC | | | | | | | | | | |

## Features

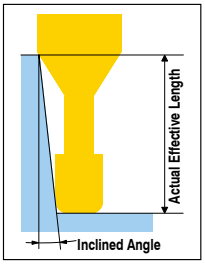
**Optimized CBN material for milling of ultra-hard materials and the improved cutting edge geometry enables high precision milling and long tool life.**
**Excellent wear resistance and chipping resistance ensures an outstanding surface roughness and precision throughout the long cycle time.**
**High precision shank diameter tolerance of 0/-0.004 mm.**
**CBN-RSF : Diameter tolerance 0/-0.005 mm. High precision corner R and super finishing.**




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




Diameter and Corner R accuracy measurements are printed on the label to support High Precision milling.




Total 42 models

*Shank taper angle Bta is only for reference.

Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CBN-RSF 1002-002003 | 0.2 | R0.02 | 0.3 | 0.08 | 0.19 | 15° | 50 | 4 | 36,600 | 0.30 | 0.30 | 0.30 | 0.31 | 0.34 |
| CBN-RSF 1002-002005 | | | 0.5 | | | | 50 | 4 | 36,600 | 0.50 | 0.50 | 0.52 | 0.54 | 0.59 |
| CBN-RSF 1002-005003 | | R0.05 | 0.3 | | | | 50 | 4 | 32,900 | 0.30 | 0.30 | 0.30 | 0.31 | 0.33 |
| CBN-RSF 1002-005005 | | | 0.5 | | | | 50 | 4 | 32,900 | 0.50 | 0.50 | 0.52 | 0.54 | 0.58 |
| CBN-RSF 1003-002005 | 0.3 | R0.02 | 0.5 | 0.13 | 0.28 | 15° | 50 | 4 | 36,200 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-RSF 1003-002010 | | | 1 | | | | 50 | 4 | 36,600 | 1.03 | 1.07 | 1.11 | 1.15 | 1.25 |
| CBN-RSF 1003-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 32,500 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-RSF 1003-005010 | | | 1 | | | | 50 | 4 | 32,900 | 1.03 | 1.07 | 1.10 | 1.15 | 1.24 |





Next Page ➡

Unit (mm)

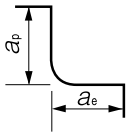
| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CBN-RSF 1004-002005 | 0.4 | R0.02 | 0.5 | 0.24 | 0.38 | 15° | 50 | 4 | 34,300 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-RSF 1004-002015 | | | 1.5 | | | | 50 | 4 | 35,000 | 1.54 | 1.59 | 1.65 | 1.71 | 1.86 |
| CBN-RSF 1004-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 30,900 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-RSF 1004-005015 | | | 1.5 | | | | 50 | 4 | 31,100 | 1.54 | 1.59 | 1.65 | 1.71 | 1.85 |
| CBN-RSF 1005-002005 | 0.5 | R0.02 | 0.5 | 0.3 | 0.48 | 15° | 50 | 4 | 28,200 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-RSF 1005-002015 | | | 1.5 | | | | 50 | 4 | 28,700 | 1.54 | 1.59 | 1.65 | 1.71 | 1.86 |
| CBN-RSF 1005-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 25,400 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-RSF 1005-005015 | | | 1.5 | | | | 50 | 4 | 25,800 | 1.54 | 1.59 | 1.65 | 1.71 | 1.85 |
| CBN-RSF 1006-002010 | 0.6 | R0.02 | 1 | 0.3 | 0.58 | 15° | 50 | 4 | 28,500 | 1.03 | 1.07 | 1.11 | 1.15 | 1.25 |
| CBN-RSF 1006-002015 | | | 1.5 | | | | 50 | 4 | 28,700 | 1.54 | 1.59 | 1.65 | 1.71 | 1.86 |
| CBN-RSF 1006-005010 | | R0.05 | 1 | | | | 50 | 4 | 25,600 | 1.03 | 1.07 | 1.10 | 1.15 | 1.24 |
| CBN-RSF 1006-005015 | | | 1.5 | | | | 50 | 4 | 25,800 | 1.54 | 1.59 | 1.65 | 1.71 | 1.85 |
| CBN-RSF 1008-002010 | 0.8 | R0.02 | 1 | 0.56 | 0.78 | 15° | 50 | 4 | 28,700 | 1.03 | 1.07 | 1.11 | 1.15 | 1.25 |
| CBN-RSF 1008-002020 | | | 2 | | | | 50 | 4 | 28,700 | 2.05 | 2.13 | 2.20 | 2.29 | 2.48 |
| CBN-RSF 1008-005010 | | R0.05 | 1 | | | | 50 | 4 | 25,800 | 1.03 | 1.07 | 1.10 | 1.15 | 1.24 |
| CBN-RSF 1008-005020 | | | 2 | | | | 50 | 4 | 25,800 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-RSF 1010-002010 | 1 | R0.02 | 1 | 0.7 | 0.98 | 15° | 50 | 4 | 26,400 | 1.03 | 1.07 | 1.11 | 1.15 | 1.25 |
| CBN-RSF 1010-002020 | | | 2 | | | | 50 | 4 | 26,400 | 2.07 | 2.14 | 2.22 | 2.30 | 2.49 |
| CBN-RSF 1010-002030 | | | 3 | | | | 50 | 4 | 26,400 | 3.10 | 3.21 | 3.33 | 3.45 | 3.73 |
| CBN-RSF 1010-005010 | | R0.05 | 1 | | | | 50 | 4 | 23,700 | 1.03 | 1.07 | 1.11 | 1.15 | 1.24 |
| CBN-RSF 1010-005020 | | | 2 | | | | 50 | 4 | 23,700 | 2.06 | 2.14 | 2.21 | 2.30 | 2.48 |
| CBN-RSF 1010-005030 | | | 3 | | | | 50 | 4 | 23,700 | 3.10 | 3.21 | 3.32 | 3.45 | 3.73 |
| CBN-RSF 1010-010010 | | R0.1 | 1 | | | | 50 | 4 | 23,700 | 1.03 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-RSF 1010-010020 | | | 2 | | | | 50 | 4 | 23,700 | 2.06 | 2.13 | 2.21 | 2.29 | 2.47 |
| CBN-RSF 1010-010030 | | | 3 | | | | 50 | 4 | 23,700 | 3.10 | 3.20 | 3.32 | 3.44 | 3.72 |
| CBN-RSF 1015-002030 | 1.5 | R0.02 | 3 | 1 | 1.46 | 15° | 50 | 4 | 31,000 | 3.14 | 3.25 | 3.37 | 3.49 | 3.78 |
| CBN-RSF 1015-005030 | | R0.05 | 3 | | | | 50 | 4 | 27,900 | 3.14 | 3.25 | 3.36 | 3.49 | 3.77 |
| CBN-RSF 1015-010030 | | R0.1 | 3 | | | | 50 | 4 | 27,900 | 3.14 | 3.24 | 3.36 | 3.48 | 3.76 |
| CBN-RSF 1020-002040 | 2 | R0.02 | 4 | 1.2 | 1.97 | 15° | 50 | 4 | 32,000 | 4.15 | 4.30 | 4.45 | 4.62 | 5.00 |
| CBN-RSF 1020-002060 | | | 6 | | | | 50 | 4 | 32,000 | 6.22 | 6.44 | 6.67 | 6.92 | 7.49 |
| CBN-RSF 1020-005040 | | R0.05 | 4 | | | | 50 | 4 | 28,700 | 4.15 | 4.30 | 4.45 | 4.62 | 4.99 |
| CBN-RSF 1020-005060 | | | 6 | | | | 50 | 4 | 28,700 | 6.22 | 6.44 | 6.67 | 6.92 | 7.48 |
| CBN-RSF 1020-010040 | | R0.1 | 4 | | | | 50 | 4 | 28,700 | 4.15 | 4.29 | 4.45 | 4.61 | 4.98 |
| CBN-RSF 1020-010060 | | | 6 | | | | 50 | 4 | 28,700 | 6.22 | 6.43 | 6.66 | 6.91 | 7.47 |

## Milling Conditions for CBN-RSF

| WORK MATERIAL | | | | HARDENED STEELS ELMAX (58~62HRC) | | | | HARDENED STEELS HAP10 (62~65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Effective Length (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) |
| **1002-002003** | **0.2** | R0.02 | 0.3 | 60,000 | 80 MAX | 0.003 | 0.01 | 60,000 | 20 MAX | 0.003 | 0.005 |
| **1002-002005** | | | 0.5 | 60,000 | 80 MAX | 0.003 | 0.01 | 60,000 | 20 MAX | 0.003 | 0.005 |
| **1002-005003** | | R0.05 | 0.3 | 60,000 | 80 MAX | 0.003 | 0.01 | 60,000 | 20 MAX | 0.003 | 0.005 |
| **1002-005005** | | | 0.5 | 60,000 | 80 MAX | 0.003 | 0.01 | 60,000 | 20 MAX | 0.003 | 0.005 |
| **1003-002005** | **0.3** | R0.02 | 0.5 | 40,000 | 80 MAX | 0.004 | 0.015 | 40,000 | 20 MAX | 0.004 | 0.005 |
| **1003-002010** | | | 1 | 40,000 | 80 MAX | 0.004 | 0.015 | 40,000 | 20 MAX | 0.004 | 0.005 |
| **1003-005005** | | R0.05 | 0.5 | 40,000 | 80 MAX | 0.004 | 0.015 | 40,000 | 20 MAX | 0.004 | 0.005 |
| **1003-005010** | | | 1 | 40,000 | 80 MAX | 0.004 | 0.015 | 40,000 | 20 MAX | 0.004 | 0.005 |
| **1004-002005** | **0.4** | R0.02 | 0.5 | 30,000 | 80 MAX | 0.005 | 0.02 | 30,000 | 20 MAX | 0.005 | 0.006 |
| **1004-002015** | | | 1.5 | 30,000 | 80 MAX | 0.005 | 0.02 | 30,000 | 20 MAX | 0.005 | 0.006 |
| **1004-005005** | | R0.05 | 0.5 | 30,000 | 100 MAX | 0.005 | 0.02 | 30,000 | 60 MAX | 0.005 | 0.02 |
| **1004-005015** | | | 1.5 | 30,000 | 100 MAX | 0.005 | 0.02 | 30,000 | 60 MAX | 0.005 | 0.02 |
| **1005-002005** | **0.5** | R0.02 | 0.5 | 30,000 | 90 MAX | 0.005 | 0.025 | 30,000 | 25 MAX | 0.005 | 0.008 |
| **1005-002015** | | | 1.5 | 30,000 | 90 MAX | 0.005 | 0.025 | 30,000 | 25 MAX | 0.005 | 0.008 |
| **1005-005005** | | R0.05 | 0.5 | 30,000 | 100 MAX | 0.01 | 0.025 | 30,000 | 60 MAX | 0.01 | 0.025 |
| **1005-005015** | | | 1.5 | 30,000 | 100 MAX | 0.01 | 0.025 | 30,000 | 60 MAX | 0.01 | 0.025 |
| **1006-002010** | **0.6** | R0.02 | 1 | 30,000 | 100 MAX | 0.005 | 0.03 | 30,000 | 30 MAX | 0.005 | 0.01 |
| **1006-002015** | | | 1.5 | 30,000 | 100 MAX | 0.005 | 0.03 | 30,000 | 30 MAX | 0.005 | 0.01 |
| **1006-005010** | | R0.05 | 1 | 30,000 | 110 MAX | 0.01 | 0.03 | 30,000 | 65 MAX | 0.01 | 0.03 |
| **1006-005015** | | | 1.5 | 30,000 | 110 MAX | 0.01 | 0.03 | 30,000 | 65 MAX | 0.01 | 0.03 |
| **1008-002010** | **0.8** | R0.02 | 1 | 30,000 | 125 MAX | 0.005 | 0.04 | 30,000 | 40 MAX | 0.005 | 0.012 |
| **1008-002020** | | | 2 | 30,000 | 125 MAX | 0.005 | 0.04 | 30,000 | 40 MAX | 0.005 | 0.012 |
| **1008-005010** | | R0.05 | 1 | 30,000 | 140 MAX | 0.01 | 0.04 | 30,000 | 85 MAX | 0.01 | 0.04 |
| **1008-005020** | | | 2 | 30,000 | 140 MAX | 0.01 | 0.04 | 30,000 | 85 MAX | 0.01 | 0.04 |
| **1010-002010** | **1** | R0.02 | 1 | 30,000 | 150 MAX | 0.005 | 0.05 | 30,000 | 50 MAX | 0.005 | 0.015 |
| **1010-002020** | | | 2 | 30,000 | 150 MAX | 0.005 | 0.05 | 30,000 | 50 MAX | 0.005 | 0.015 |
| **1010-002030** | | | 3 | 30,000 | 150 MAX | 0.005 | 0.05 | 30,000 | 50 MAX | 0.005 | 0.015 |
| **1010-005010** | | R0.05 | 1 | 30,000 | 165 MAX | 0.01 | 0.05 | 30,000 | 100 MAX | 0.01 | 0.04 |
| **1010-005020** | | | 2 | 30,000 | 165 MAX | 0.01 | 0.05 | 30,000 | 100 MAX | 0.01 | 0.04 |
| **1010-005030** | | | 3 | 30,000 | 165 MAX | 0.01 | 0.05 | 30,000 | 100 MAX | 0.01 | 0.04 |
| **1010-010010** | | R0.1 | 1 | 30,000 | 185 MAX | 0.01 | 0.05 | 30,000 | 150 MAX | 0.01 | 0.05 |
| **1010-010020** | | | 2 | 30,000 | 185 MAX | 0.01 | 0.05 | 30,000 | 150 MAX | 0.01 | 0.05 |
| **1010-010030** | | | 3 | 30,000 | 185 MAX | 0.01 | 0.05 | 30,000 | 150 MAX | 0.01 | 0.05 |

## Milling Conditions for CBN-RSF

| WORK MATERIAL | | | | HARDENED STEELS ELMAX (58～62HRC) | | | | HARDENED STEELS HAP10 (62～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Effective Length (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) |
| **1015-002030** | **1.5** | R0.02 | 3 | 30,000 | 225 MAX | 0.005 | 0.075 | 30,000 | 75 MAX | 0.005 | 0.025 |
| **1015-005030** | | R0.05 | 3 | 30,000 | 250 MAX | 0.01 | 0.075 | 30,000 | 150 MAX | 0.01 | 0.05 |
| **1015-010030** | | R0.1 | 3 | 30,000 | 280 MAX | 0.01 | 0.075 | 30,000 | 225 MAX | 0.01 | 0.075 |
| **1020-002040** | **2** | R0.02 | 4 | 30,000 | 300 MAX | 0.005 | 0.1 | 30,000 | 100 MAX | 0.005 | 0.03 |
| **1020-002060** | | | 6 | 30,000 | 300 MAX | 0.005 | 0.1 | 30,000 | 100 MAX | 0.005 | 0.03 |
| **1020-005040** | | R0.05 | 4 | 30,000 | 330 MAX | 0.01 | 0.1 | 30,000 | 200 MAX | 0.01 | 0.07 |
| **1020-005060** | | | 6 | 30,000 | 330 MAX | 0.01 | 0.1 | 30,000 | 200 MAX | 0.01 | 0.07 |
| **1020-010040** | | R0.1 | 4 | 30,000 | 375 MAX | 0.01 | 0.1 | 30,000 | 300 MAX | 0.01 | 0.1 |
| **1020-010060** | | | 6 | 30,000 | 375 MAX | 0.01 | 0.1 | 30,000 | 300 MAX | 0.01 | 0.1 |



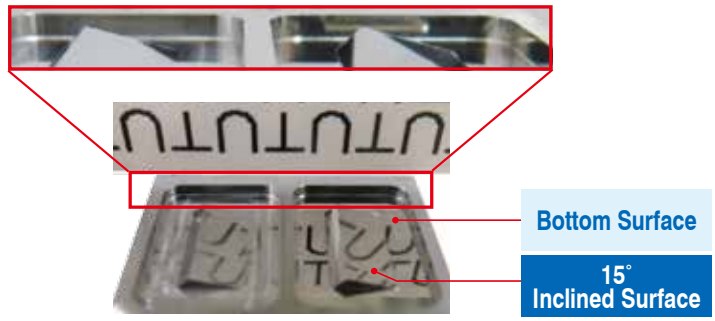

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Recommend oil mist to avoid tool damage.

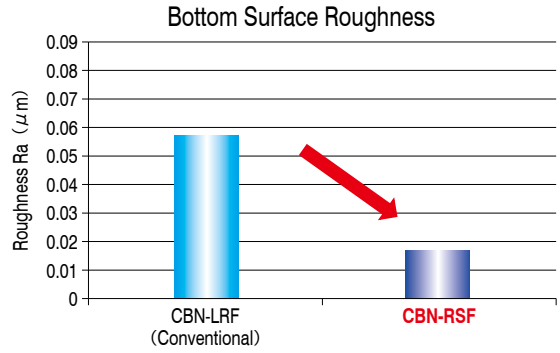
## Milling example of inclined pocket
## CBN-RSF φ2 × CR0.1 × Effective Length 4

ELMAX (60.5HRC)

Vertical Wall




Milled Size : 9 × 13 × Depth 1 mm
Coolant : Oil Mist

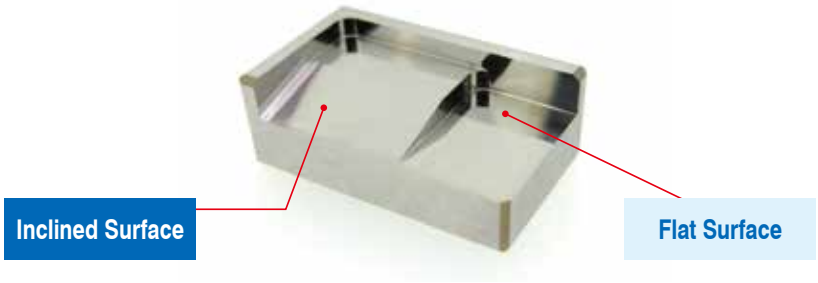



| | |
|---|---|
| Tool | CBN-RSF 1020-010040 |
| Process | Finishing |
| Milling Method | Contour Milling |
| Spindle Speed | 30,000 $min^{-1}$ |
| Feed Rate | 375 mm/min |
| Finishing Allowance | 0.01 mm |
| Cusp Height at Inclined Surface | 0.00003 mm |
| Cycle Time | 61 min |

**Improved quality for milling on the bottom, inclined and vertical surfaces as compared to conventional CBN-LRF series.**

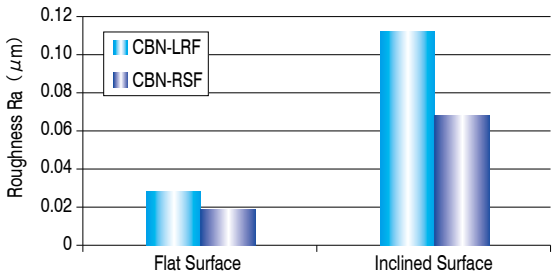
## Milling example of pocket
## CBN-RSF ϕ 2 × CR0.1 × Effective Length 4

ELMAX（60HRC）




Work Size：25 × 15 × 10 mm
Coolant：Oil Mist

Surface Roughness




| No. | Process | Tool | Spindle Speed (min$^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Allowance (mm) | Cycle Time |
|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | HGLB 2020-040 (R1 x Effective Length 4) | 14,000 | 2,100 | 0.15 | 0.5 | 0.05 | 0:10:17 |
| 2 | Semi-finishing | HLRS 4020-01-040 (ϕ 2 x CR0.1 x Effective Length 4) | 11,500 | 860 | 0.031 | 0.36 | 0.05 | 1:11:50 |
| | | | | | 0.02 | 0.36 | 0.02 | |
| | | | | | 0.005 | 0.1 | 0.01 | |
| 3 | Finishing | CBN-RSF 1020-010040 (ϕ 2 x CR0.1 x Effective Length 4) | 30,000 | 375 | 0.01 | 0.1 | 0 | 2:25:01 |
| | | | | | | | Total | 3:47:08 |

Size φ0.1～φ2

# CBN-LRF

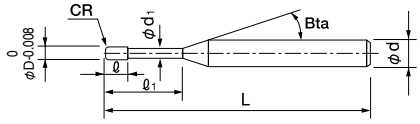
CBN | 0° | R | R ±0.002 (CR≦0.03) | R ±0.003 (CR>0.03) | Shank Dia 0/-0.004 | Back Taper Geometry

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

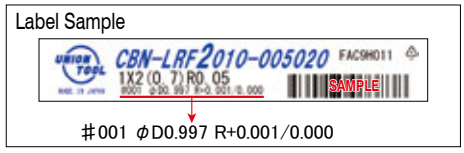
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ ～68HRC | | | | | | | | | | |

## Features

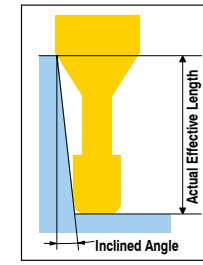
**Optimized CBN material for milling the ultra-hard materials and cutting edge geometry offer high precision milling and long tool life.**
**Excellent wear and chipping resistance maintain outstanding surface roughness and precision throughout the long cycle time.**
**High precision shank diameter tolerance 0/-0.004 mm.**
**Diameter tolerance 0/-0.008 mm, with highly precision corner radius.**




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




Diameter and Corner R accuracy measurements are printed on the label to support High Precision milling.




Total 139 models

*Shank taper angle Bta is only for reference.

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CBN-LRF 2001-002002 | 0.1 | R0.02 | 0.2 | 0.04 | 0.09 | 15° | 50 | 4 | 44,500 | 0.20 | 0.20 | 0.20 | 0.20 | 0.21 |
| CBN-LRF 2001-002003 | | | 0.3 | | | | 50 | 4 | 45,200 | 0.30 | 0.30 | 0.30 | 0.30 | 0.33 |
| CBN-LRF 2001-002005 | | | 0.5 | | | | 50 | 4 | 46,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.58 |
| CBN-LRF 2001-003002 | | R0.03 | 0.2 | | | | 50 | 4 | 42,500 | 0.20 | 0.20 | 0.20 | 0.20 | 0.21 |
| CBN-LRF 2001-003003 | | | 0.3 | | | | 50 | 4 | 43,200 | 0.30 | 0.30 | 0.30 | 0.30 | 0.33 |
| CBN-LRF 2001-003005 | | | 0.5 | | | | 50 | 4 | 44,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.58 |
| CBN-LRF 20015-002X2 | 0.15 | R0.02 | 0.2 | 0.06 | 0.14 | 15° | 50 | 4 | 44,500 | 0.20 | 0.20 | 0.20 | 0.20 | 0.21 |
| CBN-LRF 20015-002X3 | | | 0.3 | | | | 50 | 4 | 45,200 | 0.30 | 0.30 | 0.30 | 0.30 | 0.33 |
| CBN-LRF 20015-002X5 | | | 0.5 | | | | 50 | 4 | 46,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.58 |
| CBN-LRF 20015-003X2 | | R0.03 | 0.2 | | | | 50 | 4 | 42,500 | 0.20 | 0.20 | 0.20 | 0.20 | 0.21 |
| CBN-LRF 20015-003X3 | | | 0.3 | | | | 50 | 4 | 43,200 | 0.30 | 0.30 | 0.30 | 0.30 | 0.33 |
| CBN-LRF 20015-003X5 | | | 0.5 | | | | 50 | 4 | 44,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.58 |

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CBN-LRF 2002-002005 | 0.2 | R0.02 | 0.5 | 0.08 | 0.19 | 15° | 50 | 4 | 33,900 | 0.50 | 0.50 | 0.51 | 0.53 | 0.58 |
| CBN-LRF 2002-002X75 | | | 0.75 | | | | 50 | 4 | 34,400 | 0.75 | 0.76 | 0.79 | 0.82 | 0.89 |
| CBN-LRF 2002-002010 | | | 1 | | | | 50 | 4 | 34,900 | 1.00 | 1.03 | 1.07 | 1.11 | 1.20 |
| CBN-LRF 2002-003005 | | R0.03 | 0.5 | | | | 50 | 4 | 30,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.58 |
| CBN-LRF 2002-003X75 | | | 0.75 | | | | 50 | 4 | 30,900 | 0.75 | 0.76 | 0.79 | 0.82 | 0.89 |
| CBN-LRF 2002-003010 | | | 1 | | | | 50 | 4 | 31,400 | 1.00 | 1.03 | 1.07 | 1.11 | 1.20 |
| CBN-LRF 2002-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 30,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.57 |
| CBN-LRF 2002-005X75 | | | 0.75 | | | | 50 | 4 | 30,900 | 0.75 | 0.76 | 0.79 | 0.82 | 0.88 |
| CBN-LRF 2002-005010 | | | 1 | | | | 50 | 4 | 31,400 | 1.00 | 1.03 | 1.06 | 1.10 | 1.19 |
| CBN-LRF 20025-005X5 | 0.25 | R0.05 | 0.5 | 0.1 | 0.24 | 15° | 50 | 4 | 30,500 | 0.50 | 0.50 | 0.51 | 0.53 | 0.57 |
| CBN-LRF 20025-X5X75 | | | 0.75 | | | | 50 | 4 | 30,900 | 0.75 | 0.76 | 0.79 | 0.82 | 0.88 |
| CBN-LRF 20025-X5010 | | | 1 | | | | 50 | 4 | 31,400 | 1.00 | 1.03 | 1.06 | 1.10 | 1.19 |
| CBN-LRF 2003-001010 | 0.3 | R0.01 | 1 | 0.13 | 0.28 | 15° | 50 | 4 | 33,900 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2003-002005 | | R0.02 | 0.5 | | | | 50 | 4 | 33,500 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2003-002X75 | | | 0.75 | | | | 50 | 4 | 33,700 | 0.77 | 0.79 | 0.82 | 0.86 | 0.93 |
| CBN-LRF 2003-002010 | | | 1 | | | | 50 | 4 | 33,900 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2003-002015 | | | 1.5 | | | | 50 | 4 | 34,400 | 1.54 | 1.60 | 1.65 | 1.72 | 1.86 |
| CBN-LRF 2003-002020 | | | 2 | | | | 50 | 4 | 34,900 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2003-003005 | | R0.03 | 0.5 | | | | 50 | 4 | 30,100 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2003-003X75 | | | 0.75 | | | | 50 | 4 | 30,300 | 0.77 | 0.79 | 0.82 | 0.85 | 0.93 |
| CBN-LRF 2003-003010 | | | 1 | | | | 50 | 4 | 30,500 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2003-003015 | | | 1.5 | | | | 50 | 4 | 30,900 | 1.54 | 1.60 | 1.65 | 1.72 | 1.86 |
| CBN-LRF 2003-003020 | | | 2 | | | | 50 | 4 | 31,300 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2003-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 30,100 | 0.51 | 0.52 | 0.54 | 0.56 | 0.61 |
| CBN-LRF 2003-005X75 | | | 0.75 | | | | 50 | 4 | 30,300 | 0.76 | 0.79 | 0.82 | 0.85 | 0.92 |
| CBN-LRF 2003-005010 | | | 1 | | | | 50 | 4 | 30,500 | 1.02 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-LRF 2003-005015 | | | 1.5 | | | | 50 | 4 | 30,900 | 1.54 | 1.59 | 1.65 | 1.71 | 1.85 |
| CBN-LRF 2003-005020 | | | 2 | | | | 50 | 4 | 31,300 | 2.05 | 2.12 | 2.20 | 2.28 | 2.46 |
| CBN-LRF 2004-002005 | 0.4 | R0.02 | 0.5 | 0.24 | 0.38 | 15° | 50 | 4 | 31,800 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2004-002010 | | | 1 | | | | 50 | 4 | 32,000 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2004-002015 | | | 1.5 | | | | 50 | 4 | 32,400 | 1.53 | 1.59 | 1.64 | 1.71 | 1.85 |
| CBN-LRF 2004-002020 | | | 2 | | | | 50 | 4 | 32,800 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2004-003005 | | R0.03 | 0.5 | | | | 50 | 4 | 28,600 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2004-003010 | | | 1 | | | | 50 | 4 | 28,800 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2004-003015 | | | 1.5 | | | | 50 | 4 | 28,800 | 1.53 | 1.59 | 1.64 | 1.71 | 1.85 |
| CBN-LRF 2004-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 28,600 | 0.51 | 0.52 | 0.54 | 0.56 | 0.61 |
| CBN-LRF 2004-005010 | | | 1 | | | | 50 | 4 | 28,800 | 1.02 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-LRF 2004-005015 | | | 1.5 | | | | 50 | 4 | 28,800 | 1.53 | 1.58 | 1.64 | 1.70 | 1.84 |
| CBN-LRF 2004-005020 | | | 2 | | | | 50 | 4 | 28,800 | 2.05 | 2.12 | 2.20 | 2.28 | 2.46 |
| CBN-LRF 2004-005040 | | | 4 | | | | 50 | 4 | 29,800 | 4.11 | 4.26 | 4.41 | 4.58 | 4.95 |
| CBN-LRF 2004-010005 | | R0.1 | 0.5 | | | | 50 | 4 | 28,600 | 0.50 | 0.52 | 0.54 | 0.56 | 0.60 |
| CBN-LRF 2004-010010 | | | 1 | | | | 50 | 4 | 28,800 | 1.02 | 1.06 | 1.09 | 1.13 | 1.22 |
| CBN-LRF 2004-010015 | | | 1.5 | | | | 50 | 4 | 28,800 | 1.53 | 1.58 | 1.64 | 1.70 | 1.83 |

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CBN-LRF 2005-001010 | 0.5 | R0.01 | 1 | 0.3 | 0.48 | 15° | 50 | 4 | 26,400 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2005-002005 | | R0.02 | 0.5 | | | | 50 | 4 | 26,100 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2005-002010 | | | 1 | | | | 50 | 4 | 26,400 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2005-002015 | | | 1.5 | | | | 50 | 4 | 26,600 | 1.53 | 1.59 | 1.64 | 1.71 | 1.85 |
| CBN-LRF 2005-002020 | | | 2 | | | | 50 | 4 | 26,800 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2005-003005 | | R0.03 | 0.5 | | | | 50 | 4 | 23,500 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2005-003010 | | | 1 | | | | 50 | 4 | 23,700 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2005-003015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.59 | 1.64 | 1.71 | 1.85 |
| CBN-LRF 2005-003020 | | | 2 | | | | 50 | 4 | 24,100 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2005-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 23,500 | 0.51 | 0.52 | 0.54 | 0.56 | 0.61 |
| CBN-LRF 2005-005010 | | | 1 | | | | 50 | 4 | 23,700 | 1.02 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-LRF 2005-005015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.58 | 1.64 | 1.70 | 1.84 |
| CBN-LRF 2005-005020 | | | 2 | | | | 50 | 4 | 24,100 | 2.05 | 2.12 | 2.20 | 2.28 | 2.46 |
| CBN-LRF 2005-010005 | | R0.1 | 0.5 | | | | 50 | 4 | 23,500 | 0.50 | 0.52 | 0.54 | 0.56 | 0.60 |
| CBN-LRF 2005-010010 | | | 1 | | | | 50 | 4 | 23,700 | 1.02 | 1.06 | 1.09 | 1.13 | 1.22 |
| CBN-LRF 2005-010015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.58 | 1.64 | 1.70 | 1.83 |
| CBN-LRF 2005-010020 | | | 2 | | | | 50 | 4 | 24,100 | 2.05 | 2.12 | 2.19 | 2.27 | 2.45 |
| CBN-LRF 2006-002005 | 0.6 | R0.02 | 0.5 | 0.3 | 0.58 | 15° | 50 | 4 | 26,100 | 0.51 | 0.53 | 0.55 | 0.57 | 0.62 |
| CBN-LRF 2006-002010 | | | 1 | | | | 50 | 4 | 26,400 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2006-002015 | | | 1.5 | | | | 50 | 4 | 26,600 | 1.53 | 1.59 | 1.64 | 1.71 | 1.85 |
| CBN-LRF 2006-005005 | | R0.05 | 0.5 | | | | 50 | 4 | 23,500 | 0.51 | 0.52 | 0.54 | 0.56 | 0.61 |
| CBN-LRF 2006-005010 | | | 1 | | | | 50 | 4 | 23,700 | 1.02 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-LRF 2006-005015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.58 | 1.64 | 1.70 | 1.84 |
| CBN-LRF 2006-005030 | | | 3 | | | | 50 | 4 | 26,100 | 3.08 | 3.19 | 3.30 | 3.43 | 3.71 |
| CBN-LRF 2006-010005 | | R0.1 | 0.5 | | | | 50 | 4 | 23,500 | 0.50 | 0.52 | 0.54 | 0.56 | 0.60 |
| CBN-LRF 2006-010010 | | | 1 | | | | 50 | 4 | 23,700 | 1.02 | 1.06 | 1.09 | 1.13 | 1.22 |
| CBN-LRF 2006-010015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.58 | 1.64 | 1.70 | 1.83 |
| CBN-LRF 2008-002010 | 0.8 | R0.02 | 1 | 0.56 | 0.78 | 15° | 50 | 4 | 26,600 | 1.02 | 1.06 | 1.10 | 1.14 | 1.24 |
| CBN-LRF 2008-002015 | | | 1.5 | | | | 50 | 4 | 26,600 | 1.53 | 1.59 | 1.64 | 1.71 | 1.85 |
| CBN-LRF 2008-002020 | | | 2 | | | | 50 | 4 | 26,600 | 2.05 | 2.12 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2008-002050 | | | 5 | | | | 50 | 4 | 30,100 | 5.15 | 5.33 | 5.52 | 5.73 | 6.20 |
| CBN-LRF 2008-005010 | | R0.05 | 1 | | | | 50 | 4 | 23,900 | 1.02 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-LRF 2008-005015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.58 | 1.64 | 1.70 | 1.84 |
| CBN-LRF 2008-005020 | | | 2 | | | | 50 | 4 | 23,900 | 2.05 | 2.12 | 2.20 | 2.28 | 2.46 |
| CBN-LRF 2008-005050 | | | 5 | | | | 50 | 4 | 27,000 | 5.15 | 5.33 | 5.52 | 5.73 | 6.19 |
| CBN-LRF 2008-010010 | | R0.1 | 1 | | | | 50 | 4 | 23,900 | 1.02 | 1.06 | 1.09 | 1.13 | 1.22 |
| CBN-LRF 2008-010015 | | | 1.5 | | | | 50 | 4 | 23,900 | 1.53 | 1.58 | 1.64 | 1.70 | 1.83 |
| CBN-LRF 2008-010020 | | | 2 | | | | 50 | 4 | 23,900 | 2.05 | 2.12 | 2.19 | 2.27 | 2.45 |
| CBN-LRF 2008-010050 | | | 5 | | | | 50 | 4 | 27,000 | 5.15 | 5.32 | 5.52 | 5.72 | 6.18 |





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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CBN-LRF 2010-002010 | 1 | R0.02 | 1 | 0.7 | 0.98 | 15° | 50 | 4 | 24,400 | 1.03 | 1.06 | 1.10 | 1.15 | 1.24 |
| CBN-LRF 2010-002020 | | | 2 | | | | 50 | 4 | 24,400 | 2.06 | 2.13 | 2.21 | 2.30 | 2.48 |
| CBN-LRF 2010-002030 | | | 3 | | | | 50 | 4 | 24,400 | 3.09 | 3.20 | 3.32 | 3.45 | 3.73 |
| CBN-LRF 2010-002050 | | | 5 | | | | 50 | 4 | 27,600 | 5.16 | 5.34 | 5.54 | 5.74 | 6.21 |
| CBN-LRF 2010-005010 | | R0.05 | 1 | | | | 50 | 4 | 21,900 | 1.03 | 1.06 | 1.10 | 1.14 | 1.23 |
| CBN-LRF 2010-005020 | | | 2 | | | | 50 | 4 | 21,900 | 2.06 | 2.13 | 2.21 | 2.29 | 2.48 |
| CBN-LRF 2010-005030 | | | 3 | | | | 50 | 4 | 21,900 | 3.09 | 3.20 | 3.32 | 3.44 | 3.72 |
| CBN-LRF 2010-005050 | | | 5 | | | | 50 | 4 | 24,800 | 5.16 | 5.34 | 5.53 | 5.74 | 6.21 |
| CBN-LRF 2010-010010 | | R0.1 | 1 | | | | 50 | 4 | 21,900 | 1.02 | 1.06 | 1.09 | 1.13 | 1.22 |
| CBN-LRF 2010-010020 | | | 2 | | | | 50 | 4 | 21,900 | 2.06 | 2.13 | 2.20 | 2.28 | 2.47 |
| CBN-LRF 2010-010030 | | | 3 | | | | 50 | 4 | 21,900 | 3.09 | 3.20 | 3.31 | 3.43 | 3.71 |
| CBN-LRF 2010-010050 | | | 5 | | | | 50 | 4 | 24,800 | 5.16 | 5.34 | 5.53 | 5.73 | 6.20 |
| CBN-LRF 2010-020010 | | R0.2 | 1 | | | | 50 | 4 | 21,900 | 1.02 | 1.05 | 1.08 | 1.12 | 1.20 |
| CBN-LRF 2010-020020 | | | 2 | | | | 50 | 4 | 21,900 | 2.05 | 2.12 | 2.19 | 2.27 | 2.44 |
| CBN-LRF 2015-002030 | 1.5 | R0.02 | 3 | 1 | 1.46 | 15° | 50 | 4 | 28,700 | 3.13 | 3.24 | 3.36 | 3.49 | 3.77 |
| CBN-LRF 2015-002040 | | | 4 | | | | 50 | 4 | 28,700 | 4.17 | 4.31 | 4.47 | 4.64 | 5.02 |
| CBN-LRF 2015-002060 | | | 6 | | | | 50 | 4 | 28,700 | 6.23 | 6.45 | 6.69 | 6.94 | 7.50 |
| CBN-LRF 2015-005030 | | R0.05 | 3 | | | | 50 | 4 | 25,800 | 3.13 | 3.24 | 3.36 | 3.48 | 3.77 |
| CBN-LRF 2015-005040 | | | 4 | | | | 50 | 4 | 25,800 | 4.16 | 4.31 | 4.47 | 4.63 | 5.01 |
| CBN-LRF 2015-005060 | | | 6 | | | | 50 | 4 | 25,800 | 6.23 | 6.45 | 6.68 | 6.93 | 7.50 |
| CBN-LRF 2015-010030 | | R0.1 | 3 | | | | 50 | 4 | 25,800 | 3.13 | 3.24 | 3.35 | 3.48 | 3.76 |
| CBN-LRF 2015-010040 | | | 4 | | | | 50 | 4 | 25,800 | 4.16 | 4.31 | 4.46 | 4.63 | 5.00 |
| CBN-LRF 2015-010060 | | | 6 | | | | 50 | 4 | 25,800 | 6.23 | 6.45 | 6.68 | 6.93 | 7.48 |
| CBN-LRF 2015-030045 | | R0.3 | 4.5 | | | | 50 | 4 | 25,800 | 4.67 | 4.83 | 4.99 | 5.17 | 5.57 |
| CBN-LRF 2020-002040 | 2 | R0.02 | 4 | 1.2 | 1.97 | 15° | 50 | 4 | 29,600 | 4.15 | 4.29 | 4.45 | 4.62 | 4.99 |
| CBN-LRF 2020-002060 | | | 6 | | | | 50 | 4 | 29,600 | 6.21 | 6.43 | 6.67 | 6.92 | 7.48 |
| CBN-LRF 2020-002080 | | | 8 | | | | 50 | 4 | 31,300 | 8.28 | 8.57 | 8.88 | 9.22 | 9.97 |
| CBN-LRF 2020-002100 | | | 10 | | | | 50 | 4 | 33,000 | 10.35 | 10.71 | 11.10 | 11.52 | 12.45 |
| CBN-LRF 2020-003030 | | R0.03 | 3 | | | | 50 | 4 | 26,600 | 3.11 | 3.22 | 3.34 | 3.47 | 3.75 |
| CBN-LRF 2020-005040 | | R0.05 | 4 | | | | 50 | 4 | 26,600 | 4.15 | 4.29 | 4.45 | 4.61 | 4.99 |
| CBN-LRF 2020-005060 | | | 6 | | | | 50 | 4 | 26,600 | 6.21 | 6.43 | 6.66 | 6.91 | 7.47 |
| CBN-LRF 2020-005080 | | | 8 | | | | 50 | 4 | 28,150 | 8.28 | 8.57 | 8.88 | 9.21 | 9.96 |
| CBN-LRF 2020-005100 | | | 10 | | | | 50 | 4 | 29,700 | 10.35 | 10.71 | 11.10 | 11.51 | 12.45 |
| CBN-LRF 2020-010040 | | R0.1 | 4 | | | | 50 | 4 | 26,600 | 4.14 | 4.29 | 4.44 | 4.60 | 4.98 |
| CBN-LRF 2020-010060 | | | 6 | | | | 50 | 4 | 26,600 | 6.21 | 6.43 | 6.66 | 6.90 | 7.46 |
| CBN-LRF 2020-010080 | | | 8 | | | | 50 | 4 | 28,150 | 8.28 | 8.57 | 8.87 | 9.20 | 9.95 |
| CBN-LRF 2020-010100 | | | 10 | | | | 50 | 4 | 29,700 | 10.35 | 10.70 | 11.09 | 11.50 | 12.43 |
| CBN-LRF 2020-020040 | | R0.2 | 4 | | | | 50 | 4 | 26,600 | 4.14 | 4.28 | 4.43 | 4.59 | 4.95 |
| CBN-LRF 2020-020060 | | | 6 | | | | 50 | 4 | 26,600 | 6.21 | 6.42 | 6.65 | 6.89 | 7.44 |
| CBN-LRF 2020-020080 | | | 8 | | | | 50 | 4 | 28,150 | 8.28 | 8.56 | 8.86 | 9.19 | 9.92 |
| CBN-LRF 2020-020100 | | | 10 | | | | 50 | 4 | 29,700 | 10.34 | 10.70 | 11.08 | 11.49 | 12.41 |
| CBN-LRF 2020-050040 | | R0.5 | 4 | | | | 50 | 4 | 26,600 | 4.13 | 4.26 | 4.40 | 4.55 | 4.88 |
| CBN-LRF 2020-050060 | | | 6 | | | | 50 | 4 | 26,600 | 6.20 | 6.40 | 6.61 | 6.85 | 7.37 |
| CBN-LRF 2020-050080 | | | 8 | | | | 50 | 4 | 28,150 | 8.27 | 8.54 | 8.83 | 9.15 | 9.85 |
| CBN-LRF 2020-050100 | | | 10 | | | | 50 | 4 | 29,700 | 10.33 | 10.68 | 11.05 | 11.45 | 12.34 |

## Milling Conditions for CBN-LRF

| WORK MATERIAL | | | | HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC) | | | | HARDENED STEELS SKD11 (~62HRC) | | | | HARDENED STEELS HAP10 / HAP72 (~68HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Effective Length (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) |
| **2001-002002** | 0.1 | R0.02 | 0.2 | 30,000 | 90 | 0.002 | 0.01 | 30,000 | 60 | 0.002 | 0.01 | 30,000 | 30 | 0.002 | 0.005 |
| **2001-002003** | | | 0.3 | 30,000 | 90 | 0.002 | 0.01 | 30,000 | 60 | 0.002 | 0.01 | 30,000 | 30 | 0.002 | 0.005 |
| **2001-002005** | | | 0.5 | 30,000 | 90 | 0.002 | 0.01 | 30,000 | 60 | 0.002 | 0.01 | 30,000 | 30 | 0.002 | 0.005 |
| **2001-003002** | | R0.03 | 0.2 | 30,000 | 90 | 0.002 | 0.01 | 30,000 | 60 | 0.002 | 0.01 | 30,000 | 30 | 0.002 | 0.005 |
| **2001-003003** | | | 0.3 | 30,000 | 90 | 0.002 | 0.01 | 30,000 | 60 | 0.002 | 0.01 | 30,000 | 30 | 0.002 | 0.005 |
| **2001-003005** | | | 0.5 | 30,000 | 90 | 0.002 | 0.01 | 30,000 | 60 | 0.002 | 0.01 | 30,000 | 30 | 0.002 | 0.005 |
| **20015-002X2** | 0.15 | R0.02 | 0.2 | 30,000 | 120 | 0.003 | 0.015 | 30,000 | 90 | 0.003 | 0.015 | 30,000 | 60 | 0.002 | 0.01 |
| **20015-002X3** | | | 0.3 | 30,000 | 120 | 0.003 | 0.015 | 30,000 | 90 | 0.003 | 0.015 | 30,000 | 60 | 0.002 | 0.01 |
| **20015-002X5** | | | 0.5 | 30,000 | 120 | 0.003 | 0.015 | 30,000 | 90 | 0.003 | 0.015 | 30,000 | 60 | 0.002 | 0.01 |
| **20015-003X2** | | R0.03 | 0.2 | 30,000 | 120 | 0.003 | 0.015 | 30,000 | 90 | 0.003 | 0.015 | 30,000 | 60 | 0.002 | 0.01 |
| **20015-003X3** | | | 0.3 | 30,000 | 120 | 0.003 | 0.015 | 30,000 | 90 | 0.003 | 0.015 | 30,000 | 60 | 0.002 | 0.01 |
| **20015-003X5** | | | 0.5 | 30,000 | 120 | 0.003 | 0.015 | 30,000 | 90 | 0.003 | 0.015 | 30,000 | 60 | 0.002 | 0.01 |
| **2002-002005** | 0.2 | R0.02 | 0.5 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-002X75** | | | 0.75 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-002010** | | | 1 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-003005** | | R0.03 | 0.5 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-003X75** | | | 0.75 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-003010** | | | 1 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-005005** | | R0.05 | 0.5 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-005X75** | | | 0.75 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **2002-005010** | | | 1 | 30,000 | 140 | 0.003 | 0.02 | 30,000 | 120 | 0.003 | 0.02 | 30,000 | 80 | 0.003 | 0.01 |
| **20025-005X5** | 0.25 | R0.05 | 0.5 | 30,000 | 190 | 0.004 | 0.03 | 30,000 | 170 | 0.004 | 0.03 | 30,000 | 140 | 0.003 | 0.015 |
| **20025-X5X75** | | | 0.75 | 30,000 | 190 | 0.004 | 0.03 | 30,000 | 170 | 0.004 | 0.03 | 30,000 | 140 | 0.003 | 0.015 |
| **20025-X5010** | | | 1 | 30,000 | 190 | 0.004 | 0.03 | 30,000 | 170 | 0.004 | 0.03 | 30,000 | 140 | 0.003 | 0.015 |
| **2003-001010** | 0.3 | R0.01 | 1 | 30,000 | 185 | 0.003 | 0.045 | 30,000 | 160 | 0.003 | 0.045 | 30,000 | 120 | 0.003 | 0.02 |
| **2003-002005** | | R0.02 | 0.5 | 30,000 | 185 | 0.003 | 0.045 | 30,000 | 160 | 0.003 | 0.045 | 30,000 | 120 | 0.003 | 0.02 |
| **2003-002X75** | | | 0.75 | 30,000 | 185 | 0.003 | 0.045 | 30,000 | 160 | 0.003 | 0.045 | 30,000 | 120 | 0.003 | 0.02 |
| **2003-002010** | | | 1 | 30,000 | 185 | 0.003 | 0.045 | 30,000 | 160 | 0.003 | 0.045 | 30,000 | 120 | 0.003 | 0.02 |
| **2003-002015** | | | 1.5 | 30,000 | 185 | 0.003 | 0.045 | 30,000 | 160 | 0.003 | 0.045 | 30,000 | 120 | 0.003 | 0.02 |
| **2003-002020** | | | 2 | 30,000 | 130 | 0.003 | 0.022 | 30,000 | 110 | 0.003 | 0.022 | 30,000 | 80 | 0.003 | 0.01 |
| **2003-003005** | | R0.03 | 0.5 | 30,000 | 200 | 0.004 | 0.045 | 30,000 | 175 | 0.004 | 0.045 | 30,000 | 150 | 0.003 | 0.02 |
| **2003-003X75** | | | 0.75 | 30,000 | 200 | 0.004 | 0.045 | 30,000 | 175 | 0.004 | 0.045 | 30,000 | 150 | 0.003 | 0.02 |
| **2003-003010** | | | 1 | 30,000 | 200 | 0.004 | 0.045 | 30,000 | 175 | 0.004 | 0.045 | 30,000 | 150 | 0.003 | 0.02 |
| **2003-003015** | | | 1.5 | 30,000 | 200 | 0.004 | 0.045 | 30,000 | 175 | 0.004 | 0.045 | 30,000 | 150 | 0.003 | 0.02 |
| **2003-003020** | | | 2 | 30,000 | 140 | 0.004 | 0.022 | 30,000 | 120 | 0.004 | 0.022 | 30,000 | 110 | 0.003 | 0.01 |
| **2003-005005** | | R0.05 | 0.5 | 30,000 | 240 | 0.005 | 0.045 | 30,000 | 225 | 0.005 | 0.045 | 30,000 | 210 | 0.004 | 0.02 |
| **2003-005X75** | | | 0.75 | 30,000 | 240 | 0.005 | 0.045 | 30,000 | 225 | 0.005 | 0.045 | 30,000 | 210 | 0.004 | 0.02 |
| **2003-005010** | | | 1 | 30,000 | 240 | 0.005 | 0.045 | 30,000 | 225 | 0.005 | 0.045 | 30,000 | 210 | 0.004 | 0.02 |
| **2003-005015** | | | 1.5 | 30,000 | 240 | 0.005 | 0.045 | 30,000 | 225 | 0.005 | 0.045 | 30,000 | 210 | 0.004 | 0.02 |
| **2003-005020** | | | 2 | 30,000 | 170 | 0.005 | 0.022 | 30,000 | 160 | 0.005 | 0.022 | 30,000 | 150 | 0.004 | 0.01 |
| **2004-002005** | 0.4 | R0.02 | 0.5 | 30,000 | 230 | 0.005 | 0.065 | 30,000 | 200 | 0.005 | 0.065 | 30,000 | 160 | 0.004 | 0.02 |
| **2004-002010** | | | 1 | 30,000 | 230 | 0.005 | 0.065 | 30,000 | 200 | 0.005 | 0.065 | 30,000 | 160 | 0.004 | 0.02 |
| **2004-002015** | | | 1.5 | 30,000 | 230 | 0.005 | 0.065 | 30,000 | 200 | 0.005 | 0.065 | 30,000 | 160 | 0.004 | 0.02 |
| **2004-002020** | | | 2 | 30,000 | 230 | 0.005 | 0.065 | 30,000 | 200 | 0.005 | 0.065 | 30,000 | 160 | 0.004 | 0.02 |
| **2004-003005** | | R0.03 | 0.5 | 30,000 | 270 | 0.006 | 0.065 | 30,000 | 230 | 0.006 | 0.065 | 30,000 | 180 | 0.004 | 0.02 |
| **2004-003010** | | | 1 | 30,000 | 270 | 0.006 | 0.065 | 30,000 | 230 | 0.006 | 0.065 | 30,000 | 180 | 0.004 | 0.02 |
| **2004-003015** | | | 1.5 | 30,000 | 270 | 0.006 | 0.065 | 30,000 | 230 | 0.006 | 0.065 | 30,000 | 180 | 0.004 | 0.02 |
| **2004-005005** | | R0.05 | 0.5 | 30,000 | 340 | 0.01 | 0.065 | 30,000 | 300 | 0.01 | 0.065 | 30,000 | 220 | 0.005 | 0.02 |
| **2004-005010** | | | 1 | 30,000 | 340 | 0.01 | 0.065 | 30,000 | 300 | 0.01 | 0.065 | 30,000 | 220 | 0.005 | 0.02 |
| **2004-005015** | | | 1.5 | 30,000 | 340 | 0.01 | 0.065 | 30,000 | 300 | 0.01 | 0.065 | 30,000 | 220 | 0.005 | 0.02 |
| **2004-005020** | | | 2 | 30,000 | 340 | 0.01 | 0.065 | 30,000 | 300 | 0.01 | 0.065 | 30,000 | 220 | 0.005 | 0.02 |
| **2004-005040** | | | 4 | 30,000 | 170 | 0.01 | 0.032 | 30,000 | 150 | 0.01 | 0.032 | 30,000 | 110 | 0.005 | 0.01 |
| **2004-010005** | | R0.1 | 0.5 | 30,000 | 520 | 0.01 | 0.065 | 30,000 | 450 | 0.01 | 0.065 | 30,000 | 320 | 0.005 | 0.02 |
| **2004-010010** | | | 1 | 30,000 | 520 | 0.01 | 0.065 | 30,000 | 450 | 0.01 | 0.065 | 30,000 | 320 | 0.005 | 0.02 |
| **2004-010015** | | | 1.5 | 30,000 | 520 | 0.01 | 0.065 | 30,000 | 450 | 0.01 | 0.065 | 30,000 | 320 | 0.005 | 0.02 |

## Milling Conditions for CBN-LRF

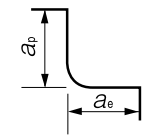
| WORK MATERIAL | | | | HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC) | | | | HARDENED STEELS SKD11 (~62HRC) | | | | HARDENED STEELS HAP10 / HAP72 (~68HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Effective Length (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) |
| **2005-001010** | **0.5** | R0.01 | 1 | 30,000 | 280 | 0.003 | 0.09 | 30,000 | 240 | 0.003 | 0.09 | 30,000 | 200 | 0.003 | 0.03 |
| **2005-002005** | | R0.02 | 0.5 | 30,000 | 280 | 0.005 | 0.09 | 30,000 | 240 | 0.005 | 0.09 | 30,000 | 200 | 0.005 | 0.03 |
| **2005-002010** | | | 1 | 30,000 | 280 | 0.005 | 0.09 | 30,000 | 240 | 0.005 | 0.09 | 30,000 | 200 | 0.005 | 0.03 |
| **2005-002015** | | | 1.5 | 30,000 | 280 | 0.005 | 0.09 | 30,000 | 240 | 0.005 | 0.09 | 30,000 | 200 | 0.005 | 0.03 |
| **2005-002020** | | | 2 | 30,000 | 280 | 0.005 | 0.09 | 30,000 | 240 | 0.005 | 0.09 | 30,000 | 200 | 0.005 | 0.03 |
| **2005-003005** | | R0.03 | 0.5 | 30,000 | 330 | 0.006 | 0.09 | 30,000 | 280 | 0.006 | 0.09 | 30,000 | 230 | 0.005 | 0.03 |
| **2005-003010** | | | 1 | 30,000 | 330 | 0.006 | 0.09 | 30,000 | 280 | 0.006 | 0.09 | 30,000 | 230 | 0.005 | 0.03 |
| **2005-003015** | | | 1.5 | 30,000 | 330 | 0.006 | 0.09 | 30,000 | 280 | 0.006 | 0.09 | 30,000 | 230 | 0.005 | 0.03 |
| **2005-003020** | | | 2 | 30,000 | 330 | 0.006 | 0.09 | 30,000 | 280 | 0.006 | 0.09 | 30,000 | 230 | 0.005 | 0.03 |
| **2005-005005** | | R0.05 | 0.5 | 30,000 | 440 | 0.01 | 0.09 | 30,000 | 380 | 0.01 | 0.09 | 30,000 | 280 | 0.01 | 0.03 |
| **2005-005010** | | | 1 | 30,000 | 440 | 0.01 | 0.09 | 30,000 | 380 | 0.01 | 0.09 | 30,000 | 280 | 0.01 | 0.03 |
| **2005-005015** | | | 1.5 | 30,000 | 440 | 0.01 | 0.09 | 30,000 | 380 | 0.01 | 0.09 | 30,000 | 280 | 0.01 | 0.03 |
| **2005-005020** | | | 2 | 30,000 | 440 | 0.01 | 0.09 | 30,000 | 380 | 0.01 | 0.09 | 30,000 | 280 | 0.01 | 0.03 |
| **2005-010005** | | R0.1 | 0.5 | 30,000 | 700 | 0.02 | 0.09 | 30,000 | 600 | 0.02 | 0.09 | 30,000 | 410 | 0.01 | 0.03 |
| **2005-010010** | | | 1 | 30,000 | 700 | 0.02 | 0.09 | 30,000 | 600 | 0.02 | 0.09 | 30,000 | 410 | 0.01 | 0.03 |
| **2005-010015** | | | 1.5 | 30,000 | 700 | 0.02 | 0.09 | 30,000 | 600 | 0.02 | 0.09 | 30,000 | 410 | 0.01 | 0.03 |
| **2005-010020** | | | 2 | 30,000 | 700 | 0.02 | 0.09 | 30,000 | 600 | 0.02 | 0.09 | 30,000 | 410 | 0.01 | 0.03 |
| **2006-002005** | **0.6** | R0.02 | 0.5 | 30,000 | 320 | 0.005 | 0.11 | 30,000 | 270 | 0.005 | 0.11 | 30,000 | 240 | 0.005 | 0.035 |
| **2006-002010** | | | 1 | 30,000 | 320 | 0.005 | 0.11 | 30,000 | 270 | 0.005 | 0.11 | 30,000 | 240 | 0.005 | 0.035 |
| **2006-002015** | | | 1.5 | 30,000 | 320 | 0.005 | 0.11 | 30,000 | 270 | 0.005 | 0.11 | 30,000 | 240 | 0.005 | 0.035 |
| **2006-005005** | | R0.05 | 0.5 | 30,000 | 500 | 0.01 | 0.11 | 30,000 | 430 | 0.01 | 0.11 | 30,000 | 340 | 0.01 | 0.035 |
| **2006-005010** | | | 1 | 30,000 | 500 | 0.01 | 0.11 | 30,000 | 430 | 0.01 | 0.11 | 30,000 | 340 | 0.01 | 0.035 |
| **2006-005015** | | | 1.5 | 30,000 | 500 | 0.01 | 0.11 | 30,000 | 430 | 0.01 | 0.11 | 30,000 | 340 | 0.01 | 0.035 |
| **2006-005030** | | | 3 | 30,000 | 500 | 0.01 | 0.11 | 30,000 | 430 | 0.01 | 0.11 | 30,000 | 340 | 0.01 | 0.035 |
| **2006-010005** | | R0.1 | 0.5 | 30,000 | 800 | 0.02 | 0.11 | 30,000 | 675 | 0.02 | 0.11 | 30,000 | 492 | 0.01 | 0.035 |
| **2006-010010** | | | 1 | 30,000 | 800 | 0.02 | 0.11 | 30,000 | 675 | 0.02 | 0.11 | 30,000 | 492 | 0.01 | 0.035 |
| **2006-010015** | | | 1.5 | 30,000 | 800 | 0.02 | 0.11 | 30,000 | 675 | 0.02 | 0.11 | 30,000 | 492 | 0.01 | 0.035 |
| **2008-002010** | **0.8** | R0.02 | 1 | 30,000 | 410 | 0.005 | 0.16 | 30,000 | 350 | 0.005 | 0.16 | 30,000 | 320 | 0.005 | 0.04 |
| **2008-002015** | | | 1.5 | 30,000 | 410 | 0.005 | 0.16 | 30,000 | 350 | 0.005 | 0.16 | 30,000 | 320 | 0.005 | 0.04 |
| **2008-002020** | | | 2 | 30,000 | 410 | 0.005 | 0.16 | 30,000 | 350 | 0.005 | 0.16 | 30,000 | 320 | 0.005 | 0.04 |
| **2008-002050** | | | 5 | 30,000 | 290 | 0.005 | 0.08 | 30,000 | 250 | 0.005 | 0.08 | 30,000 | 220 | 0.005 | 0.02 |
| **2008-005010** | | R0.05 | 1 | 30,000 | 600 | 0.01 | 0.16 | 30,000 | 510 | 0.01 | 0.16 | 30,000 | 450 | 0.01 | 0.04 |
| **2008-005015** | | | 1.5 | 30,000 | 600 | 0.01 | 0.16 | 30,000 | 510 | 0.01 | 0.16 | 30,000 | 450 | 0.01 | 0.04 |
| **2008-005020** | | | 2 | 30,000 | 600 | 0.01 | 0.16 | 30,000 | 510 | 0.01 | 0.16 | 30,000 | 450 | 0.01 | 0.04 |
| **2008-005050** | | | 5 | 30,000 | 420 | 0.01 | 0.08 | 30,000 | 360 | 0.01 | 0.08 | 30,000 | 320 | 0.01 | 0.02 |
| **2008-010010** | | R0.1 | 1 | 30,000 | 920 | 0.02 | 0.16 | 30,000 | 790 | 0.02 | 0.16 | 30,000 | 560 | 0.01 | 0.04 |
| **2008-010015** | | | 1.5 | 30,000 | 920 | 0.02 | 0.16 | 30,000 | 790 | 0.02 | 0.16 | 30,000 | 560 | 0.01 | 0.04 |
| **2008-010020** | | | 2 | 30,000 | 920 | 0.02 | 0.16 | 30,000 | 790 | 0.02 | 0.16 | 30,000 | 560 | 0.01 | 0.04 |
| **2008-010050** | | | 5 | 30,000 | 640 | 0.02 | 0.08 | 30,000 | 550 | 0.02 | 0.08 | 30,000 | 390 | 0.01 | 0.02 |

## Milling Conditions for CBN-LRF

| WORK MATERIAL | | | | HEAT-TREATED STEELS / HARDENED STEELS STAVAX (~52HRC) | | | | HARDENED STEELS SKD11 (~62HRC) | | | | HARDENED STEELS HAP10 / HAP72 (~68HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Effective Length (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) |
| **2010-002010** | 1 | R0.02 | 1 | 30,000 | 500 | 0.005 | 0.2 | 30,000 | 430 | 0.005 | 0.2 | 30,000 | 400 | 0.005 | 0.05 |
| **2010-002020** | | | 2 | 30,000 | 500 | 0.005 | 0.2 | 30,000 | 430 | 0.005 | 0.2 | 30,000 | 400 | 0.005 | 0.05 |
| **2010-002030** | | | 3 | 30,000 | 500 | 0.005 | 0.2 | 30,000 | 430 | 0.005 | 0.2 | 30,000 | 400 | 0.005 | 0.05 |
| **2010-002050** | | | 5 | 30,000 | 500 | 0.005 | 0.2 | 30,000 | 430 | 0.005 | 0.2 | 30,000 | 400 | 0.005 | 0.05 |
| **2010-005010** | | R0.05 | 1 | 30,000 | 700 | 0.01 | 0.2 | 30,000 | 600 | 0.01 | 0.2 | 30,000 | 500 | 0.01 | 0.05 |
| **2010-005020** | | | 2 | 30,000 | 700 | 0.01 | 0.2 | 30,000 | 600 | 0.01 | 0.2 | 30,000 | 500 | 0.01 | 0.05 |
| **2010-005030** | | | 3 | 30,000 | 700 | 0.01 | 0.2 | 30,000 | 600 | 0.01 | 0.2 | 30,000 | 500 | 0.01 | 0.05 |
| **2010-005050** | | | 5 | 30,000 | 700 | 0.01 | 0.2 | 30,000 | 600 | 0.01 | 0.2 | 30,000 | 500 | 0.01 | 0.05 |
| **2010-010010** | | R0.1 | 1 | 30,000 | 1,000 | 0.02 | 0.2 | 30,000 | 850 | 0.02 | 0.2 | 30,000 | 600 | 0.01 | 0.05 |
| **2010-010020** | | | 2 | 30,000 | 1,000 | 0.02 | 0.2 | 30,000 | 850 | 0.02 | 0.2 | 30,000 | 600 | 0.01 | 0.05 |
| **2010-010030** | | | 3 | 30,000 | 1,000 | 0.02 | 0.2 | 30,000 | 850 | 0.02 | 0.2 | 30,000 | 600 | 0.01 | 0.05 |
| **2010-010050** | | | 5 | 30,000 | 1,000 | 0.02 | 0.2 | 30,000 | 850 | 0.02 | 0.2 | 30,000 | 600 | 0.01 | 0.05 |
| **2010-020010** | | R0.2 | 1 | 30,000 | 1,600 | 0.04 | 0.2 | 30,000 | 1,350 | 0.04 | 0.2 | 30,000 | 850 | 0.01 | 0.05 |
| **2010-020020** | | | 2 | 30,000 | 1,600 | 0.04 | 0.2 | 30,000 | 1,350 | 0.04 | 0.2 | 30,000 | 850 | 0.01 | 0.05 |
| **2015-002030** | 1.5 | R0.02 | 3 | 27,000 | 800 | 0.005 | 0.3 | 27,000 | 680 | 0.005 | 0.3 | 20,000 | 470 | 0.005 | 0.23 |
| **2015-002040** | | | 4 | 27,000 | 800 | 0.005 | 0.3 | 27,000 | 680 | 0.005 | 0.3 | 20,000 | 470 | 0.005 | 0.23 |
| **2015-002060** | | | 6 | 27,000 | 800 | 0.005 | 0.3 | 27,000 | 680 | 0.005 | 0.3 | 20,000 | 470 | 0.005 | 0.23 |
| **2015-005030** | | R0.05 | 3 | 27,000 | 1,200 | 0.01 | 0.3 | 27,000 | 1,000 | 0.01 | 0.3 | 20,000 | 520 | 0.01 | 0.23 |
| **2015-005040** | | | 4 | 27,000 | 1,200 | 0.01 | 0.3 | 27,000 | 1,000 | 0.01 | 0.3 | 20,000 | 520 | 0.01 | 0.23 |
| **2015-005060** | | | 6 | 27,000 | 1,200 | 0.01 | 0.3 | 27,000 | 1,000 | 0.01 | 0.3 | 20,000 | 520 | 0.01 | 0.23 |
| **2015-010030** | | R0.1 | 3 | 27,000 | 1,500 | 0.02 | 0.3 | 27,000 | 1,300 | 0.02 | 0.3 | 20,000 | 600 | 0.01 | 0.23 |
| **2015-010040** | | | 4 | 27,000 | 1,500 | 0.02 | 0.3 | 27,000 | 1,300 | 0.02 | 0.3 | 20,000 | 600 | 0.01 | 0.23 |
| **2015-010060** | | | 6 | 27,000 | 1,500 | 0.02 | 0.3 | 27,000 | 1,300 | 0.02 | 0.3 | 20,000 | 600 | 0.01 | 0.23 |
| **2015-030045** | | R0.3 | 4.5 | 27,000 | 1,800 | 0.06 | 0.3 | 27,000 | 1,500 | 0.06 | 0.3 | 25,000 | 930 | 0.01 | 0.23 |
| **2020-002040** | 2 | R0.02 | 4 | 24,000 | 1,000 | 0.005 | 0.4 | 24,000 | 850 | 0.005 | 0.4 | 16,000 | 530 | 0.005 | 0.4 |
| **2020-002060** | | | 6 | 24,000 | 1,000 | 0.005 | 0.4 | 24,000 | 850 | 0.005 | 0.4 | 16,000 | 530 | 0.005 | 0.4 |
| **2020-002080** | | | 8 | 24,000 | 1,000 | 0.005 | 0.4 | 24,000 | 850 | 0.005 | 0.4 | 16,000 | 530 | 0.005 | 0.4 |
| **2020-002100** | | | 10 | 24,000 | 1,000 | 0.005 | 0.4 | 24,000 | 850 | 0.005 | 0.4 | 16,000 | 530 | 0.005 | 0.4 |
| **2020-003030** | | R0.03 | 3 | 24,000 | 1,000 | 0.006 | 0.4 | 24,000 | 850 | 0.006 | 0.4 | 16,000 | 550 | 0.005 | 0.4 |
| **2020-005040** | | R0.05 | 4 | 24,000 | 1,500 | 0.01 | 0.4 | 24,000 | 1,300 | 0.01 | 0.4 | 16,500 | 600 | 0.01 | 0.4 |
| **2020-005060** | | | 6 | 24,000 | 1,500 | 0.01 | 0.4 | 24,000 | 1,300 | 0.01 | 0.4 | 16,500 | 600 | 0.01 | 0.4 |
| **2020-005080** | | | 8 | 24,000 | 1,500 | 0.01 | 0.4 | 24,000 | 1,300 | 0.01 | 0.4 | 16,500 | 600 | 0.01 | 0.35 |
| **2020-005100** | | | 10 | 24,000 | 1,500 | 0.01 | 0.4 | 24,000 | 1,300 | 0.01 | 0.4 | 16,500 | 600 | 0.01 | 0.3 |
| **2020-010040** | | R0.1 | 4 | 24,000 | 2,000 | 0.02 | 0.4 | 24,000 | 1,700 | 0.02 | 0.4 | 17,000 | 700 | 0.01 | 0.4 |
| **2020-010060** | | | 6 | 24,000 | 2,000 | 0.02 | 0.4 | 24,000 | 1,700 | 0.02 | 0.4 | 17,000 | 700 | 0.01 | 0.4 |
| **2020-010080** | | | 8 | 24,000 | 2,000 | 0.02 | 0.4 | 24,000 | 1,700 | 0.02 | 0.4 | 17,000 | 700 | 0.01 | 0.35 |
| **2020-010100** | | | 10 | 24,000 | 2,000 | 0.02 | 0.4 | 24,000 | 1,700 | 0.02 | 0.4 | 17,000 | 700 | 0.01 | 0.3 |
| **2020-020040** | | R0.2 | 4 | 24,000 | 2,000 | 0.04 | 0.4 | 24,000 | 1,700 | 0.04 | 0.4 | 17,700 | 770 | 0.01 | 0.4 |
| **2020-020060** | | | 6 | 24,000 | 2,000 | 0.04 | 0.4 | 24,000 | 1,700 | 0.04 | 0.4 | 17,700 | 770 | 0.01 | 0.4 |
| **2020-020080** | | | 8 | 24,000 | 2,000 | 0.03 | 0.4 | 24,000 | 1,700 | 0.03 | 0.4 | 17,700 | 770 | 0.01 | 0.35 |
| **2020-020100** | | | 10 | 24,000 | 2,000 | 0.025 | 0.4 | 24,000 | 1,700 | 0.025 | 0.4 | 17,700 | 770 | 0.01 | 0.3 |
| **2020-050040** | | R0.5 | 4 | 24,000 | 2,000 | 0.1 | 0.4 | 24,000 | 1,700 | 0.1 | 0.4 | 20,000 | 1,000 | 0.01 | 0.4 |
| **2020-050060** | | | 6 | 24,000 | 2,000 | 0.1 | 0.4 | 24,000 | 1,700 | 0.1 | 0.4 | 20,000 | 1,000 | 0.01 | 0.4 |
| **2020-050080** | | | 8 | 24,000 | 2,000 | 0.075 | 0.4 | 24,000 | 1,700 | 0.075 | 0.4 | 20,000 | 1,000 | 0.01 | 0.35 |
| **2020-050100** | | | 10 | 24,000 | 2,000 | 0.05 | 0.4 | 24,000 | 1,700 | 0.05 | 0.4 | 20,000 | 1,000 | 0.01 | 0.3 |

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- Recommend oil mist to avoid tool damage.

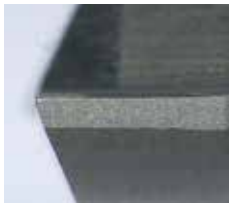
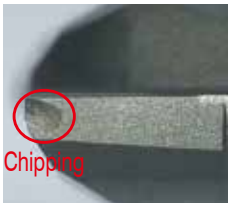
*** Refer to page 588 for tool geometry.**

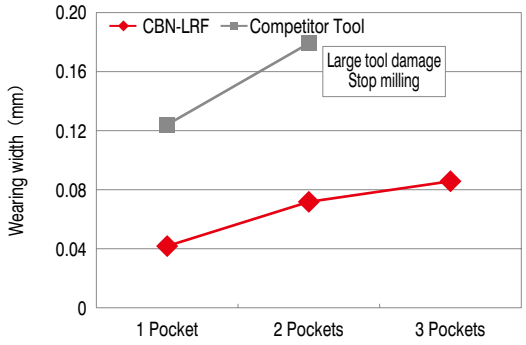



$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## Milling example of square pocket
## CBN-LRF　$\phi$2 × CR0.02 × Effective Length 4

HAP10（65HRC）

| | CBN-LRF<br>After milling 3 pockets | Competitor Tool<br>After milling 2 pockets |
|---|---|---|
| End relief | | |
| Peripheral relief |  |  |



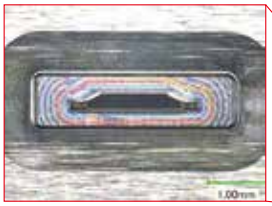

**Less tool damage on 65HRC high speed steel.**

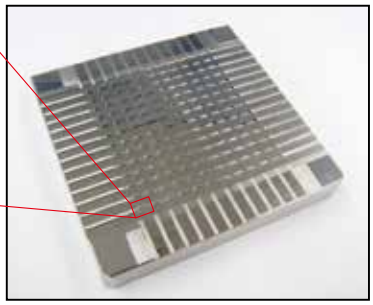
Pocket Size：15 × 15 × 0.3 mm
Coolant：Oil Mist

| Tool | Spindle Speed (min$^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Cycle Time |
|---|---|---|---|---|---|
| CBN-LRF 2020-002040 | 16,000 | 530 | 0.005 | 0.4 | 59 min / pocket |

## Milling example of LED mold
## CBN-LRF　$\phi$0.4 × CR0.02 × Effective Length1

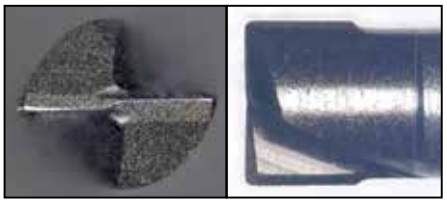
ELMAX（62～64HRC）





Work Size：80 × 80 × 10 mm
Coolant：Oil Mist

**After Finishing**



**Less tool damage after 10 hours of milling!**

| Tool | Milling Process | Spindle Speed (min$^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Cycle Time |
|---|---|---|---|---|---|---|
| CBN-LRF 2004-002010 | Finishing | 38,000 | 600 | 0.01 | 0.01 | 10 h |

## Size φ0.1～φ12

# CSS

Super MG | UT COAT | 30°*1 | 40°*2 | Flatland | Shank Dia 0/-0.005

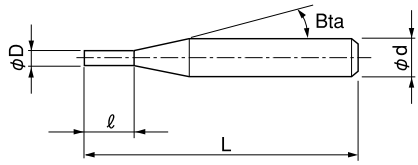
*1 Helix angle 30° : φD < 0.6, 1 ≦ φD (length of cut 2.5D~3D)
*2 Helix angle 40° : 0.6 ≦ φD < 1, 1 ≦ φD (length of cut 1D～2D)

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | |

## Features

**The new flute design offers excellent chip evacuation.**
**Resistance to breakage and wear has been improved by combining a special carbide grade with a new version of UTCOAT.**




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

Total 112 models

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **CSS 2001-0010** | 0.1 | 0.1 | 16° | 45 | 4 | 7,800 |
| **CSS 2001-0015** | | 0.15 | | 45 | 4 | 7,800 |
| **CSS 2001-0020** | | 0.2 | | 45 | 4 | 7,800 |
| **CSS 2001-0025** | | 0.25 | | 45 | 4 | 7,800 |
| **CSS 2001-0030** | | 0.3 | | 45 | 4 | 7,800 |
| **CSS 2002-0020** | 0.2 | 0.2 | 16° | 45 | 4 | 4,680 |
| **CSS 2002-0030** | | 0.3 | | 45 | 4 | 4,680 |
| **CSS 2002-0040-3** | | 0.4 | | 38 | 3 | 4,680 |
| **CSS 2002-0040-4** | | | | 45 | 4 | 4,680 |
| **CSS 2002-0050** | | 0.5 | | 45 | 4 | 4,680 |
| **CSS 2002-0060** | | 0.6 | | 45 | 4 | 4,680 |
| **CSS 2003-0030** | 0.3 | 0.3 | 16° | 45 | 4 | 4,080 |
| **CSS 2003-0045** | | 0.45 | | 45 | 4 | 4,080 |
| **CSS 2003-0060-3** | | 0.6 | | 38 | 3 | 4,080 |
| **CSS 2003-0060-4** | | | | 45 | 4 | 4,080 |
| **CSS 2003-0075** | | 0.75 | | 45 | 4 | 4,080 |
| **CSS 2003-0090** | | 0.9 | | 45 | 4 | 4,080 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CSS 2004-0040 | 0.4 | 0.4 | 16° | 45 | 4 | 4,560 |
| CSS 2004-0060 | | 0.6 | | 45 | 4 | 4,560 |
| CSS 2004-0080-3 | | 0.8 | | 38 | 3 | 4,560 |
| CSS 2004-0080-4 | | | | 45 | 4 | 4,560 |
| CSS 2004-0100 | | 1 | | 45 | 4 | 4,560 |
| CSS 2004-0120 | | 1.2 | | 45 | 4 | 4,560 |
| CSS 2005-0050 | 0.5 | 0.5 | 16° | 45 | 4 | 2,280 |
| CSS 2005-0075 | | 0.75 | | 45 | 4 | 2,280 |
| CSS 2005-0080 | | 0.8 | | 38 | 3 | 2,280 |
| CSS 2005-0100 | | 1 | | 45 | 4 | 2,280 |
| CSS 2005-0125 | | 1.25 | | 45 | 4 | 2,280 |
| CSS 2005-0150 | | 1.5 | | 45 | 4 | 2,280 |
| CSS 2006-0060 | 0.6 | 0.6 | 16° | 45 | 4 | 3,480 |
| CSS 2006-0090 | | 0.9 | | 45 | 4 | 3,480 |
| CSS 2006-0100 | | 1 | | 38 | 3 | 3,480 |
| CSS 2006-0120 | | 1.2 | | 45 | 4 | 3,480 |
| CSS 2006-0150 | | 1.5 | | 45 | 4 | 3,480 |
| CSS 2006-0180 | | 1.8 | | 45 | 4 | 3,480 |
| CSS 2007-0070 | 0.7 | 0.7 | 16° | 45 | 4 | 3,840 |
| CSS 2007-0100 | | 1 | | 38 | 3 | 3,840 |
| CSS 2007-0140 | | 1.4 | | 45 | 4 | 3,840 |
| CSS 2007-0175 | | 1.75 | | 45 | 4 | 3,840 |
| CSS 2007-0210 | | 2.1 | | 45 | 4 | 3,840 |
| CSS 2008-0080 | 0.8 | 0.8 | 16° | 45 | 4 | 2,280 |
| CSS 2008-0120-3 | | 1.2 | | 38 | 3 | 2,280 |
| CSS 2008-0120-4 | | | | 45 | 4 | 2,280 |
| CSS 2008-0160 | | 1.6 | | 45 | 4 | 2,280 |
| CSS 2008-0200 | | 2 | | 45 | 4 | 2,280 |
| CSS 2008-0240 | | 2.4 | | 45 | 4 | 2,280 |
| CSS 2009-0090 | 0.9 | 0.9 | 16° | 45 | 4 | 3,840 |
| CSS 2009-0120 | | 1.2 | | 38 | 3 | 3,840 |
| CSS 2009-0180 | | 1.8 | | 45 | 4 | 3,840 |
| CSS 2009-0225 | | 2.25 | | 45 | 4 | 3,840 |
| CSS 2009-0270 | | 2.7 | | 45 | 4 | 3,840 |
| CSS 2010-0100 | 1 | 1 | 16° | 45 | 4 | 2,040 |
| CSS 2010-0150 | | 1.5 | | 45 | 4 | 2,040 |
| CSS 2010-0200 | | 2 | | 45 | 4 | 2,040 |
| CSS 2010-0250 | | 2.5 | | 45 | 4 | 2,040 |
| CSS 2010-0300 | | 3 | | 45 | 4 | 2,040 |
| CSS 2015-0150 | 1.5 | 1.5 | 16° | 45 | 4 | 2,040 |
| CSS 2015-0225 | | 2.25 | | 45 | 4 | 2,040 |
| CSS 2015-0300 | | 3 | | 45 | 4 | 2,040 |
| CSS 2015-0375 | | 3.75 | | 45 | 4 | 2,040 |
| CSS 2015-0450 | | 4.5 | | 45 | 4 | 2,040 |
| CSS 2020-0200 | 2 | 2 | 16° | 45 | 4 | 2,040 |
| CSS 2020-0300 | | 3 | | 45 | 4 | 2,040 |
| CSS 2020-0400 | | 4 | | 45 | 4 | 2,040 |
| CSS 2020-0500 | | 5 | | 45 | 4 | 2,040 |
| CSS 2020-0600 | | 6 | | 45 | 4 | 2,040 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CSS 2025-0250 | 2.5 | 2.5 | 16° | 50 | 4 | 2,040 |
| CSS 2025-0375 | | 3.75 | | 50 | 4 | 2,040 |
| CSS 2025-0500 | | 5 | | 50 | 4 | 2,040 |
| CSS 2025-0625 | | 6.25 | | 50 | 4 | 2,040 |
| CSS 2025-0750 | | 7.5 | | 50 | 4 | 2,040 |
| CSS 2030-0300 | 3 | 3 | 16° | 50 | 6 | 2,640 |
| CSS 2030-0450 | | 4.5 | | 50 | 6 | 2,640 |
| CSS 2030-0600 | | 6 | | 50 | 6 | 2,640 |
| CSS 2030-0750 | | 7.5 | | 50 | 6 | 2,640 |
| CSS 2030-0900 | | 9 | | 50 | 6 | 2,640 |
| CSS 2040-0400 | 4 | 4 | 16° | 50 | 6 | 2,880 |
| CSS 2040-0600 | | 6 | | 50 | 6 | 2,880 |
| CSS 2040-0800 | | 8 | | 50 | 6 | 2,880 |
| CSS 2040-1000 | | 10 | | 50 | 6 | 2,880 |
| CSS 2040-1200 | | 12 | | 50 | 6 | 2,880 |
| CSS 2050-0500 | 5 | 5 | 16° | 50 | 6 | 3,120 |
| CSS 2050-0750 | | 7.5 | | 50 | 6 | 3,120 |
| CSS 2050-1000 | | 10 | | 50 | 6 | 3,120 |
| CSS 2050-1250 | | 12.5 | | 60 | 6 | 3,120 |
| CSS 2050-1500 | | 15 | | 60 | 6 | 3,120 |
| CSS 2060-0600 | 6 | 6 | — | 50 | 6 | 3,360 |
| CSS 2060-0900 | | 9 | | 50 | 6 | 3,360 |
| CSS 2060-1200 | | 12 | | 50 | 6 | 3,360 |
| CSS 2060-1500 | | 15 | | 60 | 6 | 3,360 |
| CSS 2060-1800 | | 18 | | 60 | 6 | 3,360 |
| CSS 2070-1750 | 7 | 17.5 | 16° | 70 | 8 | 8,700 |
| CSS 2070-2100 | | 21 | | 80 | 8 | 8,700 |
| CSS 2080-0800 | 8 | 8 | — | 70 | 8 | 6,320 |
| CSS 2080-1200 | | 12 | | 70 | 8 | 6,320 |
| CSS 2080-1600 | | 16 | | 70 | 8 | 6,320 |
| CSS 2080-2000 | | 20 | | 70 | 8 | 6,320 |
| CSS 2080-2400 | | 24 | | 80 | 8 | 6,320 |
| CSS 2090-2250 | 9 | 22.5 | 16° | 80 | 10 | 12,420 |
| CSS 2090-2700 | | 27 | | 80 | 10 | 12,420 |
| CSS 2100-1000 | 10 | 10 | — | 70 | 10 | 7,580 |
| CSS 2100-1500 | | 15 | | 70 | 10 | 7,580 |
| CSS 2100-2000 | | 20 | | 70 | 10 | 7,580 |
| CSS 2100-2500 | | 25 | | 80 | 10 | 7,580 |
| CSS 2100-3000 | | 30 | | 80 | 10 | 7,580 |
| CSS 2110-2750 | 11 | 27.5 | 16° | 80 | 12 | 17,160 |
| CSS 2110-3300 | | 33 | | 80 | 12 | 17,160 |
| CSS 2120-1200 | 12 | 12 | — | 80 | 12 | 11,170 |
| CSS 2120-1800 | | 18 | | 80 | 12 | 11,170 |
| CSS 2120-2400 | | 24 | | 80 | 12 | 11,170 |
| CSS 2120-3000 | | 30 | | 80 | 12 | 11,170 |
| CSS 2120-3600 | | 36 | | 90 | 12 | 11,170 |

# Milling Conditions for CSS

**Slotting**

**◆ 1D flute length type L/D=1**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0010** | **0.1** | 0.1 | 30,000 | 30 | 0.01 | 30,000 | 30 | 0.01 | 30,000 | 30 | 0.01 |
| **2002-0020** | **0.2** | 0.2 | 30,000 | 85 | 0.02 | 30,000 | 85 | 0.02 | 30,000 | 60 | 0.02 |
| **2003-0030** | **0.3** | 0.3 | 30,000 | 110 | 0.03 | 30,000 | 110 | 0.03 | 30,000 | 110 | 0.03 |
| **2004-0040** | **0.4** | 0.4 | 30,000 | 120 | 0.04 | 30,000 | 120 | 0.04 | 30,000 | 120 | 0.04 |
| **2005-0050** | **0.5** | 0.5 | 27,000 | 120 | 0.05 | 24,000 | 105 | 0.05 | 24,000 | 120 | 0.05 |
| **2006-0060** | **0.6** | 0.6 | 24,000 | 120 | 0.09 | 20,000 | 90 | 0.09 | 20,000 | 120 | 0.09 |
| **2007-0070** | **0.7** | 0.7 | 22,500 | 115 | 0.105 | 17,800 | 90 | 0.105 | 17,800 | 120 | 0.105 |
| **2008-0080** | **0.8** | 0.8 | 21,000 | 110 | 0.12 | 16,700 | 90 | 0.12 | 16,700 | 120 | 0.12 |
| **2009-0090** | **0.9** | 0.9 | 19,500 | 105 | 0.135 | 15,600 | 85 | 0.135 | 15,600 | 120 | 0.135 |
| **2010-0100** | **1** | 1 | 18,000 | 100 | 1 | 14,500 | 75 | 1 | 14,500 | 125 | 1 |
| **2015-0150** | **1.5** | 1.5 | 16,000 | 275 | 1.5 | 13,000 | 200 | 1.5 | 13,000 | 135 | 1.5 |
| **2020-0200** | **2** | 2 | 12,000 | 275 | 2 | 10,000 | 200 | 2 | 10,000 | 135 | 2 |
| **2025-0250** | **2.5** | 2.5 | 10,200 | 375 | 2.5 | 8,400 | 260 | 2.5 | 8,400 | 140 | 2.5 |
| **2030-0300** | **3** | 3 | 8,500 | 475 | 3 | 6,800 | 325 | 3 | 6,800 | 150 | 3 |
| **2040-0400** | **4** | 4 | 7,200 | 475 | 4 | 5,700 | 325 | 4 | 5,700 | 175 | 4 |
| **2050-0500** | **5** | 5 | 6,000 | 500 | 5 | 4,800 | 350 | 5 | 4,800 | 200 | 5 |
| **2060-0600** | **6** | 6 | 5,000 | 500 | 6 | 4,000 | 350 | 6 | 4,000 | 200 | 6 |
| **2080-0800** | **8** | 8 | 3,500 | 475 | 8 | 2,700 | 350 | 8 | 2,400 | 150 | 8 |
| **2100-1000** | **10** | 10 | 2,300 | 450 | 10 | 1,900 | 325 | 10 | 1,400 | 100 | 10 |
| **2120-1200** | **12** | 12 | 1,850 | 425 | 12 | 1,550 | 300 | 12 | 1,250 | 90 | 12 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0010** | **0.1** | 0.1 | 30,000 | 15 | 0.01 | 24,000 | 10 | 0.004 |
| **2002-0020** | **0.2** | 0.2 | 30,000 | 30 | 0.02 | 23,000 | 25 | 0.008 |
| **2003-0030** | **0.3** | 0.3 | 30,000 | 55 | 0.03 | 20,000 | 25 | 0.012 |
| **2004-0040** | **0.4** | 0.4 | 30,000 | 60 | 0.04 | 16,800 | 25 | 0.016 |
| **2005-0050** | **0.5** | 0.5 | 24,000 | 60 | 0.05 | 14,400 | 30 | 0.025 |
| **2006-0060** | **0.6** | 0.6 | 20,000 | 60 | 0.09 | 12,000 | 35 | 0.03 |
| **2007-0070** | **0.7** | 0.7 | 17,800 | 60 | 0.105 | 10,000 | 35 | 0.035 |
| **2008-0080** | **0.8** | 0.8 | 16,700 | 60 | 0.12 | 8,500 | 35 | 0.04 |
| **2009-0090** | **0.9** | 0.9 | 15,600 | 60 | 0.135 | 7,300 | 35 | 0.045 |
| **2010-0100** | **1** | 1 | 14,500 | 60 | 1 | 6,550 | 35 | 0.2 |
| **2015-0150** | **1.5** | 1.5 | 12,000 | 160 | 1.5 | 4,400 | 35 | 0.3 |
| **2020-0200** | **2** | 2 | 9,000 | 160 | 2 | 3,300 | 35 | 0.4 |
| **2025-0250** | **2.5** | 2.5 | 7,900 | 210 | 2.5 | 2,750 | 35 | 0.5 |
| **2030-0300** | **3** | 3 | 6,800 | 260 | 3 | 2,200 | 35 | 0.6 |
| **2040-0400** | **4** | 4 | 5,100 | 260 | 4 | 1,650 | 40 | 0.8 |
| **2050-0500** | **5** | 5 | 4,050 | 260 | 5 | 1,300 | 40 | 1 |
| **2060-0600** | **6** | 6 | 3,300 | 260 | 6 | 1,100 | 40 | 1.2 |
| **2080-0800** | **8** | 8 | 2,300 | 235 | 8 | 800 | 40 | 1.6 |
| **2100-1000** | **10** | 10 | 1,500 | 225 | 10 | 690 | 40 | 2 |
| **2120-1200** | **12** | 12 | 1,200 | 210 | 12 | 550 | 40 | 2.4 |

## Milling Conditions for CSS

◆ **1.5D flute length type 1 < L/D ≦ 1.5**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 *Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0015** | **0.1** | 0.15 | 30,000 | 30 | 0.01 | 30,000 | 30 | 0.01 | 30,000 | 30 | 0.01 |
| **2002-0030** | **0.2** | 0.3 | 30,000 | 85 | 0.02 | 30,000 | 85 | 0.02 | 30,000 | 60 | 0.02 |
| **2003-0045** | **0.3** | 0.45 | 30,000 | 110 | 0.03 | 30,000 | 110 | 0.03 | 30,000 | 110 | 0.03 |
| **2004-0060** | **0.4** | 0.6 | 30,000 | 120 | 0.04 | 30,000 | 120 | 0.04 | 30,000 | 120 | 0.04 |
| **2005-0075** | **0.5** | 0.75 | 27,000 | 120 | 0.05 | 24,000 | 105 | 0.05 | 24,000 | 120 | 0.05 |
| **2006-0090** | **0.6** | 0.9 | 24,000 | 120 | 0.09 | 20,000 | 90 | 0.09 | 20,000 | 120 | 0.09 |
| **2007-0100** | **0.7** | 1 | 22,500 | 115 | 0.105 | 17,800 | 90 | 0.105 | 17,800 | 120 | 0.105 |
| **2008-0120** | **0.8** | 1.2 | 21,000 | 110 | 0.12 | 16,700 | 90 | 0.12 | 16,700 | 120 | 0.12 |
| **2009-0120** | **0.9** | 1.2 | 19,500 | 105 | 0.135 | 15,600 | 85 | 0.135 | 15,600 | 120 | 0.135 |
| **2010-0150** | **1** | 1.5 | 18,000 | 100 | 1 | 14,500 | 75 | 1 | 14,500 | 125 | 1 |
| **2015-0225** | **1.5** | 2.25 | 16,000 | 275 | 1.5 | 13,000 | 200 | 1.5 | 13,000 | 135 | 1.5 |
| **2020-0300** | **2** | 3 | 12,000 | 275 | 2 | 10,000 | 200 | 2 | 10,000 | 135 | 2 |
| **2025-0375** | **2.5** | 3.75 | 10,200 | 375 | 2.5 | 8,400 | 260 | 2.5 | 8,400 | 140 | 2.5 |
| **2030-0450** | **3** | 4.5 | 8,500 | 475 | 3 | 6,800 | 325 | 3 | 6,800 | 150 | 3 |
| **2040-0600** | **4** | 6 | 7,200 | 475 | 4 | 5,700 | 325 | 4 | 5,700 | 175 | 4 |
| **2050-0750** | **5** | 7.5 | 6,000 | 500 | 5 | 4,800 | 350 | 5 | 4,800 | 200 | 5 |
| **2060-0900** | **6** | 9 | 5,000 | 500 | 6 | 4,000 | 350 | 6 | 4,000 | 200 | 6 |
| **2080-1200** | **8** | 12 | 3,500 | 475 | 8 | 2,700 | 350 | 8 | 2,400 | 150 | 8 |
| **2100-1500** | **10** | 15 | 2,300 | 450 | 10 | 1,900 | 325 | 10 | 1,400 | 100 | 10 |
| **2120-1800** | **12** | 18 | 1,850 | 425 | 12 | 1,550 | 300 | 12 | 1,250 | 90 | 12 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0015** | **0.1** | 0.15 | 30,000 | 15 | 0.01 | 24,000 | 10 | 0.004 |
| **2002-0030** | **0.2** | 0.3 | 30,000 | 30 | 0.02 | 23,000 | 25 | 0.008 |
| **2003-0045** | **0.3** | 0.45 | 30,000 | 55 | 0.03 | 20,000 | 25 | 0.012 |
| **2004-0060** | **0.4** | 0.6 | 30,000 | 60 | 0.04 | 16,800 | 25 | 0.016 |
| **2005-0075** | **0.5** | 0.75 | 24,000 | 60 | 0.05 | 14,400 | 30 | 0.025 |
| **2006-0090** | **0.6** | 0.9 | 20,000 | 60 | 0.09 | 12,000 | 35 | 0.03 |
| **2007-0100** | **0.7** | 1 | 17,800 | 60 | 0.105 | 10,000 | 35 | 0.035 |
| **2008-0120** | **0.8** | 1.2 | 16,700 | 60 | 0.12 | 8,500 | 35 | 0.04 |
| **2009-0120** | **0.9** | 1.2 | 15,600 | 60 | 0.135 | 7,300 | 35 | 0.045 |
| **2010-0150** | **1** | 1.5 | 14,500 | 60 | 1 | 6,550 | 35 | 0.2 |
| **2015-0225** | **1.5** | 2.25 | 12,000 | 160 | 1.5 | 4,400 | 35 | 0.3 |
| **2020-0300** | **2** | 3 | 9,000 | 160 | 2 | 3,300 | 35 | 0.4 |
| **2025-0375** | **2.5** | 3.75 | 7,900 | 210 | 2.5 | 2,750 | 35 | 0.5 |
| **2030-0450** | **3** | 4.5 | 6,800 | 260 | 3 | 2,200 | 35 | 0.6 |
| **2040-0600** | **4** | 6 | 5,100 | 260 | 4 | 1,650 | 40 | 0.8 |
| **2050-0750** | **5** | 7.5 | 4,050 | 260 | 5 | 1,300 | 40 | 1 |
| **2060-0900** | **6** | 9 | 3,300 | 260 | 6 | 1,100 | 40 | 1.2 |
| **2080-1200** | **8** | 12 | 2,300 | 235 | 8 | 800 | 40 | 1.6 |
| **2100-1500** | **10** | 15 | 1,500 | 225 | 10 | 690 | 40 | 2 |
| **2120-1800** | **12** | 18 | 1,200 | 210 | 12 | 550 | 40 | 2.4 |

# Milling Conditions for CSS

◆ **2D flute length type** 1.5 < L/D ≦ 2

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0020** | **0.1** | 0.2 | 30,000 | 30 | 0.01 | 30,000 | 30 | 0.01 | 30,000 | 30 | 0.01 |
| **2002-0040** | **0.2** | 0.4 | 30,000 | 85 | 0.02 | 30,000 | 85 | 0.02 | 30,000 | 60 | 0.02 |
| **2003-0060** | **0.3** | 0.6 | 30,000 | 110 | 0.03 | 30,000 | 110 | 0.03 | 30,000 | 110 | 0.03 |
| **2004-0080** | **0.4** | 0.8 | 30,000 | 120 | 0.04 | 30,000 | 120 | 0.04 | 30,000 | 120 | 0.04 |
| **2005-0080** | **0.5** | 0.8 | 27,000 | 120 | 0.05 | 24,000 | 105 | 0.05 | 24,000 | 120 | 0.05 |
| **2005-0100** | **0.5** | 1 | 27,000 | 120 | 0.05 | 24,000 | 105 | 0.05 | 24,000 | 120 | 0.05 |
| **2006-0100** | **0.6** | 1 | 24,000 | 120 | 0.09 | 20,000 | 90 | 0.09 | 20,000 | 120 | 0.09 |
| **2006-0120** | **0.6** | 1.2 | 24,000 | 120 | 0.09 | 20,000 | 90 | 0.09 | 20,000 | 120 | 0.09 |
| **2007-0140** | **0.7** | 1.4 | 22,500 | 115 | 0.105 | 17,800 | 90 | 0.105 | 17,800 | 120 | 0.105 |
| **2008-0160** | **0.8** | 1.6 | 21,000 | 110 | 0.12 | 16,700 | 90 | 0.12 | 16,700 | 120 | 0.12 |
| **2009-0180** | **0.9** | 1.8 | 19,500 | 105 | 0.135 | 15,600 | 85 | 0.135 | 15,600 | 120 | 0.135 |
| **2010-0200** | **1** | 2 | 18,000 | 100 | 0.8 | 14,500 | 75 | 0.8 | 14,500 | 125 | 0.8 |
| **2015-0300** | **1.5** | 3 | 16,000 | 275 | 1.2 | 13,000 | 200 | 1.2 | 13,000 | 135 | 1.2 |
| **2020-0400** | **2** | 4 | 12,000 | 275 | 1.6 | 10,000 | 200 | 1.6 | 10,000 | 135 | 1.6 |
| **2025-0500** | **2.5** | 5 | 10,200 | 375 | 2 | 8,400 | 260 | 2 | 8,400 | 140 | 2 |
| **2030-0600** | **3** | 6 | 8,500 | 475 | 2.4 | 6,800 | 325 | 2.4 | 6,800 | 150 | 2.4 |
| **2040-0800** | **4** | 8 | 7,200 | 475 | 3.2 | 5,700 | 325 | 3.2 | 5,700 | 175 | 3.2 |
| **2050-1000** | **5** | 10 | 6,000 | 500 | 4 | 4,800 | 350 | 4 | 4,800 | 200 | 4 |
| **2060-1200** | **6** | 12 | 5,000 | 500 | 4.8 | 4,000 | 350 | 4.8 | 4,000 | 200 | 4.8 |
| **2080-1600** | **8** | 16 | 3,500 | 475 | 6.4 | 2,700 | 350 | 6.4 | 2,400 | 150 | 6.4 |
| **2100-2000** | **10** | 20 | 2,300 | 450 | 8 | 1,900 | 325 | 8 | 1,400 | 100 | 8 |
| **2120-2400** | **12** | 24 | 1,850 | 425 | 9.6 | 1,550 | 300 | 9.6 | 1,250 | 90 | 9.6 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0020** | **0.1** | 0.2 | 30,000 | 15 | 0.01 | 24,000 | 10 | 0.003 |
| **2002-0040** | **0.2** | 0.4 | 30,000 | 30 | 0.02 | 23,000 | 25 | 0.008 |
| **2003-0060** | **0.3** | 0.6 | 30,000 | 55 | 0.03 | 20,000 | 25 | 0.012 |
| **2004-0080** | **0.4** | 0.8 | 30,000 | 60 | 0.04 | 16,800 | 25 | 0.016 |
| **2005-0080** | **0.5** | 0.8 | 24,000 | 60 | 0.05 | 14,400 | 30 | 0.025 |
| **2005-0100** | **0.5** | 1 | 24,000 | 60 | 0.05 | 14,400 | 30 | 0.025 |
| **2006-0100** | **0.6** | 1 | 20,000 | 60 | 0.09 | 12,000 | 35 | 0.03 |
| **2006-0120** | **0.6** | 1.2 | 20,000 | 60 | 0.09 | 12,000 | 35 | 0.03 |
| **2007-0140** | **0.7** | 1.4 | 17,800 | 60 | 0.105 | 10,000 | 35 | 0.035 |
| **2008-0160** | **0.8** | 1.6 | 16,700 | 60 | 0.12 | 8,500 | 35 | 0.04 |
| **2009-0180** | **0.9** | 1.8 | 15,600 | 60 | 0.135 | 7,300 | 35 | 0.045 |
| **2010-0200** | **1** | 2 | 14,500 | 60 | 0.8 | 6,550 | 35 | 0.15 |
| **2015-0300** | **1.5** | 3 | 12,000 | 160 | 1.2 | 4,400 | 35 | 0.225 |
| **2020-0400** | **2** | 4 | 9,000 | 160 | 1.6 | 3,300 | 35 | 0.3 |
| **2025-0500** | **2.5** | 5 | 7,900 | 210 | 2 | 2,750 | 35 | 0.37 |
| **2030-0600** | **3** | 6 | 6,800 | 260 | 2.4 | 2,200 | 35 | 0.45 |
| **2040-0800** | **4** | 8 | 5,100 | 260 | 3.2 | 1,650 | 40 | 0.6 |
| **2050-1000** | **5** | 10 | 4,050 | 260 | 4 | 1,300 | 40 | 0.75 |
| **2060-1200** | **6** | 12 | 3,300 | 260 | 4.8 | 1,100 | 40 | 0.9 |
| **2080-1600** | **8** | 16 | 2,300 | 235 | 3.2 | 800 | 40 | 1.2 |
| **2100-2000** | **10** | 20 | 1,500 | 225 | 4 | 690 | 40 | 1.5 |
| **2120-2400** | **12** | 24 | 1,200 | 210 | 4.8 | 550 | 40 | 1.8 |

## Milling Conditions for CSS

◆ **2.5D flute length type 2 < L/D ≦ 2.5**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0025** | **0.1** | 0.25 | 30,000 | 30 | 0.007 | 30,000 | 30 | 0.007 | 30,000 | 30 | 0.007 |
| **2002-0050** | **0.2** | 0.5 | 30,000 | 85 | 0.014 | 30,000 | 85 | 0.014 | 30,000 | 60 | 0.014 |
| **2003-0075** | **0.3** | 0.75 | 30,000 | 110 | 0.021 | 30,000 | 110 | 0.021 | 30,000 | 110 | 0.021 |
| **2004-0100** | **0.4** | 1 | 30,000 | 120 | 0.028 | 30,000 | 120 | 0.028 | 30,000 | 120 | 0.028 |
| **2005-0125** | **0.5** | 1.25 | 27,000 | 120 | 0.035 | 24,000 | 105 | 0.035 | 24,000 | 120 | 0.035 |
| **2006-0150** | **0.6** | 1.5 | 24,000 | 120 | 0.06 | 20,000 | 90 | 0.06 | 20,000 | 120 | 0.06 |
| **2007-0175** | **0.7** | 1.75 | 22,500 | 115 | 0.07 | 17,800 | 90 | 0.07 | 17,800 | 120 | 0.07 |
| **2008-0200** | **0.8** | 2 | 21,000 | 110 | 0.08 | 16,700 | 90 | 0.08 | 16,700 | 120 | 0.08 |
| **2009-0225** | **0.9** | 2.25 | 19,500 | 105 | 0.09 | 15,600 | 85 | 0.09 | 15,600 | 120 | 0.09 |
| **2010-0250** | **1** | 2.5 | 20,000 | 130 | 0.5 | 15,000 | 60 | 0.5 | 11,000 | 120 | 0.25 |
| **2015-0375** | **1.5** | 3.75 | 12,800 | 170 | 0.75 | 10,000 | 100 | 0.75 | 7,000 | 120 | 0.375 |
| **2020-0500** | **2** | 5 | 9,300 | 210 | 1 | 7,500 | 140 | 1 | 5,000 | 120 | 0.5 |
| **2025-0625** | **2.5** | 6.25 | 7,600 | 235 | 1.25 | 6,250 | 160 | 1.25 | 4,100 | 120 | 0.62 |
| **2030-0750** | **3** | 7.5 | 5,900 | 260 | 1.5 | 5,000 | 180 | 1.5 | 3,200 | 120 | 0.75 |
| **2040-1000** | **4** | 10 | 4,200 | 300 | 2 | 3,750 | 220 | 2 | 2,250 | 120 | 1 |
| **2050-1250** | **5** | 12.5 | 3,200 | 340 | 2.5 | 3,000 | 260 | 2.5 | 1,700 | 120 | 1.25 |
| **2060-1500** | **6** | 15 | 2,500 | 380 | 3 | 2,500 | 300 | 3 | 1,350 | 120 | 1.5 |
| **2070-1750** | **7** | 17.5 | 2,270 | 345 | 3.5 | 2,270 | 270 | 3.5 | 1,150 | 105 | 1.75 |
| **2080-2000** | **8** | 20 | 2,100 | 320 | 4 | 2,100 | 250 | 4 | 1,000 | 90 | 2 |
| **2090-2250** | **9** | 22.5 | 1,935 | 300 | 4.5 | 1,935 | 220 | 4.5 | 895 | 80 | 2.25 |
| **2100-2500** | **10** | 25 | 1,800 | 280 | 5 | 1,800 | 200 | 5 | 810 | 75 | 2.5 |
| **2110-2750** | **11** | 27.5 | 1,635 | 265 | 5.5 | 1,635 | 180 | 5.5 | 735 | 70 | 2.75 |
| **2120-3000** | **12** | 30 | 1,500 | 250 | 6 | 1,500 | 160 | 6 | 670 | 65 | 3 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0025** | **0.1** | 0.25 | 30,000 | 15 | 0.007 | 24,000 | 10 | 0.002 |
| **2002-0050** | **0.2** | 0.5 | 30,000 | 30 | 0.014 | 23,000 | 25 | 0.004 |
| **2003-0075** | **0.3** | 0.75 | 30,000 | 55 | 0.021 | 20,000 | 25 | 0.006 |
| **2004-0100** | **0.4** | 1 | 30,000 | 60 | 0.028 | 16,800 | 25 | 0.008 |
| **2005-0125** | **0.5** | 1.25 | 24,000 | 60 | 0.035 | 14,400 | 30 | 0.015 |
| **2006-0150** | **0.6** | 1.5 | 20,000 | 60 | 0.06 | 12,000 | 35 | 0.018 |
| **2007-0175** | **0.7** | 1.75 | 17,800 | 60 | 0.07 | 10,000 | 35 | 0.021 |
| **2008-0200** | **0.8** | 2 | 16,700 | 60 | 0.08 | 8,500 | 35 | 0.024 |
| **2009-0225** | **0.9** | 2.25 | 15,600 | 60 | 0.09 | 7,300 | 35 | 0.027 |
| **2010-0250** | **1** | 2.5 | 11,000 | 60 | 0.25 | 5,500 | 20 | 0.05 |
| **2015-0375** | **1.5** | 3.75 | 7,500 | 90 | 0.375 | 3,750 | 25 | 0.075 |
| **2020-0500** | **2** | 5 | 5,700 | 120 | 0.5 | 2,850 | 30 | 0.1 |
| **2025-0625** | **2.5** | 6.25 | 4,800 | 135 | 0.62 | 2,400 | 30 | 0.12 |
| **2030-0750** | **3** | 7.5 | 3,900 | 150 | 0.75 | 1,950 | 35 | 0.15 |
| **2040-1000** | **4** | 10 | 2,900 | 180 | 1 | 1,450 | 40 | 0.2 |
| **2050-1250** | **5** | 12.5 | 2,400 | 210 | 1.25 | 1,200 | 45 | 0.25 |
| **2060-1500** | **6** | 15 | 2,000 | 240 | 1.5 | 1,000 | 55 | 0.3 |
| **2070-1750** | **7** | 17.5 | 1,630 | 230 | 1.5 | 815 | 55 | 0.3 |
| **2080-2000** | **8** | 20 | 1,350 | 220 | 1.5 | 675 | 55 | 0.3 |
| **2090-2250** | **9** | 22.5 | 1,135 | 210 | 1.5 | 565 | 55 | 0.3 |
| **2100-2500** | **10** | 25 | 960 | 200 | 1.5 | 480 | 55 | 0.3 |
| **2110-2750** | **11** | 27.5 | 845 | 180 | 1.5 | 425 | 55 | 0.3 |
| **2120-3000** | **12** | 30 | 750 | 160 | 1.5 | 375 | 55 | 0.3 |

# Milling Conditions for CSS

◆ **3D flute length type L/D=3**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0030** | **0.1** | 0.3 | 30,000 | 30 | 0.005 | 30,000 | 30 | 0.005 | 30,000 | 30 | 0.005 |
| **2002-0060** | **0.2** | 0.6 | 30,000 | 85 | 0.01 | 30,000 | 85 | 0.01 | 30,000 | 60 | 0.01 |
| **2003-0090** | **0.3** | 0.9 | 30,000 | 110 | 0.015 | 30,000 | 110 | 0.015 | 30,000 | 110 | 0.015 |
| **2004-0120** | **0.4** | 1.2 | 30,000 | 120 | 0.02 | 30,000 | 120 | 0.02 | 30,000 | 120 | 0.02 |
| **2005-0150** | **0.5** | 1.5 | 27,000 | 120 | 0.025 | 24,000 | 105 | 0.025 | 24,000 | 120 | 0.025 |
| **2006-0180** | **0.6** | 1.8 | 24,000 | 120 | 0.05 | 20,000 | 90 | 0.05 | 20,000 | 120 | 0.05 |
| **2007-0210** | **0.7** | 2.1 | 22,500 | 115 | 0.056 | 17,800 | 90 | 0.056 | 17,800 | 120 | 0.056 |
| **2008-0240** | **0.8** | 2.4 | 21,000 | 110 | 0.064 | 16,700 | 90 | 0.064 | 16,700 | 120 | 0.064 |
| **2009-0270** | **0.9** | 2.7 | 19,500 | 105 | 0.072 | 15,600 | 85 | 0.072 | 15,600 | 120 | 0.072 |
| **2010-0300** | **1** | 3 | 20,000 | 130 | 0.5 | 15,000 | 60 | 0.5 | 11,000 | 120 | 0.25 |
| **2015-0450** | **1.5** | 4.5 | 12,800 | 170 | 0.75 | 10,000 | 100 | 0.75 | 7,000 | 120 | 0.375 |
| **2020-0600** | **2** | 6 | 9,300 | 210 | 1 | 7,500 | 140 | 1 | 5,000 | 120 | 0.5 |
| **2025-0750** | **2.5** | 7.5 | 7,600 | 235 | 1.25 | 6,250 | 160 | 1.25 | 4,100 | 120 | 0.62 |
| **2030-0900** | **3** | 9 | 5,900 | 260 | 1.5 | 5,000 | 180 | 1.5 | 3,200 | 120 | 0.75 |
| **2040-1200** | **4** | 12 | 4,200 | 300 | 2 | 3,750 | 220 | 2 | 2,250 | 120 | 1 |
| **2050-1500** | **5** | 15 | 3,200 | 340 | 2.5 | 3,000 | 260 | 2.5 | 1,700 | 120 | 1.25 |
| **2060-1800** | **6** | 18 | 2,500 | 380 | 3 | 2,500 | 300 | 3 | 1,350 | 120 | 1.5 |
| **2070-2100** | **7** | 21 | 2,270 | 345 | 3.5 | 2,270 | 270 | 3.5 | 1,150 | 105 | 1.75 |
| **2080-2400** | **8** | 24 | 2,100 | 320 | 4 | 2,100 | 250 | 4 | 1,000 | 90 | 2 |
| **2090-2700** | **9** | 27 | 1,935 | 300 | 4.5 | 1,935 | 220 | 4.5 | 895 | 80 | 2.25 |
| **2100-3000** | **10** | 30 | 1,800 | 280 | 5 | 1,800 | 200 | 5 | 810 | 75 | 2.5 |
| **2110-3300** | **11** | 33 | 1,635 | 265 | 5.5 | 1,635 | 180 | 5.5 | 735 | 70 | 2.75 |
| **2120-3600** | **12** | 36 | 1,500 | 250 | 6 | 1,500 | 160 | 6 | 670 | 65 | 3 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) |
| | | | | Slotting | $a_p$ | | Slotting | $a_p$ |
| **2001-0030** | **0.1** | 0.3 | 30,000 | 15 | 0.005 | 24,000 | 10 | 0.001 |
| **2002-0060** | **0.2** | 0.6 | 30,000 | 30 | 0.01 | 23,000 | 25 | 0.002 |
| **2003-0090** | **0.3** | 0.9 | 30,000 | 55 | 0.015 | 20,000 | 25 | 0.003 |
| **2004-0120** | **0.4** | 1.2 | 30,000 | 60 | 0.02 | 16,800 | 25 | 0.004 |
| **2005-0150** | **0.5** | 1.5 | 24,000 | 60 | 0.025 | 14,400 | 30 | 0.013 |
| **2006-0180** | **0.6** | 1.8 | 20,000 | 60 | 0.05 | 12,000 | 35 | 0.015 |
| **2007-0210** | **0.7** | 2.1 | 17,800 | 60 | 0.056 | 10,000 | 35 | 0.018 |
| **2008-0240** | **0.8** | 2.4 | 16,700 | 60 | 0.064 | 8,500 | 35 | 0.02 |
| **2009-0270** | **0.9** | 2.7 | 15,600 | 60 | 0.072 | 7,300 | 35 | 0.023 |
| **2010-0300** | **1** | 3 | 11,000 | 60 | 0.25 | 5,500 | 15 | 0.05 |
| **2015-0450** | **1.5** | 4.5 | 7,500 | 90 | 0.375 | 3,750 | 20 | 0.075 |
| **2020-0600** | **2** | 6 | 5,700 | 120 | 0.5 | 2,850 | 25 | 0.1 |
| **2025-0750** | **2.5** | 7.5 | 4,800 | 135 | 0.62 | 2,400 | 30 | 0.12 |
| **2030-0900** | **3** | 9 | 3,900 | 150 | 0.75 | 1,950 | 35 | 0.15 |
| **2040-1200** | **4** | 12 | 2,900 | 180 | 1 | 1,450 | 40 | 0.2 |
| **2050-1500** | **5** | 15 | 2,400 | 210 | 1.25 | 1,200 | 45 | 0.25 |
| **2060-1800** | **6** | 18 | 2,000 | 240 | 1.5 | 1,000 | 55 | 0.3 |
| **2070-2100** | **7** | 21 | 1,630 | 230 | 1.5 | 815 | 55 | 0.3 |
| **2080-2400** | **8** | 24 | 1,350 | 220 | 1.5 | 675 | 55 | 0.3 |
| **2090-2700** | **9** | 27 | 1,135 | 210 | 1.5 | 565 | 55 | 0.3 |
| **2100-3000** | **10** | 30 | 960 | 200 | 1.5 | 480 | 55 | 0.3 |
| **2110-3300** | **11** | 33 | 845 | 180 | 1.5 | 425 | 55 | 0.3 |
| **2120-3600** | **12** | 36 | 750 | 160 | 1.5 | 375 | 55 | 0.3 |

# Milling Conditions for CSS

**Side Milling**

**◆ 1D flute length type L/D=1**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0010** | **0.1** | 0.1 | 30,000 | 70 | 0.1 | 0.007 | 30,000 | 55 | 0.1 | 0.006 | 30,000 | 60 | 0.1 | 0.005 |
| **2002-0020** | **0.2** | 0.2 | 30,000 | 180 | 0.2 | 0.014 | 30,000 | 140 | 0.2 | 0.012 | 30,000 | 120 | 0.2 | 0.01 |
| **2003-0030** | **0.3** | 0.3 | 30,000 | 280 | 0.3 | 0.021 | 30,000 | 210 | 0.3 | 0.018 | 30,000 | 180 | 0.3 | 0.015 |
| **2004-0040** | **0.4** | 0.4 | 30,000 | 380 | 0.4 | 0.028 | 30,000 | 260 | 0.4 | 0.024 | 30,000 | 225 | 0.4 | 0.02 |
| **2005-0050** | **0.5** | 0.5 | 27,000 | 490 | 0.5 | 0.035 | 24,000 | 360 | 0.5 | 0.03 | 24,000 | 315 | 0.5 | 0.025 |
| **2006-0060** | **0.6** | 0.6 | 24,000 | 600 | 0.6 | 0.042 | 20,000 | 450 | 0.6 | 0.036 | 20,000 | 400 | 0.6 | 0.03 |
| **2007-0070** | **0.7** | 0.7 | 22,500 | 600 | 0.7 | 0.049 | 17,800 | 450 | 0.7 | 0.042 | 17,800 | 400 | 0.7 | 0.035 |
| **2008-0080** | **0.8** | 0.8 | 21,000 | 600 | 0.8 | 0.056 | 16,700 | 450 | 0.8 | 0.048 | 16,700 | 400 | 0.8 | 0.04 |
| **2009-0090** | **0.9** | 0.9 | 19,500 | 600 | 0.9 | 0.063 | 15,600 | 450 | 0.9 | 0.054 | 15,600 | 400 | 0.9 | 0.045 |
| **2010-0100** | **1** | 1 | 18,000 | 600 | 1 | 0.075 | 14,500 | 450 | 1 | 0.075 | 14,500 | 500 | 1 | 0.05 |
| **2015-0150** | **1.5** | 1.5 | 16,000 | 900 | 1.5 | 0.113 | 13,000 | 600 | 1.5 | 0.113 | 13,000 | 750 | 1.5 | 0.075 |
| **2020-0200** | **2** | 2 | 12,000 | 900 | 2 | 0.15 | 10,000 | 600 | 2 | 0.15 | 10,000 | 750 | 2 | 0.1 |
| **2025-0250** | **2.5** | 2.5 | 10,200 | 900 | 2.5 | 0.19 | 8,400 | 600 | 2.5 | 0.19 | 8,400 | 750 | 2.5 | 0.13 |
| **2030-0300** | **3** | 3 | 8,500 | 900 | 3 | 0.225 | 6,800 | 600 | 3 | 0.225 | 6,800 | 750 | 3 | 0.15 |
| **2040-0400** | **4** | 4 | 7,200 | 675 | 4 | 0.6 | 5,700 | 500 | 4 | 0.6 | 5,700 | 575 | 4 | 0.4 |
| **2050-0500** | **5** | 5 | 6,000 | 750 | 5 | 0.75 | 4,800 | 550 | 5 | 0.75 | 4,800 | 650 | 5 | 0.5 |
| **2060-0600** | **6** | 6 | 5,000 | 800 | 6 | 0.9 | 4,000 | 600 | 6 | 0.9 | 4,000 | 650 | 6 | 0.6 |
| **2080-0800** | **8** | 8 | 3,500 | 700 | 8 | 1.2 | 2,700 | 525 | 8 | 1.2 | 2,400 | 600 | 8 | 0.8 |
| **2100-1000** | **10** | 10 | 2,300 | 600 | 10 | 1.5 | 1,900 | 450 | 10 | 1.5 | 1,400 | 500 | 10 | 1 |
| **2120-1200** | **12** | 12 | 1,850 | 550 | 12 | 1.8 | 1,550 | 400 | 12 | 1.8 | 1,250 | 450 | 12 | 1.2 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0010** | **0.1** | 0.1 | 30,000 | 40 | 0.1 | 0.005 | 24,000 | 25 | 0.1 | 0.004 |
| **2002-0020** | **0.2** | 0.2 | 30,000 | 80 | 0.2 | 0.01 | 23,000 | 35 | 0.2 | 0.008 |
| **2003-0030** | **0.3** | 0.3 | 30,000 | 120 | 0.3 | 0.015 | 20,000 | 45 | 0.3 | 0.012 |
| **2004-0040** | **0.4** | 0.4 | 30,000 | 150 | 0.4 | 0.02 | 16,800 | 55 | 0.4 | 0.016 |
| **2005-0050** | **0.5** | 0.5 | 24,000 | 210 | 0.5 | 0.025 | 14,400 | 65 | 0.5 | 0.02 |
| **2006-0060** | **0.6** | 0.6 | 20,000 | 265 | 0.6 | 0.03 | 12,000 | 80 | 0.6 | 0.024 |
| **2007-0070** | **0.7** | 0.7 | 17,800 | 265 | 0.7 | 0.035 | 10,000 | 80 | 0.7 | 0.028 |
| **2008-0080** | **0.8** | 0.8 | 16,700 | 265 | 0.8 | 0.04 | 8,500 | 80 | 0.8 | 0.032 |
| **2009-0090** | **0.9** | 0.9 | 15,600 | 265 | 0.9 | 0.045 | 7,300 | 80 | 0.9 | 0.036 |
| **2010-0100** | **1** | 1 | 14,500 | 300 | 1 | 0.05 | 6,550 | 80 | 1 | 0.045 |
| **2015-0150** | **1.5** | 1.5 | 12,000 | 450 | 1.5 | 0.075 | 4,400 | 100 | 1.5 | 0.068 |
| **2020-0200** | **2** | 2 | 9,000 | 450 | 2 | 0.1 | 3,300 | 115 | 2 | 0.09 |
| **2025-0250** | **2.5** | 2.5 | 7,900 | 450 | 2.5 | 0.13 | 2,750 | 120 | 2.5 | 0.11 |
| **2030-0300** | **3** | 3 | 6,800 | 450 | 3 | 0.15 | 2,200 | 130 | 3 | 0.135 |
| **2040-0400** | **4** | 4 | 5,100 | 350 | 4 | 0.4 | 1,650 | 150 | 4 | 0.18 |
| **2050-0500** | **5** | 5 | 4,050 | 425 | 5 | 0.5 | 1,300 | 160 | 5 | 0.225 |
| **2060-0600** | **6** | 6 | 3,300 | 500 | 6 | 0.6 | 1,100 | 180 | 6 | 0.27 |
| **2080-0800** | **8** | 8 | 2,300 | 450 | 8 | 0.8 | 800 | 130 | 8 | 0.36 |
| **2100-1000** | **10** | 10 | 1,500 | 450 | 10 | 1 | 690 | 110 | 10 | 0.45 |
| **2120-1200** | **12** | 12 | 1,200 | 400 | 12 | 1.2 | 550 | 110 | 12 | 0.54 |

# Milling Conditions for CSS

◆ **1.5D flute length type** $1 < L/D \leqq 1.5$

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0015** | **0.1** | 0.15 | 30,000 | 70 | 0.15 | 0.007 | 30,000 | 55 | 0.15 | 0.006 | 30,000 | 60 | 0.15 | 0.005 |
| **2002-0030** | **0.2** | 0.3 | 30,000 | 180 | 0.3 | 0.014 | 30,000 | 140 | 0.3 | 0.012 | 30,000 | 120 | 0.3 | 0.01 |
| **2003-0045** | **0.3** | 0.45 | 30,000 | 280 | 0.45 | 0.021 | 30,000 | 210 | 0.45 | 0.018 | 30,000 | 180 | 0.45 | 0.015 |
| **2004-0060** | **0.4** | 0.6 | 30,000 | 380 | 0.6 | 0.028 | 30,000 | 260 | 0.6 | 0.024 | 30,000 | 225 | 0.6 | 0.02 |
| **2005-0075** | **0.5** | 0.75 | 27,000 | 490 | 0.75 | 0.035 | 24,000 | 360 | 0.75 | 0.03 | 24,000 | 315 | 0.75 | 0.025 |
| **2006-0090** | **0.6** | 0.9 | 24,000 | 600 | 0.9 | 0.042 | 20,000 | 450 | 0.9 | 0.036 | 20,000 | 400 | 0.9 | 0.03 |
| **2007-0100** | **0.7** | 1 | 22,500 | 600 | 1 | 0.049 | 17,800 | 450 | 1 | 0.042 | 17,800 | 400 | 1 | 0.035 |
| **2008-0120** | **0.8** | 1.2 | 21,000 | 600 | 1.2 | 0.056 | 16,700 | 450 | 1.2 | 0.048 | 16,700 | 400 | 1.2 | 0.04 |
| **2009-0120** | **0.9** | 1.2 | 19,500 | 600 | 1.2 | 0.063 | 15,600 | 450 | 1.2 | 0.054 | 15,600 | 400 | 1.2 | 0.045 |
| **2010-0150** | **1** | 1.5 | 18,000 | 600 | 1.5 | 0.075 | 14,500 | 450 | 1.5 | 0.075 | 14,500 | 500 | 1.5 | 0.05 |
| **2015-0225** | **1.5** | 2.25 | 16,000 | 900 | 2.25 | 0.113 | 13,000 | 600 | 2.25 | 0.113 | 13,000 | 750 | 2.25 | 0.075 |
| **2020-0300** | **2** | 3 | 12,000 | 900 | 3 | 0.15 | 10,000 | 600 | 3 | 0.15 | 10,000 | 750 | 3 | 0.1 |
| **2025-0375** | **2.5** | 3.75 | 10,200 | 900 | 3.75 | 0.19 | 8,400 | 600 | 3.75 | 0.19 | 8,400 | 750 | 3.75 | 0.13 |
| **2030-0450** | **3** | 4.5 | 8,500 | 900 | 4.5 | 0.225 | 6,800 | 600 | 4.5 | 0.225 | 6,800 | 750 | 4.5 | 0.15 |
| **2040-0600** | **4** | 6 | 7,200 | 675 | 6 | 0.6 | 5,700 | 500 | 6 | 0.6 | 5,700 | 575 | 6 | 0.4 |
| **2050-0750** | **5** | 7.5 | 6,000 | 750 | 7.5 | 0.75 | 4,800 | 550 | 7.5 | 0.75 | 4,800 | 650 | 7.5 | 0.5 |
| **2060-0900** | **6** | 9 | 5,000 | 800 | 9 | 0.9 | 4,000 | 600 | 9 | 0.9 | 4,000 | 650 | 9 | 0.6 |
| **2080-1200** | **8** | 12 | 3,500 | 700 | 12 | 1.2 | 2,700 | 525 | 12 | 1.2 | 2,400 | 600 | 12 | 0.8 |
| **2100-1500** | **10** | 15 | 2,300 | 600 | 15 | 1.5 | 1,900 | 450 | 15 | 1.5 | 1,400 | 500 | 15 | 1 |
| **2120-1800** | **12** | 18 | 1,850 | 550 | 18 | 1.8 | 1,550 | 400 | 18 | 1.8 | 1,250 | 450 | 18 | 1.2 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0015** | **0.1** | 0.15 | 30,000 | 40 | 0.15 | 0.005 | 24,000 | 25 | 0.15 | 0.004 |
| **2002-0030** | **0.2** | 0.3 | 30,000 | 80 | 0.3 | 0.01 | 23,000 | 35 | 0.3 | 0.008 |
| **2003-0045** | **0.3** | 0.45 | 30,000 | 120 | 0.45 | 0.015 | 20,000 | 45 | 0.45 | 0.012 |
| **2004-0060** | **0.4** | 0.6 | 30,000 | 150 | 0.6 | 0.02 | 16,800 | 55 | 0.6 | 0.016 |
| **2005-0075** | **0.5** | 0.75 | 24,000 | 210 | 0.75 | 0.025 | 14,400 | 65 | 0.75 | 0.02 |
| **2006-0090** | **0.6** | 0.9 | 20,000 | 265 | 0.9 | 0.03 | 12,000 | 80 | 0.9 | 0.024 |
| **2007-0100** | **0.7** | 1 | 17,800 | 265 | 1 | 0.035 | 10,000 | 80 | 1 | 0.028 |
| **2008-0120** | **0.8** | 1.2 | 16,700 | 265 | 1.2 | 0.04 | 8,500 | 80 | 1.2 | 0.032 |
| **2009-0120** | **0.9** | 1.2 | 15,600 | 265 | 1.2 | 0.045 | 7,300 | 80 | 1.2 | 0.036 |
| **2010-0150** | **1** | 1.5 | 14,500 | 300 | 1.5 | 0.05 | 6,550 | 80 | 1 | 0.045 |
| **2015-0225** | **1.5** | 2.25 | 12,000 | 450 | 2.25 | 0.075 | 4,400 | 100 | 1.5 | 0.068 |
| **2020-0300** | **2** | 3 | 9,000 | 450 | 3 | 0.1 | 3,300 | 115 | 2 | 0.09 |
| **2025-0375** | **2.5** | 3.75 | 7,900 | 450 | 3.75 | 0.13 | 2,750 | 120 | 2.5 | 0.11 |
| **2030-0450** | **3** | 4.5 | 6,800 | 450 | 4.5 | 0.15 | 2,200 | 130 | 3 | 0.135 |
| **2040-0600** | **4** | 6 | 5,100 | 350 | 6 | 0.4 | 1,650 | 150 | 4 | 0.18 |
| **2050-0750** | **5** | 7.5 | 4,050 | 425 | 7.5 | 0.5 | 1,300 | 160 | 5 | 0.225 |
| **2060-0900** | **6** | 9 | 3,300 | 500 | 9 | 0.6 | 1,100 | 180 | 6 | 0.27 |
| **2080-1200** | **8** | 12 | 2,300 | 450 | 12 | 0.8 | 800 | 130 | 12 | 0.36 |
| **2100-1500** | **10** | 15 | 1,500 | 450 | 15 | 1 | 690 | 110 | 15 | 0.45 |
| **2120-1800** | **12** | 18 | 1,200 | 400 | 18 | 1.2 | 550 | 110 | 18 | 0.54 |

## Milling Conditions for CSS

◆ **2D flute length type 1.5 < L/D ≦ 2**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0020** | **0.1** | 0.2 | 30,000 | 50 | 0.15 | 0.006 | 30,000 | 50 | 0.15 | 0.006 | 30,000 | 45 | 0.15 | 0.005 |
| **2002-0040** | **0.2** | 0.4 | 30,000 | 150 | 0.3 | 0.012 | 30,000 | 140 | 0.3 | 0.012 | 30,000 | 105 | 0.3 | 0.01 |
| **2003-0060** | **0.3** | 0.6 | 30,000 | 230 | 0.45 | 0.018 | 30,000 | 185 | 0.45 | 0.018 | 30,000 | 165 | 0.45 | 0.015 |
| **2004-0080** | **0.4** | 0.8 | 30,000 | 315 | 0.6 | 0.024 | 30,000 | 240 | 0.6 | 0.02 | 30,000 | 225 | 0.6 | 0.016 |
| **2005-0080** | **0.5** | 0.8 | 27,000 | 490 | 0.75 | 0.03 | 24,000 | 360 | 0.75 | 0.025 | 24,000 | 315 | 0.75 | 0.02 |
| **2005-0100** | **0.5** | 1 | 27,000 | 400 | 0.75 | 0.03 | 24,000 | 300 | 0.75 | 0.025 | 24,000 | 260 | 0.75 | 0.02 |
| **2006-0100** | **0.6** | 1 | 24,000 | 600 | 1 | 0.036 | 20,000 | 450 | 1 | 0.03 | 20,000 | 400 | 1 | 0.024 |
| **2006-0120** | **0.6** | 1.2 | 24,000 | 500 | 1.2 | 0.036 | 20,000 | 360 | 1.2 | 0.03 | 20,000 | 315 | 1.2 | 0.024 |
| **2007-0140** | **0.7** | 1.4 | 22,500 | 500 | 1.4 | 0.042 | 17,800 | 360 | 1.4 | 0.035 | 17,800 | 315 | 1.4 | 0.028 |
| **2008-0160** | **0.8** | 1.6 | 21,000 | 500 | 1.6 | 0.048 | 16,700 | 360 | 1.6 | 0.04 | 16,700 | 315 | 1.6 | 0.032 |
| **2009-0180** | **0.9** | 1.8 | 19,500 | 500 | 1.8 | 0.054 | 15,600 | 360 | 1.8 | 0.045 | 15,600 | 315 | 1.8 | 0.036 |
| **2010-0200** | **1** | 2 | 18,000 | 600 | 1.5 | 0.09 | 14,500 | 450 | 1.5 | 0.09 | 14,500 | 500 | 1.5 | 0.06 |
| **2015-0300** | **1.5** | 3 | 16,000 | 900 | 2.25 | 0.135 | 13,000 | 600 | 2.25 | 0.135 | 13,000 | 750 | 2.25 | 0.09 |
| **2020-0400** | **2** | 4 | 12,000 | 900 | 3 | 0.18 | 10,000 | 600 | 3 | 0.18 | 10,000 | 750 | 3 | 0.12 |
| **2025-0500** | **2.5** | 5 | 10,200 | 900 | 3.75 | 0.23 | 8,400 | 600 | 3.75 | 0.23 | 8,400 | 750 | 3.75 | 0.15 |
| **2030-0600** | **3** | 6 | 8,500 | 900 | 4.5 | 0.27 | 6,800 | 600 | 4.5 | 0.27 | 6,800 | 750 | 4.5 | 0.18 |
| **2040-0800** | **4** | 8 | 7,200 | 675 | 6 | 0.6 | 5,700 | 500 | 6 | 0.6 | 5,700 | 575 | 6 | 0.4 |
| **2050-1000** | **5** | 10 | 6,000 | 750 | 7.5 | 0.75 | 4,800 | 550 | 7.5 | 0.75 | 4,800 | 650 | 7.5 | 0.5 |
| **2060-1200** | **6** | 12 | 5,000 | 800 | 9 | 0.9 | 4,000 | 600 | 9 | 0.9 | 4,000 | 650 | 9 | 0.6 |
| **2080-1600** | **8** | 16 | 3,500 | 700 | 12 | 1.2 | 2,700 | 525 | 12 | 1.2 | 2,400 | 600 | 12 | 0.8 |
| **2100-2000** | **10** | 20 | 2,300 | 600 | 15 | 1.5 | 1,900 | 450 | 15 | 1.5 | 1,400 | 500 | 15 | 1 |
| **2120-2400** | **12** | 24 | 1,850 | 550 | 18 | 1.8 | 1,550 | 400 | 18 | 1.8 | 1,250 | 450 | 18 | 1.2 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0020** | **0.1** | 0.2 | 30,000 | 30 | 0.15 | 0.005 | 24,000 | 10 | 0.2 | 0.003 |
| **2002-0040** | **0.2** | 0.4 | 30,000 | 70 | 0.3 | 0.01 | 23,000 | 30 | 0.4 | 0.006 |
| **2003-0060** | **0.3** | 0.6 | 30,000 | 110 | 0.45 | 0.015 | 20,000 | 40 | 0.6 | 0.009 |
| **2004-0080** | **0.4** | 0.8 | 30,000 | 150 | 0.6 | 0.016 | 16,800 | 50 | 0.8 | 0.012 |
| **2005-0080** | **0.5** | 0.8 | 24,000 | 210 | 0.75 | 0.02 | 14,400 | 65 | 0.8 | 0.015 |
| **2005-0100** | **0.5** | 1 | 24,000 | 175 | 0.75 | 0.02 | 14,400 | 50 | 1 | 0.015 |
| **2006-0100** | **0.6** | 1 | 20,000 | 265 | 1 | 0.024 | 12,000 | 80 | 1 | 0.018 |
| **2006-0120** | **0.6** | 1.2 | 20,000 | 210 | 1.2 | 0.024 | 12,000 | 60 | 1.2 | 0.018 |
| **2007-0140** | **0.7** | 1.4 | 17,800 | 210 | 1.4 | 0.028 | 10,000 | 60 | 1.4 | 0.021 |
| **2008-0160** | **0.8** | 1.6 | 16,700 | 210 | 1.6 | 0.032 | 8,500 | 60 | 1.6 | 0.024 |
| **2009-0180** | **0.9** | 1.8 | 15,600 | 210 | 1.8 | 0.036 | 7,300 | 60 | 1.8 | 0.027 |
| **2010-0200** | **1** | 2 | 14,500 | 300 | 1.5 | 0.06 | 6,550 | 80 | 1.5 | 0.045 |
| **2015-0300** | **1.5** | 3 | 12,000 | 450 | 2.25 | 0.09 | 4,400 | 100 | 2.25 | 0.068 |
| **2020-0400** | **2** | 4 | 9,000 | 450 | 3 | 0.12 | 3,300 | 115 | 3 | 0.09 |
| **2025-0500** | **2.5** | 5 | 7,900 | 450 | 3.75 | 0.15 | 2,750 | 120 | 3.75 | 0.11 |
| **2030-0600** | **3** | 6 | 6,800 | 450 | 4.5 | 0.18 | 2,200 | 130 | 4.5 | 0.135 |
| **2040-0800** | **4** | 8 | 5,100 | 350 | 6 | 0.4 | 1,650 | 150 | 6 | 0.18 |
| **2050-1000** | **5** | 10 | 4,050 | 425 | 7.5 | 0.5 | 1,300 | 160 | 7.5 | 0.225 |
| **2060-1200** | **6** | 12 | 3,300 | 500 | 9 | 0.6 | 1,100 | 180 | 9 | 0.27 |
| **2080-1600** | **8** | 16 | 2,300 | 450 | 12 | 0.8 | 800 | 130 | 12 | 0.36 |
| **2100-2000** | **10** | 20 | 1,500 | 450 | 15 | 1 | 690 | 110 | 15 | 0.45 |
| **2120-2400** | **12** | 24 | 1,200 | 400 | 18 | 1.2 | 550 | 110 | 18 | 0.54 |

# Milling Conditions for CSS

◆ **2.5D flute length type 2.5 < L/D ≦ 3**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0025** | **0.1** | 0.25 | 30,000 | 40 | 0.2 | 0.005 | 30,000 | 40 | 0.2 | 0.005 | 30,000 | 25 | 0.2 | 0.004 |
| **2002-0050** | **0.2** | 0.5 | 30,000 | 150 | 0.4 | 0.008 | 30,000 | 120 | 0.4 | 0.01 | 30,000 | 65 | 0.4 | 0.008 |
| **2003-0075** | **0.3** | 0.75 | 30,000 | 230 | 0.6 | 0.012 | 30,000 | 160 | 0.6 | 0.015 | 30,000 | 100 | 0.6 | 0.012 |
| **2004-0100** | **0.4** | 1 | 30,000 | 315 | 0.8 | 0.016 | 30,000 | 220 | 0.8 | 0.016 | 30,000 | 140 | 0.8 | 0.012 |
| **2005-0125** | **0.5** | 1.25 | 27,000 | 400 | 1 | 0.02 | 24,000 | 260 | 1 | 0.02 | 24,000 | 155 | 1 | 0.015 |
| **2006-0150** | **0.6** | 1.5 | 24,000 | 500 | 1.5 | 0.024 | 20,000 | 360 | 1.5 | 0.024 | 20,000 | 210 | 1.5 | 0.018 |
| **2007-0175** | **0.7** | 1.75 | 22,500 | 500 | 1.75 | 0.028 | 17,800 | 360 | 1.75 | 0.028 | 17,800 | 210 | 1.75 | 0.021 |
| **2008-0200** | **0.8** | 2 | 21,000 | 500 | 2 | 0.032 | 16,700 | 360 | 2 | 0.032 | 16,700 | 210 | 2 | 0.024 |
| **2009-0225** | **0.9** | 2.25 | 19,500 | 500 | 2.25 | 0.036 | 15,600 | 360 | 2.25 | 0.036 | 15,600 | 210 | 2.25 | 0.027 |
| **2010-0250** | **1** | 2.5 | 20,000 | 700 | 2.5 | 0.05 | 15,000 | 500 | 2.5 | 0.05 | 11,000 | 200 | 2.5 | 0.05 |
| **2015-0375** | **1.5** | 3.75 | 12,800 | 710 | 3.75 | 0.075 | 10,000 | 500 | 3.75 | 0.075 | 7,000 | 210 | 3.75 | 0.075 |
| **2020-0500** | **2** | 5 | 9,300 | 720 | 5 | 0.1 | 7,500 | 510 | 5 | 0.1 | 5,000 | 230 | 5 | 0.1 |
| **2025-0625** | **2.5** | 6.25 | 7,600 | 725 | 6.25 | 0.13 | 6,250 | 515 | 6.25 | 0.13 | 4,100 | 250 | 6.25 | 0.13 |
| **2030-0750** | **3** | 7.5 | 5,900 | 730 | 7.5 | 0.15 | 5,000 | 520 | 7.5 | 0.15 | 3,200 | 275 | 7.5 | 0.15 |
| **2040-1000** | **4** | 10 | 4,200 | 740 | 10 | 0.4 | 3,750 | 520 | 10 | 0.4 | 2,250 | 300 | 10 | 0.2 |
| **2050-1250** | **5** | 12.5 | 3,200 | 750 | 12.5 | 0.5 | 3,000 | 530 | 12.5 | 0.5 | 1,700 | 330 | 12.5 | 0.25 |
| **2060-1500** | **6** | 15 | 2,500 | 750 | 15 | 0.6 | 2,500 | 530 | 15 | 0.6 | 1,350 | 350 | 15 | 0.3 |
| **2070-1750** | **7** | 17.5 | 2,270 | 700 | 17.5 | 0.7 | 2,270 | 495 | 17.5 | 0.7 | 1,150 | 350 | 17.5 | 0.35 |
| **2080-2000** | **8** | 20 | 2,100 | 660 | 20 | 0.8 | 2,100 | 470 | 20 | 0.8 | 1,000 | 350 | 20 | 0.4 |
| **2090-2250** | **9** | 22.5 | 1,935 | 615 | 22.5 | 0.9 | 1,935 | 440 | 22.5 | 0.9 | 895 | 350 | 22.5 | 0.45 |
| **2100-2500** | **10** | 25 | 1,800 | 580 | 25 | 1 | 1,800 | 410 | 25 | 1 | 810 | 350 | 25 | 0.5 |
| **2110-2750** | **11** | 27.5 | 1,635 | 545 | 27.5 | 1.1 | 1,635 | 375 | 27.5 | 1.1 | 735 | 335 | 27.5 | 0.55 |
| **2120-3000** | **12** | 30 | 1,500 | 520 | 30 | 1.2 | 1,500 | 350 | 30 | 1.2 | 670 | 320 | 30 | 0.6 |

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0025** | **0.1** | 0.25 | 30,000 | 25 | 0.2 | 0.004 | 24,000 | 10 | 0.25 | 0.002 |
| **2002-0050** | **0.2** | 0.5 | 30,000 | 65 | 0.4 | 0.008 | 23,000 | 25 | 0.5 | 0.004 |
| **2003-0075** | **0.3** | 0.75 | 30,000 | 100 | 0.6 | 0.012 | 20,000 | 35 | 0.75 | 0.006 |
| **2004-0100** | **0.4** | 1 | 30,000 | 140 | 0.8 | 0.012 | 16,800 | 45 | 1 | 0.008 |
| **2005-0125** | **0.5** | 1.25 | 24,000 | 155 | 1 | 0.015 | 14,400 | 50 | 1.25 | 0.01 |
| **2006-0150** | **0.6** | 1.5 | 20,000 | 210 | 1.5 | 0.018 | 12,000 | 60 | 1.5 | 0.012 |
| **2007-0175** | **0.7** | 1.75 | 17,800 | 210 | 1.75 | 0.021 | 10,000 | 60 | 1.75 | 0.014 |
| **2008-0200** | **0.8** | 2 | 16,700 | 210 | 2 | 0.024 | 8,500 | 60 | 2 | 0.016 |
| **2009-0225** | **0.9** | 2.25 | 15,600 | 210 | 2.25 | 0.027 | 7,300 | 60 | 2.25 | 0.018 |
| **2010-0250** | **1** | 2.5 | 11,000 | 200 | 2.5 | 0.05 | 5,500 | 60 | 2.5 | 0.05 |
| **2015-0375** | **1.5** | 3.75 | 7,500 | 210 | 3.75 | 0.075 | 3,750 | 65 | 3.75 | 0.075 |
| **2020-0500** | **2** | 5 | 5,700 | 230 | 5 | 0.1 | 2,850 | 70 | 5 | 0.1 |
| **2025-0625** | **2.5** | 6.25 | 4,800 | 240 | 6.25 | 0.13 | 2,400 | 70 | 6.25 | 0.13 |
| **2030-0750** | **3** | 7.5 | 3,900 | 250 | 7.5 | 0.15 | 1,950 | 75 | 7.5 | 0.15 |
| **2040-1000** | **4** | 10 | 2,900 | 270 | 10 | 0.3 | 1,450 | 80 | 10 | 0.3 |
| **2050-1250** | **5** | 12.5 | 2,400 | 290 | 12.5 | 0.375 | 1,200 | 90 | 12.5 | 0.375 |
| **2060-1500** | **6** | 15 | 2,000 | 300 | 15 | 0.45 | 1,000 | 100 | 15 | 0.45 |
| **2070-1750** | **7** | 17.5 | 1,630 | 285 | 17.5 | 0.525 | 815 | 85 | 17.5 | 0.525 |
| **2080-2000** | **8** | 20 | 1,350 | 270 | 20 | 0.6 | 675 | 70 | 20 | 0.6 |
| **2090-2250** | **9** | 22.5 | 1,135 | 255 | 22.5 | 0.675 | 565 | 60 | 22.5 | 0.675 |
| **2100-2500** | **10** | 25 | 960 | 240 | 25 | 0.75 | 480 | 50 | 25 | 0.75 |
| **2110-2750** | **11** | 27.5 | 845 | 220 | 27.5 | 0.825 | 425 | 45 | 27.5 | 0.825 |
| **2120-3000** | **12** | 30 | 750 | 200 | 30 | 0.9 | 375 | 40 | 30 | 0.9 |

## Milling Conditions for CSS

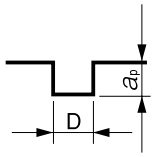
◆ **3D flute length type L/D=3**

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 * Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0030** | **0.1** | 0.3 | 30,000 | 30 | 0.25 | 0.005 | 30,000 | 30 | 0.25 | 0.005 | 30,000 | 20 | 0.25 | 0.004 |
| **2002-0060** | **0.2** | 0.6 | 30,000 | 110 | 0.5 | 0.008 | 30,000 | 85 | 0.5 | 0.01 | 30,000 | 50 | 0.5 | 0.008 |
| **2003-0090** | **0.3** | 0.9 | 30,000 | 180 | 0.75 | 0.012 | 30,000 | 135 | 0.75 | 0.015 | 30,000 | 80 | 0.75 | 0.012 |
| **2004-0120** | **0.4** | 1.2 | 30,000 | 250 | 1 | 0.016 | 30,000 | 170 | 1 | 0.016 | 30,000 | 100 | 1 | 0.012 |
| **2005-0150** | **0.5** | 1.5 | 27,000 | 320 | 1.25 | 0.02 | 24,000 | 200 | 1.25 | 0.02 | 24,000 | 125 | 1.25 | 0.015 |
| **2006-0180** | **0.6** | 1.8 | 24,000 | 400 | 1.8 | 0.024 | 20,000 | 280 | 1.8 | 0.024 | 20,000 | 170 | 1.8 | 0.018 |
| **2007-0210** | **0.7** | 2.1 | 22,500 | 400 | 2.1 | 0.028 | 17,800 | 280 | 2.1 | 0.028 | 17,800 | 170 | 2.1 | 0.021 |
| **2008-0240** | **0.8** | 2.4 | 21,000 | 400 | 2.4 | 0.032 | 16,700 | 280 | 2.4 | 0.032 | 16,700 | 170 | 2.4 | 0.024 |
| **2009-0270** | **0.9** | 2.7 | 19,500 | 400 | 2.7 | 0.036 | 15,600 | 280 | 2.7 | 0.036 | 15,600 | 170 | 2.7 | 0.027 |
| **2010-0300** | **1** | 3 | 20,000 | 700 | 3 | 0.05 | 15,000 | 500 | 3 | 0.05 | 11,000 | 200 | 3 | 0.05 |
| **2015-0450** | **1.5** | 4.5 | 12,800 | 710 | 4.5 | 0.075 | 10,000 | 500 | 4.5 | 0.075 | 7,000 | 210 | 4.5 | 0.075 |
| **2020-0600** | **2** | 6 | 9,300 | 720 | 6 | 0.1 | 7,500 | 510 | 6 | 0.1 | 5,000 | 230 | 6 | 0.1 |
| **2025-0750** | **2.5** | 7.5 | 7,600 | 725 | 7.5 | 0.13 | 6,250 | 515 | 7.5 | 0.13 | 4,100 | 250 | 7.5 | 0.13 |
| **2030-0900** | **3** | 9 | 5,900 | 730 | 9 | 0.15 | 5,000 | 520 | 9 | 0.15 | 3,200 | 275 | 9 | 0.15 |
| **2040-1200** | **4** | 12 | 4,200 | 740 | 12 | 0.4 | 3,750 | 520 | 12 | 0.4 | 2,250 | 300 | 12 | 0.2 |
| **2050-1500** | **5** | 15 | 3,200 | 750 | 15 | 0.5 | 3,000 | 530 | 15 | 0.5 | 1,700 | 330 | 15 | 0.25 |
| **2060-1800** | **6** | 18 | 2,500 | 750 | 18 | 0.6 | 2,500 | 530 | 18 | 0.6 | 1,350 | 350 | 18 | 0.3 |
| **2070-2100** | **7** | 21 | 2,270 | 700 | 21 | 0.7 | 2,270 | 495 | 21 | 0.7 | 1,150 | 350 | 21 | 0.35 |
| **2080-2400** | **8** | 24 | 2,100 | 660 | 24 | 0.8 | 2,100 | 470 | 24 | 0.8 | 1,000 | 350 | 24 | 0.4 |
| **2090-2700** | **9** | 27 | 1,935 | 615 | 27 | 0.9 | 1,935 | 440 | 27 | 0.9 | 895 | 350 | 27 | 0.45 |
| **2100-3000** | **10** | 30 | 1,800 | 580 | 30 | 1 | 1,800 | 410 | 30 | 1 | 810 | 350 | 30 | 0.5 |
| **2110-3300** | **11** | 33 | 1,635 | 545 | 33 | 1.1 | 1,635 | 375 | 33 | 1.1 | 735 | 335 | 33 | 0.55 |
| **2120-3600** | **12** | 36 | 1,500 | 520 | 36 | 1.2 | 1,500 | 350 | 36 | 1.2 | 670 | 320 | 36 | 0.6 |

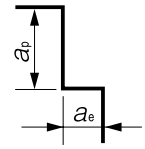
| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Milling Amount (mm) | |
| | | | | Side Milling | $a_p$ | $a_e$ | | Side Milling | $a_p$ | $a_e$ |
| **2001-0030** | **0.1** | 0.3 | 30,000 | 20 | 0.25 | 0.004 | 24,000 | 10 | 0.3 | 0.002 |
| **2002-0060** | **0.2** | 0.6 | 30,000 | 50 | 0.5 | 0.008 | 23,000 | 20 | 0.6 | 0.004 |
| **2003-0090** | **0.3** | 0.9 | 30,000 | 80 | 0.75 | 0.012 | 20,000 | 35 | 0.9 | 0.003 |
| **2004-0120** | **0.4** | 1.2 | 30,000 | 100 | 1 | 0.012 | 16,800 | 40 | 1.2 | 0.004 |
| **2005-0150** | **0.5** | 1.5 | 24,000 | 125 | 1.25 | 0.015 | 14,400 | 50 | 1.5 | 0.005 |
| **2006-0180** | **0.6** | 1.8 | 20,000 | 170 | 1.8 | 0.018 | 12,000 | 60 | 1.8 | 0.006 |
| **2007-0210** | **0.7** | 2.1 | 17,800 | 170 | 2.1 | 0.021 | 10,000 | 60 | 2.1 | 0.007 |
| **2008-0240** | **0.8** | 2.4 | 16,700 | 170 | 2.4 | 0.024 | 8,500 | 60 | 2.4 | 0.008 |
| **2009-0270** | **0.9** | 2.7 | 15,600 | 170 | 2.7 | 0.027 | 7,300 | 60 | 2.7 | 0.009 |
| **2010-0300** | **1** | 3 | 11,000 | 200 | 3 | 0.05 | 5,500 | 60 | 3 | 0.05 |
| **2015-0450** | **1.5** | 4.5 | 7,500 | 210 | 4.5 | 0.075 | 3,750 | 65 | 4.5 | 0.075 |
| **2020-0600** | **2** | 6 | 5,700 | 230 | 6 | 0.1 | 2,850 | 70 | 6 | 0.1 |
| **2025-0750** | **2.5** | 7.5 | 4,800 | 240 | 7.5 | 0.13 | 2,400 | 70 | 7.5 | 0.13 |
| **2030-0900** | **3** | 9 | 3,900 | 250 | 9 | 0.15 | 1,950 | 75 | 9 | 0.15 |
| **2040-1200** | **4** | 12 | 2,900 | 270 | 12 | 0.3 | 1,450 | 80 | 12 | 0.3 |
| **2050-1500** | **5** | 15 | 2,400 | 290 | 15 | 0.375 | 1,200 | 90 | 15 | 0.375 |
| **2060-1800** | **6** | 18 | 2,000 | 300 | 18 | 0.45 | 1,000 | 100 | 18 | 0.45 |
| **2070-2100** | **7** | 21 | 1,630 | 285 | 21 | 0.525 | 815 | 85 | 21 | 0.525 |
| **2080-2400** | **8** | 24 | 1,350 | 270 | 24 | 0.6 | 675 | 70 | 24 | 0.6 |
| **2090-2700** | **9** | 27 | 1,135 | 255 | 27 | 0.675 | 565 | 60 | 27 | 0.675 |
| **2100-3000** | **10** | 30 | 960 | 240 | 30 | 0.75 | 480 | 50 | 30 | 0.75 |
| **2110-3300** | **11** | 33 | 845 | 220 | 33 | 0.825 | 425 | 45 | 33 | 0.825 |
| **2120-3600** | **12** | 36 | 750 | 200 | 36 | 0.9 | 375 | 40 | 36 | 0.9 |

## Milling Conditions for CSS

Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
・Reduce the milling amount and feed rate in accordance with required milling precision.
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

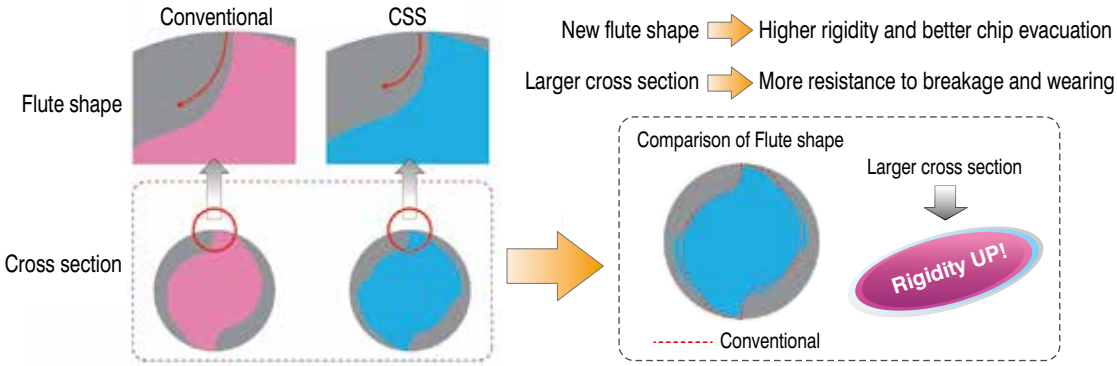



Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)



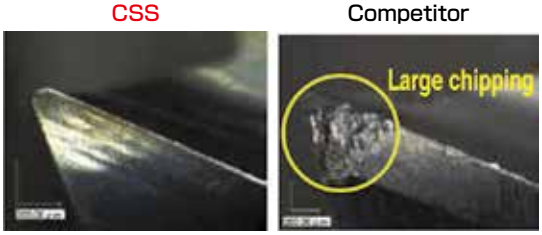

Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

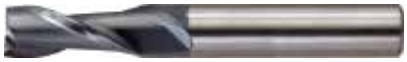
## Original Cross Section




## Milling Example: Slotting Comparison — STAVAX (53HRC)

| | |
|---|---|
| Tool | $\phi$ 6 × Length of Cut 12 mm |
| Spindle Speed | 1,100 $min^{-1}$ |
| Feed Rate | 40 mm/min |
| Axial Depth $a_p$ | 1.8 mm |
| Coolant | Air Blow (Through Spindle) |
| Cycle Time | 28 min |





Size φ0.1～φ20

# C-CES2000

Super MG | UT COAT | 30° | Flatland | Shank Dia 0/-0.005

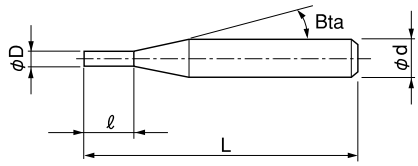
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |



## Features

**Broad application range from Copper and Carbon Steels up to Hardened Steels (55HRC).**
**Excellent performance/quality to price ratio.**
**Refer to page 208 for 4 flute C-CES.**




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

Total 207 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2001-0015 | 0.1 | 0.15 | 16° | 45 | 4 | 7,800 |
| C-CES 2001-0020 | | 0.2 | | 45 | 4 | 7,800 |
| C-CES 2001-0030 | | 0.3 | | 45 | 4 | 7,800 |
| C-CES 2002-0030 | 0.2 | 0.3 | 16° | 45 | 4 | 4,680 |
| C-CES 2002 | | 0.4 | | 38 | 3 | 4,680 |
| C-CES 2002-0040 | | 0.4 | | 45 | 4 | 4,680 |
| C-CES 2002-0050 | | 0.5 | | 45 | 4 | 4,680 |
| C-CES 2002-0060 | | 0.6 | | 45 | 4 | 4,680 |
| C-CES 2002-0080 | | 0.8 | | 45 | 4 | 7,930 |

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Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2003-0045 | 0.3 | 0.45 | 16° | 45 | 4 | 4,080 |
| C-CES 2003 | | 0.6 | | 38 | 3 | 4,080 |
| C-CES 2003-0060 | | 0.6 | | 45 | 4 | 4,080 |
| C-CES 2003-0075 | | 0.75 | | 45 | 4 | 4,080 |
| C-CES 2003-0090 | | 0.9 | | 45 | 4 | 4,080 |
| C-CES 2003-0120 | | 1.2 | | 45 | 4 | 6,120 |
| C-CES 2004-0060 | 0.4 | 0.6 | 16° | 45 | 4 | 4,560 |
| C-CES 2004 | | 0.8 | | 38 | 3 | 4,560 |
| C-CES 2004-0080 | | 0.8 | | 45 | 4 | 4,560 |
| C-CES 2004-0100 | | 1 | | 45 | 4 | 4,560 |
| C-CES 2004-0120 | | 1.2 | | 45 | 4 | 4,560 |
| C-CES 2004-0160 | | 1.6 | | 45 | 4 | 6,120 |
| C-CES 2005-0075 | 0.5 | 0.75 | 16° | 45 | 4 | 2,280 |
| C-CES 2005 | | 0.8 | | 38 | 3 | 2,280 |
| C-CES 2005-0100 | | 1 | | 45 | 4 | 2,280 |
| C-CES 2005-0125 | | 1.25 | | 45 | 4 | 2,280 |
| C-CES 2005-0150 | | 1.5 | | 45 | 4 | 2,280 |
| C-CES 2005-0200 | | 2 | | 45 | 4 | 3,840 |
| C-CES 2006-0090 | 0.6 | 0.9 | 16° | 45 | 4 | 3,480 |
| C-CES 2006 | | 1 | | 38 | 3 | 3,480 |
| C-CES 2006-0120 | | 1.2 | | 45 | 4 | 3,480 |
| C-CES 2006-0150 | | 1.5 | | 45 | 4 | 3,480 |
| C-CES 2006-0180 | | 1.8 | | 45 | 4 | 3,480 |
| C-CES 2006-0240 | | 2.4 | | 45 | 4 | 3,480 |
| C-CES 2007 | 0.7 | 1 | 16° | 38 | 3 | 3,840 |
| C-CES 2007-0140 | | 1.4 | | 45 | 4 | 3,840 |
| C-CES 2007-0175 | | 1.75 | | 45 | 4 | 3,840 |
| C-CES 2007-0210 | | 2.1 | | 45 | 4 | 3,840 |
| C-CES 2007-0280 | | 2.8 | | 45 | 4 | 3,840 |
| C-CES 2008 | 0.8 | 1.2 | 16° | 38 | 3 | 2,280 |
| C-CES 2008-0120 | | 1.2 | | 45 | 4 | 2,280 |
| C-CES 2008-0160 | | 1.6 | | 45 | 4 | 2,280 |
| C-CES 2008-0200 | | 2 | | 45 | 4 | 2,280 |
| C-CES 2008-0240 | | 2.4 | | 45 | 4 | 2,280 |
| C-CES 2008-0320 | | 3.2 | | 45 | 4 | 3,840 |
| C-CES 2009 | 0.9 | 1.2 | 16° | 38 | 3 | 3,840 |
| C-CES 2009-0180 | | 1.8 | | 45 | 4 | 3,840 |
| C-CES 2009-0225 | | 2.25 | | 45 | 4 | 3,840 |
| C-CES 2009-0270 | | 2.7 | | 45 | 4 | 3,840 |
| C-CES 2009-0360 | | 3.6 | | 45 | 4 | 3,840 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2010-0150 | 1 | 1.5 | 16° | 45 | 4 | 2,040 |
| C-CES 2010-0200 | | 2 | | 45 | 4 | 2,040 |
| C-CES 2010 | | 2.5 | | 45 | 4 | 2,040 |
| C-CES 2010-0300 | | 3 | | 45 | 4 | 2,040 |
| C-CES 2010-0400 | | 4 | | 45 | 4 | 3,480 |
| C-CES 2011 | 1.1 | 2.5 | 16° | 45 | 4 | 4,320 |
| C-CES 2012-0180 | 1.2 | 1.8 | 16° | 45 | 4 | 2,280 |
| C-CES 2012-0240 | | 2.4 | | 45 | 4 | 2,280 |
| C-CES 2012-0300 | | 3 | | 45 | 4 | 2,280 |
| C-CES 2012-0360 | | 3.6 | | 45 | 4 | 2,280 |
| C-CES 2012 | | 4 | | 45 | 4 | 2,280 |
| C-CES 2012-0480 | | 4.8 | | 45 | 4 | 3,480 |
| C-CES 2013 | 1.3 | 4 | 16° | 45 | 4 | 4,320 |
| C-CES 2014 | 1.4 | 4 | 16° | 45 | 4 | 4,320 |
| C-CES 2015-0225 | 1.5 | 2.25 | 16° | 45 | 4 | 2,040 |
| C-CES 2015-0300 | | 3 | | 45 | 4 | 2,040 |
| C-CES 2015-0375 | | 3.75 | | 45 | 4 | 2,040 |
| C-CES 2015 | | 4 | | 45 | 4 | 2,040 |
| C-CES 2015-0450 | | 4.5 | | 45 | 4 | 2,040 |
| C-CES 2015-0600 | | 6 | | 45 | 4 | 3,480 |
| C-CES 2016 | 1.6 | 5 | 16° | 45 | 4 | 4,320 |
| C-CES 2017 | 1.7 | 5 | 16° | 45 | 4 | 4,320 |
| C-CES 2018-0270 | 1.8 | 2.7 | 16° | 45 | 4 | 2,280 |
| C-CES 2018-0360 | | 3.6 | | 45 | 4 | 2,280 |
| C-CES 2018-0450 | | 4.5 | | 45 | 4 | 2,280 |
| C-CES 2018 | | 5 | | 45 | 4 | 2,280 |
| C-CES 2018-0540 | | 5.4 | | 45 | 4 | 2,280 |
| C-CES 2018-0720 | | 7.2 | | 45 | 4 | 4,200 |
| C-CES 2019 | 1.9 | 5 | 16° | 45 | 4 | 4,440 |
| C-CES 2020-0300 | 2 | 3 | 16° | 45 | 4 | 2,040 |
| C-CES 2020-0400 | | 4 | | 45 | 4 | 2,040 |
| C-CES 2020-0500 | | 5 | | 45 | 4 | 2,040 |
| C-CES 2020 | | 6 | | 45 | 4 | 2,040 |
| C-CES 2020-0800 | | 8 | | 45 | 4 | 3,480 |
| C-CES 2021 | 2.1 | 6 | 16° | 45 | 4 | 4,320 |
| C-CES 2022 | 2.2 | 6 | 16° | 45 | 4 | 4,320 |
| C-CES 2023 | 2.3 | 6 | 16° | 45 | 4 | 4,320 |
| C-CES 2024 | 2.4 | 8 | 16° | 45 | 4 | 4,320 |

Next Page ➡

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2025-0375 | 2.5 | 3.75 | 16° | 45 | 4 | 2,040 |
| C-CES 2025-0500 | | 5 | | 45 | 4 | 2,040 |
| C-CES 2025-0625 | | 6.25 | | 45 | 4 | 2,040 |
| C-CES 2025-0750 | | 7.5 | | 45 | 4 | 2,040 |
| C-CES 2025 | | 8 | | 45 | 4 | 2,040 |
| C-CES 2025-1000 | | 10 | | 50 | 4 | 3,480 |
| C-CES 2026 | 2.6 | 8 | 16° | 45 | 6 | 5,520 |
| C-CES 2027 | 2.7 | 8 | 16° | 45 | 6 | 5,520 |
| C-CES 2028 | 2.8 | 8 | 16° | 45 | 6 | 5,520 |
| C-CES 2029 | 2.9 | 8 | 16° | 45 | 6 | 5,520 |
| C-CES 2030-0450 | 3 | 4.5 | 16° | 45 | 6 | 2,640 |
| C-CES 2030-0600 | | 6 | | 45 | 6 | 2,640 |
| C-CES 2030-0750 | | 7.5 | | 45 | 6 | 2,640 |
| C-CES 2030 | | 8 | | 45 | 6 | 2,640 |
| C-CES 2030-0900 | | 9 | | 45 | 6 | 2,640 |
| C-CES 2030-1200 | | 12 | | 50 | 6 | 4,320 |
| C-CES 2031 | 3.1 | 10 | 16° | 45 | 6 | 5,760 |
| C-CES 2032 | 3.2 | 10 | 16° | 45 | 6 | 5,760 |
| C-CES 2033 | 3.3 | 10 | 16° | 45 | 6 | 5,760 |
| C-CES 2034 | 3.4 | 10 | 16° | 45 | 6 | 5,760 |
| C-CES 2035 | 3.5 | 10 | 16° | 45 | 6 | 4,680 |
| C-CES 2036 | 3.6 | 10 | 16° | 45 | 6 | 5,760 |
| C-CES 2037 | 3.7 | 10 | 16° | 45 | 6 | 5,760 |
| C-CES 2038 | 3.8 | 11 | 16° | 45 | 6 | 5,760 |
| C-CES 2039 | 3.9 | 11 | 16° | 45 | 6 | 5,760 |
| C-CES 2040-0600 | 4 | 6 | 16° | 50 | 6 | 2,880 |
| C-CES 2040-0800 | | 8 | | 50 | 6 | 2,880 |
| C-CES 2040-1000 | | 10 | | 50 | 6 | 2,880 |
| C-CES 2040 | | 11 | | 45 | 6 | 2,880 |
| C-CES 2040-1200 | | 12 | | 50 | 6 | 2,880 |
| C-CES 2040-1600 | | 16 | | 60 | 6 | 4,680 |
| C-CES 2041 | 4.1 | 11 | 16° | 45 | 6 | 5,760 |
| C-CES 2042 | 4.2 | 11 | 16° | 45 | 6 | 5,760 |
| C-CES 2043 | 4.3 | 11 | 16° | 45 | 6 | 5,760 |
| C-CES 2044 | 4.4 | 11 | 16° | 45 | 6 | 5,760 |
| C-CES 2045 | 4.5 | 11 | 16° | 45 | 6 | 5,400 |
| C-CES 2046 | 4.6 | 11 | 16° | 45 | 6 | 6,600 |
| C-CES 2047 | 4.7 | 11 | 16° | 45 | 6 | 6,600 |
| C-CES 2048 | 4.8 | 13 | 16° | 50 | 6 | 6,600 |
| C-CES 2049 | 4.9 | 13 | 16° | 50 | 6 | 6,600 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2050-0750 | 5 | 7.5 | 16° | 50 | 6 | 3,120 |
| C-CES 2050-1000 | | 10 | | 50 | 6 | 3,120 |
| C-CES 2050-1250 | | 12.5 | | 50 | 6 | 3,120 |
| C-CES 2050 | | 13 | | 50 | 6 | 3,120 |
| C-CES 2050-1500 | | 15 | | 50 | 6 | 3,120 |
| C-CES 2050-2000 | | 20 | | 60 | 6 | 5,280 |
| C-CES 2051 | 5.1 | 13 | 16° | 50 | 6 | 6,600 |
| C-CES 2052 | 5.2 | 13 | 16° | 50 | 6 | 6,600 |
| C-CES 2053 | 5.3 | 13 | 16° | 50 | 6 | 6,600 |
| C-CES 2054 | 5.4 | 13 | 16° | 50 | 6 | 6,600 |
| C-CES 2055 | 5.5 | 13 | 16° | 50 | 6 | 5,640 |
| C-CES 2056 | 5.6 | 13 | 16° | 50 | 6 | 5,640 |
| C-CES 2057 | 5.7 | 13 | 16° | 50 | 6 | 5,640 |
| C-CES 2058 | 5.8 | 13 | 16° | 50 | 6 | 5,640 |
| C-CES 2059 | 5.9 | 13 | 16° | 50 | 6 | 5,640 |
| C-CES 2060-0900 | 6 | 9 | — | 50 | 6 | 3,360 |
| C-CES 2060-1200 | | 12 | | 50 | 6 | 3,360 |
| C-CES 2060 | | 13 | | 50 | 6 | 3,360 |
| C-CES 2060-1500 | | 15 | | 50 | 6 | 3,360 |
| C-CES 2060-1800 | | 18 | | 50 | 6 | 3,360 |
| C-CES 2060-2400 | | 24 | | 60 | 6 | 5,400 |
| C-CES 2061 | 6.1 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2062 | 6.2 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2063 | 6.3 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2064 | 6.4 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2065 | 6.5 | 16 | 16° | 60 | 8 | 9,280 |
| C-CES 2066 | 6.6 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2067 | 6.7 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2068 | 6.8 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2069 | 6.9 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2070 | 7 | 16 | 16° | 60 | 8 | 8,700 |
| C-CES 2071 | 7.1 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2072 | 7.2 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2073 | 7.3 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2074 | 7.4 | 16 | 16° | 60 | 8 | 10,340 |
| C-CES 2075 | 7.5 | 16 | 16° | 60 | 8 | 10,360 |
| C-CES 2076 | 7.6 | 19 | 16° | 60 | 8 | 11,550 |
| C-CES 2077 | 7.7 | 19 | 16° | 60 | 8 | 11,550 |
| C-CES 2078 | 7.8 | 19 | 16° | 60 | 8 | 11,550 |
| C-CES 2079 | 7.9 | 19 | 16° | 60 | 8 | 11,550 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2080-1600 | 8 | 16 | — | 60 | 8 | 6,320 |
| C-CES 2080 | | 19 | | 60 | 8 | 6,320 |
| C-CES 2080-2000 | | 20 | | 60 | 8 | 6,320 |
| C-CES 2080-2400 | | 24 | | 80 | 8 | 6,320 |
| C-CES 2080-3200 | | 32 | | 80 | 8 | 11,520 |
| C-CES 2081 | 8.1 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2082 | 8.2 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2083 | 8.3 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2084 | 8.4 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2085 | 8.5 | 19 | 16° | 70 | 10 | 12,420 |
| C-CES 2086 | 8.6 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2087 | 8.7 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2088 | 8.8 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2089 | 8.9 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2090 | 9 | 19 | 16° | 70 | 10 | 12,420 |
| C-CES 2091 | 9.1 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2092 | 9.2 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2093 | 9.3 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2094 | 9.4 | 19 | 16° | 70 | 10 | 13,860 |
| C-CES 2095 | 9.5 | 19 | 16° | 70 | 10 | 12,870 |
| C-CES 2096 | 9.6 | 22 | 16° | 70 | 10 | 14,300 |
| C-CES 2097 | 9.7 | 22 | 16° | 70 | 10 | 14,300 |
| C-CES 2098 | 9.8 | 22 | 16° | 70 | 10 | 14,300 |
| C-CES 2099 | 9.9 | 22 | 16° | 70 | 10 | 14,300 |
| C-CES 2100-2000 | 10 | 20 | — | 70 | 10 | 7,580 |
| C-CES 2100 | | 22 | | 70 | 10 | 7,580 |
| C-CES 2100-2500 | | 25 | | 70 | 10 | 7,580 |
| C-CES 2100-3000 | | 30 | | 80 | 10 | 7,580 |
| C-CES 2100-4000 | | 40 | | 90 | 10 | 12,600 |
| C-CES 2105 | 10.5 | 22 | 16° | 75 | 12 | 18,920 |
| C-CES 2110 | 11 | 22 | 16° | 75 | 12 | 17,160 |
| C-CES 2115 | 11.5 | 22 | 16° | 75 | 12 | 19,580 |
| C-CES 2120-2400 | 12 | 24 | — | 75 | 12 | 11,170 |
| C-CES 2120 | | 26 | | 75 | 12 | 11,170 |
| C-CES 2120-3000 | | 30 | | 75 | 12 | 11,170 |
| C-CES 2120-3600 | | 36 | | 90 | 12 | 11,170 |
| C-CES 2120-4800 | | 48 | | 100 | 12 | 22,490 |
| C-CES 2160 | 16 | 32 | — | 110 | 16 | 35,530 |
| C-CES 2180 | 18 | 32 | 16° | 110 | 20 | 55,880 |
| C-CES 2200 | 20 | 38 | — | 110 | 20 | 60,500 |

## Milling Conditions for C-CES（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting $a_p$ (mm) | Side Milling $a_p$ (mm) | Side Milling $a_e$ (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting $a_p$ (mm) | Side Milling $a_p$ (mm) | Side Milling $a_e$ (mm) |
| **2001** | **0.1** | 0.15 | 30,000 | 30 | 0.01 | 0.15 | 0.01 | 30,000 | 30 | 0.01 | 0.15 | 0.01 |
| | | 0.2 | 30,000 | 30 | 0.01 | 0.15 | 0.01 | 30,000 | 30 | 0.01 | 0.15 | 0.01 |
| | | 0.3 | 30,000 | 30 | 0.005 | 0.25 | 0.005 | 30,000 | 30 | 0.005 | 0.25 | 0.005 |
| **2002** | **0.2** | 0.3 | 30,000 | 85 | 0.02 | 0.3 | 0.02 | 30,000 | 85 | 0.02 | 0.3 | 0.02 |
| | | 0.4 | 30,000 | 85 | 0.02 | 0.3 | 0.02 | 30,000 | 85 | 0.02 | 0.3 | 0.02 |
| | | 0.5 | 30,000 | 85 | 0.014 | 0.4 | 0.014 | 30,000 | 85 | 0.014 | 0.4 | 0.014 |
| | | 0.6 | 30,000 | 85 | 0.01 | 0.5 | 0.01 | 30,000 | 85 | 0.01 | 0.5 | 0.01 |
| | | 0.8 | 30,000 | 85 | 0.004 | 0.7 | 0.004 | 30,000 | 85 | 0.004 | 0.7 | 0.004 |
| **2003** | **0.3** | 0.45 | 30,000 | 110 | 0.03 | 0.45 | 0.03 | 30,000 | 110 | 0.03 | 0.45 | 0.03 |
| | | 0.6 | 30,000 | 110 | 0.03 | 0.45 | 0.03 | 30,000 | 110 | 0.03 | 0.45 | 0.03 |
| | | 0.75 | 30,000 | 110 | 0.021 | 0.6 | 0.021 | 30,000 | 110 | 0.021 | 0.6 | 0.021 |
| | | 0.9 | 30,000 | 110 | 0.015 | 0.75 | 0.015 | 30,000 | 110 | 0.015 | 0.75 | 0.015 |
| | | 1.2 | 30,000 | 110 | 0.006 | 1.05 | 0.006 | 30,000 | 110 | 0.006 | 1.05 | 0.006 |
| **2004** | **0.4** | 0.6 | 30,000 | 120 | 0.04 | 0.6 | 0.04 | 30,000 | 120 | 0.04 | 0.6 | 0.04 |
| | | 0.8 | 30,000 | 120 | 0.04 | 0.6 | 0.04 | 30,000 | 120 | 0.04 | 0.6 | 0.04 |
| | | 1 | 30,000 | 120 | 0.028 | 0.8 | 0.028 | 30,000 | 120 | 0.028 | 0.8 | 0.028 |
| | | 1.2 | 30,000 | 120 | 0.02 | 1 | 0.02 | 30,000 | 120 | 0.02 | 1 | 0.02 |
| | | 1.6 | 30,000 | 120 | 0.008 | 1.4 | 0.008 | 30,000 | 120 | 0.008 | 1.4 | 0.008 |
| **2005** | **0.5** | 0.75 | 30,000 | 120 | 0.05 | 0.75 | 0.05 | 29,000 | 120 | 0.05 | 0.75 | 0.05 |
| | | 0.8 | 30,000 | 120 | 0.05 | 0.75 | 0.05 | 29,000 | 120 | 0.05 | 0.75 | 0.05 |
| | | 1 | 30,000 | 120 | 0.05 | 0.75 | 0.05 | 29,000 | 120 | 0.05 | 0.75 | 0.05 |
| | | 1.25 | 30,000 | 120 | 0.035 | 1 | 0.035 | 29,000 | 120 | 0.035 | 1 | 0.035 |
| | | 1.5 | 30,000 | 120 | 0.025 | 1.25 | 0.025 | 29,000 | 120 | 0.025 | 1.25 | 0.025 |
| | | 2 | 30,000 | 120 | 0.01 | 1.75 | 0.01 | 29,000 | 120 | 0.01 | 1.75 | 0.01 |
| **2006** | **0.6** | 0.9 | 30,000 | 120 | 0.06 | 0.9 | 0.06 | 24,000 | 120 | 0.06 | 0.9 | 0.06 |
| | | 1 | 30,000 | 120 | 0.06 | 0.9 | 0.06 | 24,000 | 120 | 0.06 | 0.9 | 0.06 |
| | | 1.2 | 30,000 | 120 | 0.06 | 0.9 | 0.06 | 24,000 | 120 | 0.06 | 0.9 | 0.06 |
| | | 1.5 | 30,000 | 120 | 0.042 | 1.2 | 0.042 | 24,000 | 120 | 0.042 | 1.2 | 0.042 |
| | | 1.8 | 30,000 | 120 | 0.03 | 1.5 | 0.03 | 24,000 | 120 | 0.03 | 1.5 | 0.03 |
| | | 2.4 | 30,000 | 120 | 0.012 | 2.1 | 0.012 | 24,000 | 120 | 0.012 | 2.1 | 0.012 |
| **2007** | **0.7** | 1 | 27,500 | 120 | 0.07 | 1.05 | 0.07 | 21,000 | 120 | 0.07 | 1.05 | 0.07 |
| | | 1.4 | 27,500 | 120 | 0.07 | 1.05 | 0.07 | 21,000 | 120 | 0.07 | 1.05 | 0.07 |
| | | 1.75 | 27,500 | 120 | 0.049 | 1.4 | 0.049 | 21,000 | 120 | 0.049 | 1.4 | 0.049 |
| | | 2.1 | 27,500 | 120 | 0.035 | 1.75 | 0.035 | 21,000 | 120 | 0.035 | 1.75 | 0.035 |
| | | 2.8 | 27,500 | 120 | 0.014 | 2.45 | 0.014 | 21,000 | 120 | 0.014 | 2.45 | 0.014 |
| **2008** | **0.8** | 1.2 | 24,000 | 120 | 0.08 | 1.2 | 0.08 | 19,000 | 120 | 0.08 | 1.2 | 0.08 |
| | | 1.6 | 24,000 | 120 | 0.08 | 1.2 | 0.08 | 19,000 | 120 | 0.08 | 1.2 | 0.08 |
| | | 2 | 24,000 | 120 | 0.056 | 1.6 | 0.056 | 19,000 | 120 | 0.056 | 1.6 | 0.056 |
| | | 2.4 | 24,000 | 120 | 0.04 | 2 | 0.04 | 19,000 | 120 | 0.04 | 2 | 0.04 |
| | | 3.2 | 24,000 | 120 | 0.016 | 2.8 | 0.016 | 19,000 | 120 | 0.016 | 2.8 | 0.016 |
| **2009** | **0.9** | 1.2 | 21,500 | 125 | 0.09 | 1.35 | 0.09 | 16,500 | 120 | 0.09 | 1.35 | 0.09 |
| | | 1.8 | 21,500 | 125 | 0.09 | 1.35 | 0.09 | 16,500 | 120 | 0.09 | 1.35 | 0.09 |
| | | 2.25 | 21,500 | 125 | 0.063 | 1.8 | 0.063 | 16,500 | 120 | 0.063 | 1.8 | 0.063 |
| | | 2.7 | 21,500 | 125 | 0.045 | 2.25 | 0.045 | 16,500 | 120 | 0.045 | 2.25 | 0.045 |
| | | 3.6 | 21,500 | 125 | 0.018 | 3.15 | 0.018 | 16,500 | 120 | 0.018 | 3.15 | 0.018 |
| **2010** | **1** | 1.5 | 20,000 | 125 | 0.25 | 1.5 | 0.1 | 15,000 | 120 | 0.25 | 1.5 | 0.1 |
| | | 2 | 20,000 | 125 | 0.25 | 1.5 | 0.1 | 15,000 | 120 | 0.25 | 1.5 | 0.1 |
| | | 2.5 | 20,000 | 125 | 0.2 | 2 | 0.07 | 15,000 | 120 | 0.2 | 2 | 0.07 |
| | | 3 | 20,000 | 125 | 0.125 | 2.5 | 0.05 | 15,000 | 120 | 0.125 | 2.5 | 0.05 |
| | | 4 | 20,000 | 125 | 0.075 | 3.5 | 0.02 | 15,000 | 120 | 0.075 | 3.5 | 0.02 |
| **2012** | **1.2** | 1.8 | 16,700 | 130 | 0.3 | 1.8 | 0.12 | 12,500 | 120 | 0.3 | 1.8 | 0.12 |
| | | 2.4 | 16,700 | 130 | 0.3 | 1.8 | 0.12 | 12,500 | 120 | 0.3 | 1.8 | 0.12 |
| | | 3 | 16,700 | 130 | 0.24 | 2.4 | 0.084 | 12,500 | 120 | 0.24 | 2.4 | 0.084 |
| | | 3.6 | 16,700 | 130 | 0.15 | 3 | 0.06 | 12,500 | 120 | 0.15 | 3 | 0.06 |
| | | 4 | 16,700 | 130 | 0.09 | 4 | 0.024 | 12,500 | 120 | 0.09 | 4 | 0.024 |
| | | 4.8 | 16,700 | 130 | 0.09 | 4.2 | 0.024 | 12,500 | 120 | 0.09 | 4.2 | 0.024 |
| **2015** | **1.5** | 2.25 | 13,500 | 130 | 0.375 | 2.25 | 0.15 | 10,000 | 120 | 0.375 | 2.25 | 0.15 |
| | | 3 | 13,500 | 130 | 0.375 | 2.25 | 0.15 | 10,000 | 120 | 0.375 | 2.25 | 0.15 |
| | | 3.75 | 13,500 | 130 | 0.3 | 3 | 0.105 | 10,000 | 120 | 0.3 | 3 | 0.105 |
| | | 4 | 13,500 | 130 | 0.1875 | 3.75 | 0.075 | 10,000 | 120 | 0.1875 | 3.75 | 0.075 |
| | | 4.5 | 13,500 | 130 | 0.1875 | 3.75 | 0.075 | 10,000 | 120 | 0.1875 | 3.75 | 0.075 |
| | | 6 | 13,500 | 130 | 0.1125 | 5.25 | 0.03 | 10,000 | 120 | 0.1125 | 5.25 | 0.03 |

# Milling Conditions for C-CES（2 Flutes）

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC) | | | | | HARDENED STEELS SKD / SKT (45~55HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| **2001** | **0.1** | 0.15 | 30,000 | 15 | 0.01 | 0.15 | 0.01 | 30,000 | 10 | 0.002 | 0.1 | 0.005 |
| | | 0.2 | 30,000 | 15 | 0.01 | 0.15 | 0.01 | 30,000 | 10 | 0.002 | 0.1 | 0.005 |
| | | 0.3 | 30,000 | 15 | 0.005 | 0.25 | 0.005 | 30,000 | 10 | 0.001 | 0.2 | 0.002 |
| **2002** | **0.2** | 0.3 | 30,000 | 30 | 0.02 | 0.3 | 0.02 | 30,000 | 25 | 0.004 | 0.2 | 0.01 |
| | | 0.4 | 30,000 | 30 | 0.02 | 0.3 | 0.02 | 30,000 | 25 | 0.004 | 0.2 | 0.01 |
| | | 0.5 | 30,000 | 30 | 0.014 | 0.4 | 0.014 | 30,000 | 25 | 0.004 | 0.3 | 0.006 |
| | | 0.6 | 30,000 | 30 | 0.01 | 0.5 | 0.01 | 30,000 | 25 | 0.002 | 0.4 | 0.004 |
| | | 0.8 | 30,000 | 30 | 0.004 | 0.7 | 0.004 | 30,000 | 25 | 0.002 | 0.6 | 0.002 |
| **2003** | **0.3** | 0.45 | 30,000 | 55 | 0.03 | 0.45 | 0.03 | 22,000 | 25 | 0.006 | 0.3 | 0.015 |
| | | 0.6 | 30,000 | 55 | 0.03 | 0.45 | 0.03 | 22,000 | 25 | 0.006 | 0.3 | 0.015 |
| | | 0.75 | 30,000 | 55 | 0.021 | 0.6 | 0.021 | 22,000 | 25 | 0.006 | 0.45 | 0.009 |
| | | 0.9 | 30,000 | 55 | 0.015 | 0.75 | 0.015 | 22,000 | 25 | 0.003 | 0.6 | 0.006 |
| | | 1.2 | 30,000 | 55 | 0.006 | 1.05 | 0.006 | 22,000 | 25 | 0.003 | 0.9 | 0.003 |
| **2004** | **0.4** | 0.6 | 27,000 | 60 | 0.04 | 0.6 | 0.04 | 17,000 | 25 | 0.008 | 0.4 | 0.02 |
| | | 0.8 | 27,000 | 60 | 0.04 | 0.6 | 0.04 | 17,000 | 25 | 0.008 | 0.4 | 0.02 |
| | | 1 | 27,000 | 60 | 0.028 | 0.8 | 0.028 | 17,000 | 25 | 0.008 | 0.6 | 0.012 |
| | | 1.2 | 27,000 | 60 | 0.02 | 1 | 0.02 | 17,000 | 25 | 0.004 | 0.8 | 0.008 |
| | | 1.6 | 27,000 | 60 | 0.008 | 1.4 | 0.008 | 17,000 | 25 | 0.004 | 1.2 | 0.004 |
| **2005** | **0.5** | 0.75 | 21,500 | 60 | 0.05 | 0.75 | 0.05 | 13,000 | 25 | 0.01 | 0.5 | 0.025 |
| | | 0.8 | 21,500 | 60 | 0.05 | 0.75 | 0.05 | 13,000 | 25 | 0.01 | 0.5 | 0.025 |
| | | 1 | 21,500 | 60 | 0.05 | 0.75 | 0.05 | 13,000 | 25 | 0.01 | 0.5 | 0.025 |
| | | 1.25 | 21,500 | 60 | 0.035 | 1 | 0.035 | 13,000 | 25 | 0.01 | 0.75 | 0.015 |
| | | 1.5 | 21,500 | 60 | 0.025 | 1.25 | 0.025 | 13,000 | 25 | 0.005 | 1 | 0.01 |
| | | 2 | 21,500 | 60 | 0.01 | 1.75 | 0.01 | 13,000 | 25 | 0.005 | 1.5 | 0.005 |
| **2006** | **0.6** | 0.9 | 18,000 | 60 | 0.06 | 0.9 | 0.06 | 11,000 | 25 | 0.012 | 0.6 | 0.03 |
| | | 1 | 18,000 | 60 | 0.06 | 0.9 | 0.06 | 11,000 | 25 | 0.012 | 0.6 | 0.03 |
| | | 1.2 | 18,000 | 60 | 0.06 | 0.9 | 0.06 | 11,000 | 25 | 0.012 | 0.6 | 0.03 |
| | | 1.5 | 18,000 | 60 | 0.042 | 1.2 | 0.042 | 11,000 | 25 | 0.012 | 0.9 | 0.018 |
| | | 1.8 | 18,000 | 60 | 0.03 | 1.5 | 0.03 | 11,000 | 25 | 0.006 | 1.2 | 0.012 |
| | | 2.4 | 18,000 | 60 | 0.012 | 2.1 | 0.012 | 11,000 | 25 | 0.006 | 1.8 | 0.006 |
| **2007** | **0.7** | 1 | 15,500 | 60 | 0.07 | 1.05 | 0.07 | 10,000 | 25 | 0.014 | 0.7 | 0.035 |
| | | 1.4 | 15,500 | 60 | 0.07 | 1.05 | 0.07 | 10,000 | 25 | 0.014 | 0.7 | 0.035 |
| | | 1.75 | 15,500 | 60 | 0.049 | 1.4 | 0.049 | 10,000 | 25 | 0.014 | 1.05 | 0.021 |
| | | 2.1 | 15,500 | 60 | 0.035 | 1.75 | 0.035 | 10,000 | 25 | 0.007 | 1.4 | 0.014 |
| | | 2.8 | 15,500 | 60 | 0.014 | 2.45 | 0.014 | 10,000 | 25 | 0.007 | 2.1 | 0.007 |
| **2008** | **0.8** | 1.2 | 13,800 | 60 | 0.08 | 1.2 | 0.08 | 8,800 | 30 | 0.016 | 0.8 | 0.04 |
| | | 1.6 | 13,800 | 60 | 0.08 | 1.2 | 0.08 | 8,800 | 30 | 0.016 | 0.8 | 0.04 |
| | | 2 | 13,800 | 60 | 0.056 | 1.6 | 0.056 | 8,800 | 30 | 0.016 | 1.2 | 0.024 |
| | | 2.4 | 13,800 | 60 | 0.04 | 2 | 0.04 | 8,800 | 30 | 0.008 | 1.6 | 0.016 |
| | | 3.2 | 13,800 | 60 | 0.016 | 2.8 | 0.016 | 8,800 | 30 | 0.008 | 2.4 | 0.008 |
| **2009** | **0.9** | 1.2 | 12,000 | 65 | 0.09 | 1.35 | 0.09 | 7,800 | 30 | 0.018 | 0.9 | 0.045 |
| | | 1.8 | 12,000 | 65 | 0.09 | 1.35 | 0.09 | 7,800 | 30 | 0.018 | 0.9 | 0.045 |
| | | 2.25 | 12,000 | 65 | 0.063 | 1.8 | 0.063 | 7,800 | 30 | 0.018 | 1.35 | 0.027 |
| | | 2.7 | 12,000 | 65 | 0.045 | 2.25 | 0.045 | 7,800 | 30 | 0.009 | 1.8 | 0.018 |
| | | 3.6 | 12,000 | 65 | 0.018 | 3.15 | 0.018 | 7,800 | 30 | 0.009 | 2.7 | 0.009 |
| **2010** | **1** | 1.5 | 11,000 | 65 | 0.25 | 1.5 | 0.1 | 7,100 | 30 | 0.05 | 1 | 0.05 |
| | | 2 | 11,000 | 65 | 0.25 | 1.5 | 0.1 | 7,100 | 30 | 0.05 | 1 | 0.05 |
| | | 2.5 | 11,000 | 65 | 0.2 | 2 | 0.07 | 7,100 | 30 | 0.03 | 1.5 | 0.03 |
| | | 3 | 11,000 | 65 | 0.125 | 2.5 | 0.05 | 7,100 | 30 | 0.02 | 2 | 0.02 |
| | | 4 | 11,000 | 65 | 0.075 | 3.5 | 0.02 | 7,100 | 30 | 0.01 | 3 | 0.01 |
| **2012** | **1.2** | 1.8 | 9,400 | 65 | 0.3 | 1.8 | 0.12 | 6,000 | 30 | 0.06 | 1.2 | 0.06 |
| | | 2.4 | 9,400 | 65 | 0.3 | 1.8 | 0.12 | 6,000 | 30 | 0.06 | 1.2 | 0.06 |
| | | 3 | 9,400 | 65 | 0.24 | 2.4 | 0.084 | 6,000 | 30 | 0.036 | 1.8 | 0.036 |
| | | 3.6 | 9,400 | 65 | 0.15 | 3 | 0.06 | 6,000 | 30 | 0.024 | 2.4 | 0.024 |
| | | 4 | 9,400 | 65 | 0.09 | 4 | 0.024 | 6,000 | 30 | 0.012 | 3.6 | 0.012 |
| | | 4.8 | 9,400 | 65 | 0.09 | 4.2 | 0.024 | 6,000 | 30 | 0.012 | 3.6 | 0.012 |
| **2015** | **1.5** | 2.25 | 8,000 | 70 | 0.375 | 2.25 | 0.15 | 5,100 | 35 | 0.075 | 1.5 | 0.075 |
| | | 3 | 8,000 | 70 | 0.375 | 2.25 | 0.15 | 5,100 | 35 | 0.075 | 1.5 | 0.075 |
| | | 3.75 | 8,000 | 70 | 0.3 | 3 | 0.105 | 5,100 | 35 | 0.045 | 2.25 | 0.045 |
| | | 4 | 8,000 | 70 | 0.1875 | 3.75 | 0.075 | 5,100 | 35 | 0.03 | 3 | 0.03 |
| | | 4.5 | 8,000 | 70 | 0.1875 | 3.75 | 0.075 | 5,100 | 35 | 0.03 | 3 | 0.03 |
| | | 6 | 8,000 | 70 | 0.1125 | 5.25 | 0.03 | 5,100 | 35 | 0.015 | 4.5 | 0.015 |

## Milling Conditions for C-CES（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| 2018 | 1.8 | 2.7 | 11,500 | 130 | 0.45 | 2.7 | 0.18 | 8,800 | 120 | 0.45 | 2.7 | 0.18 |
| | | 3.6 | 11,500 | 130 | 0.45 | 2.7 | 0.18 | 8,800 | 120 | 0.45 | 2.7 | 0.18 |
| | | 4.5 | 11,500 | 130 | 0.36 | 3.6 | 0.126 | 8,800 | 120 | 0.36 | 3.6 | 0.126 |
| | | 5 | 11,500 | 130 | 0.225 | 4.5 | 0.09 | 8,800 | 120 | 0.225 | 4.5 | 0.09 |
| | | 5.4 | 11,500 | 130 | 0.225 | 4.5 | 0.09 | 8,800 | 120 | 0.225 | 4.5 | 0.09 |
| | | 7.2 | 11,500 | 130 | 0.135 | 6.3 | 0.036 | 8,800 | 120 | 0.135 | 6.3 | 0.036 |
| 2020 | 2 | 3 | 11,000 | 130 | 0.5 | 3 | 0.2 | 8,500 | 120 | 0.5 | 3 | 0.2 |
| | | 4 | 11,000 | 130 | 0.5 | 3 | 0.2 | 8,500 | 120 | 0.5 | 3 | 0.2 |
| | | 5 | 11,000 | 130 | 0.4 | 4 | 0.14 | 8,500 | 120 | 0.4 | 4 | 0.14 |
| | | 6 | 11,000 | 130 | 0.25 | 5 | 0.1 | 8,500 | 120 | 0.25 | 5 | 0.1 |
| | | 8 | 11,000 | 130 | 0.15 | 7 | 0.04 | 8,500 | 120 | 0.15 | 7 | 0.04 |
| 2025 | 2.5 | 3.75 | 8,800 | 195 | 0.625 | 3.75 | 0.25 | 7,000 | 135 | 0.625 | 3.75 | 0.25 |
| | | 5 | 8,800 | 195 | 0.625 | 3.75 | 0.25 | 7,000 | 135 | 0.625 | 3.75 | 0.25 |
| | | 6.25 | 8,800 | 195 | 0.5 | 5 | 0.175 | 7,000 | 135 | 0.5 | 5 | 0.175 |
| | | 7.5 | 8,800 | 195 | 0.3125 | 6.25 | 0.125 | 7,000 | 135 | 0.3125 | 6.25 | 0.125 |
| | | 8 | 8,800 | 195 | 0.1875 | 8 | 0.05 | 7,000 | 135 | 0.1875 | 8 | 0.05 |
| | | 10 | 8,800 | 195 | 0.1875 | 8.75 | 0.05 | 7,000 | 135 | 0.1875 | 8.75 | 0.05 |
| 2030 | 3 | 4.5 | 7,400 | 195 | 1.5 | 4.5 | 0.3 | 6,400 | 145 | 1.5 | 4.5 | 0.3 |
| | | 6 | 7,400 | 195 | 1.5 | 4.5 | 0.3 | 6,400 | 145 | 1.5 | 4.5 | 0.3 |
| | | 7.5 | 7,400 | 195 | 1.2 | 6 | 0.21 | 6,400 | 145 | 1.2 | 6 | 0.21 |
| | | 8 | 7,400 | 195 | 0.9 | 7.5 | 0.15 | 6,400 | 145 | 0.9 | 7.5 | 0.15 |
| | | 9 | 7,400 | 195 | 0.9 | 7.5 | 0.15 | 6,400 | 145 | 0.9 | 7.5 | 0.15 |
| | | 12 | 7,400 | 195 | 0.45 | 10.5 | 0.06 | 6,400 | 145 | 0.45 | 10.5 | 0.06 |
| 2040 | 4 | 6 | 5,900 | 230 | 2 | 6 | 0.4 | 5,000 | 190 | 2 | 6 | 0.4 |
| | | 8 | 5,900 | 230 | 2 | 6 | 0.4 | 5,000 | 190 | 2 | 6 | 0.4 |
| | | 10 | 5,900 | 230 | 1.6 | 8 | 0.28 | 5,000 | 190 | 1.6 | 8 | 0.28 |
| | | 11 | 5,900 | 230 | 1.2 | 10 | 0.2 | 5,000 | 190 | 1.2 | 10 | 0.2 |
| | | 12 | 5,900 | 230 | 1.2 | 10 | 0.2 | 5,000 | 190 | 1.2 | 10 | 0.2 |
| | | 16 | 5,900 | 230 | 0.6 | 14 | 0.08 | 5,000 | 190 | 0.6 | 14 | 0.08 |
| 2050 | 5 | 7.5 | 5,300 | 310 | 2.5 | 7.5 | 0.5 | 4,200 | 230 | 2.5 | 7.5 | 0.5 |
| | | 10 | 5,300 | 310 | 2.5 | 7.5 | 0.5 | 4,200 | 230 | 2.5 | 7.5 | 0.5 |
| | | 12.5 | 5,300 | 310 | 2 | 10 | 0.35 | 4,200 | 230 | 2 | 10 | 0.35 |
| | | 13 | 5,300 | 310 | 1.5 | 12.5 | 0.25 | 4,200 | 230 | 1.5 | 12.5 | 0.25 |
| | | 15 | 5,300 | 310 | 1.5 | 12.5 | 0.25 | 4,200 | 230 | 1.5 | 12.5 | 0.25 |
| | | 20 | 5,300 | 310 | 0.75 | 17.5 | 0.1 | 4,200 | 230 | 0.75 | 17.5 | 0.1 |
| 2060 | 6 | 9 | 4,400 | 305 | 3 | 9 | 0.6 | 3,500 | 230 | 3 | 9 | 0.6 |
| | | 12 | 4,400 | 305 | 3 | 9 | 0.6 | 3,500 | 230 | 3 | 9 | 0.6 |
| | | 13 | 4,400 | 305 | 2.4 | 12 | 0.42 | 3,500 | 230 | 2.4 | 12 | 0.42 |
| | | 15 | 4,400 | 305 | 2.4 | 15 | 0.42 | 3,500 | 230 | 2.4 | 12 | 0.42 |
| | | 18 | 4,400 | 305 | 1.8 | 15 | 0.3 | 3,500 | 230 | 1.8 | 15 | 0.3 |
| | | 24 | 4,400 | 305 | 0.9 | 21 | 0.12 | 3,500 | 230 | 0.9 | 21 | 0.12 |
| 2080 | 8 | 16 | 3,300 | 290 | 4 | 12 | 0.8 | 2,600 | 230 | 4 | 12 | 0.8 |
| | | 19 | 3,300 | 290 | 3.2 | 16 | 0.56 | 2,600 | 230 | 3.2 | 16 | 0.56 |
| | | 20 | 3,300 | 290 | 3.2 | 16 | 0.56 | 2,600 | 230 | 3.2 | 16 | 0.56 |
| | | 24 | 3,300 | 290 | 2.4 | 20 | 0.4 | 2,600 | 230 | 2.4 | 20 | 0.4 |
| | | 32 | 3,300 | 290 | 1.2 | 28 | 0.16 | 2,600 | 230 | 1.2 | 28 | 0.16 |
| 2100 | 10 | 20 | 2,600 | 275 | 5 | 15 | 1 | 2,100 | 225 | 5 | 15 | 1 |
| | | 22 | 2,600 | 275 | 4 | 20 | 0.7 | 2,100 | 225 | 4 | 20 | 0.7 |
| | | 25 | 2,600 | 275 | 4 | 20 | 0.7 | 2,100 | 225 | 4 | 20 | 0.7 |
| | | 30 | 2,600 | 275 | 3 | 25 | 0.5 | 2,100 | 225 | 3 | 25 | 0.5 |
| | | 40 | 2,600 | 275 | 1.5 | 35 | 0.2 | 2,100 | 225 | 1.5 | 35 | 0.2 |
| 2120 | 12 | 24 | 2,200 | 275 | 6 | 18 | 1.2 | 1,750 | 225 | 6 | 18 | 1.2 |
| | | 26 | 2,200 | 275 | 4.8 | 24 | 0.84 | 1,750 | 225 | 4.8 | 24 | 0.84 |
| | | 30 | 2,200 | 275 | 4.8 | 24 | 0.84 | 1,750 | 225 | 4.8 | 24 | 0.84 |
| | | 36 | 2,200 | 275 | 3.6 | 30 | 0.6 | 1,750 | 225 | 3.6 | 30 | 0.6 |
| | | 48 | 2,200 | 275 | 1.8 | 42 | 0.24 | 1,750 | 225 | 1.8 | 42 | 0.24 |

# Milling Conditions for C-CES（2 Flutes）

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) | | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| 2018 | 1.8 | 2.7 | 7,000 | 70 | 0.45 | 2.7 | 0.18 | 4,400 | 35 | 0.09 | 1.8 | 0.09 |
| | | 3.6 | 7,000 | 70 | 0.45 | 2.7 | 0.18 | 4,400 | 35 | 0.09 | 1.8 | 0.09 |
| | | 4.5 | 7,000 | 70 | 0.36 | 3.6 | 0.126 | 4,400 | 35 | 0.054 | 2.7 | 0.054 |
| | | 5 | 7,000 | 70 | 0.225 | 4.5 | 0.09 | 4,400 | 35 | 0.036 | 3.6 | 0.036 |
| | | 5.4 | 7,000 | 70 | 0.225 | 4.5 | 0.09 | 4,400 | 35 | 0.036 | 3.6 | 0.036 |
| | | 7.2 | 7,000 | 70 | 0.135 | 6.3 | 0.036 | 4,400 | 35 | 0.018 | 5.4 | 0.018 |
| 2020 | 2 | 3 | 6,400 | 70 | 0.5 | 3 | 0.2 | 4,000 | 40 | 0.1 | 2 | 0.1 |
| | | 4 | 6,400 | 70 | 0.5 | 3 | 0.2 | 4,000 | 40 | 0.1 | 2 | 0.1 |
| | | 5 | 6,400 | 70 | 0.4 | 4 | 0.14 | 4,000 | 40 | 0.06 | 3 | 0.06 |
| | | 6 | 6,400 | 70 | 0.25 | 5 | 0.1 | 4,000 | 40 | 0.04 | 4 | 0.04 |
| | | 8 | 6,400 | 70 | 0.15 | 7 | 0.04 | 4,000 | 40 | 0.02 | 6 | 0.02 |
| 2025 | 2.5 | 3.75 | 5,000 | 70 | 0.625 | 3.75 | 0.25 | 3,200 | 40 | 0.125 | 2.5 | 0.125 |
| | | 5 | 5,000 | 70 | 0.625 | 3.75 | 0.25 | 3,200 | 40 | 0.125 | 2.5 | 0.125 |
| | | 6.25 | 5,000 | 70 | 0.5 | 5 | 0.175 | 3,200 | 40 | 0.075 | 3.75 | 0.075 |
| | | 7.5 | 5,000 | 70 | 0.3125 | 6.25 | 0.125 | 3,200 | 40 | 0.05 | 5 | 0.05 |
| | | 8 | 5,000 | 70 | 0.1875 | 8 | 0.05 | 3,200 | 40 | 0.025 | 7.5 | 0.025 |
| | | 10 | 5,000 | 70 | 0.1875 | 8.75 | 0.05 | 3,200 | 40 | 0.025 | 7.5 | 0.025 |
| 2030 | 3 | 4.5 | 4,500 | 80 | 1.5 | 4.5 | 0.3 | 2,800 | 45 | 0.15 | 3 | 0.15 |
| | | 6 | 4,500 | 80 | 1.5 | 4.5 | 0.3 | 2,800 | 45 | 0.15 | 3 | 0.15 |
| | | 7.5 | 4,500 | 80 | 1.2 | 6 | 0.21 | 2,800 | 45 | 0.09 | 4.5 | 0.09 |
| | | 8 | 4,500 | 80 | 0.9 | 7.5 | 0.15 | 2,800 | 45 | 0.06 | 6 | 0.06 |
| | | 9 | 4,500 | 80 | 0.9 | 7.5 | 0.15 | 2,800 | 45 | 0.06 | 6 | 0.06 |
| | | 12 | 4,500 | 80 | 0.45 | 10.5 | 0.06 | 2,800 | 45 | 0.03 | 9 | 0.03 |
| 2040 | 4 | 6 | 3,500 | 90 | 2 | 6 | 0.4 | 2,150 | 50 | 0.2 | 4 | 0.2 |
| | | 8 | 3,500 | 90 | 2 | 6 | 0.4 | 2,150 | 50 | 0.2 | 4 | 0.2 |
| | | 10 | 3,500 | 90 | 1.6 | 8 | 0.28 | 2,150 | 50 | 0.12 | 6 | 0.12 |
| | | 11 | 3,500 | 90 | 1.2 | 10 | 0.2 | 2,150 | 50 | 0.08 | 8 | 0.08 |
| | | 12 | 3,500 | 90 | 1.2 | 10 | 0.2 | 2,150 | 50 | 0.08 | 8 | 0.08 |
| | | 16 | 3,500 | 90 | 0.6 | 14 | 0.08 | 2,150 | 50 | 0.04 | 12 | 0.04 |
| 2050 | 5 | 7.5 | 2,950 | 90 | 2.5 | 7.5 | 0.5 | 1,850 | 55 | 0.25 | 5 | 0.25 |
| | | 10 | 2,950 | 90 | 2.5 | 7.5 | 0.5 | 1,850 | 55 | 0.25 | 5 | 0.25 |
| | | 12.5 | 2,950 | 90 | 2 | 10 | 0.35 | 1,850 | 55 | 0.15 | 7.5 | 0.15 |
| | | 13 | 2,950 | 90 | 1.5 | 12.5 | 0.25 | 1,850 | 55 | 0.1 | 10 | 0.1 |
| | | 15 | 2,950 | 90 | 1.5 | 12.5 | 0.25 | 1,850 | 55 | 0.1 | 10 | 0.1 |
| | | 20 | 2,950 | 90 | 0.75 | 17.5 | 0.1 | 1,850 | 55 | 0.05 | 15 | 0.05 |
| 2060 | 6 | 9 | 2,450 | 100 | 3 | 9 | 0.6 | 1,500 | 55 | 0.3 | 6 | 0.3 |
| | | 12 | 2,450 | 100 | 3 | 9 | 0.6 | 1,500 | 55 | 0.3 | 6 | 0.3 |
| | | 13 | 2,450 | 100 | 2.4 | 12 | 0.42 | 1,500 | 55 | 0.18 | 9 | 0.18 |
| | | 15 | 2,450 | 100 | 2.4 | 12 | 0.42 | 1,500 | 55 | 0.18 | 9 | 0.18 |
| | | 18 | 2,450 | 100 | 1.8 | 15 | 0.3 | 1,500 | 55 | 0.12 | 12 | 0.12 |
| | | 24 | 2,450 | 100 | 0.9 | 21 | 0.12 | 1,500 | 55 | 0.06 | 18 | 0.06 |
| 2080 | 8 | 16 | 1,850 | 95 | 4 | 12 | 0.8 | 1,200 | 50 | 0.4 | 8 | 0.4 |
| | | 19 | 1,850 | 95 | 3.2 | 16 | 0.56 | 1,200 | 50 | 0.24 | 12 | 0.24 |
| | | 20 | 1,850 | 95 | 3.2 | 16 | 0.56 | 1,200 | 50 | 0.24 | 12 | 0.24 |
| | | 24 | 1,850 | 95 | 2.4 | 20 | 0.4 | 1,200 | 50 | 0.16 | 16 | 0.16 |
| | | 32 | 1,850 | 95 | 1.2 | 28 | 0.16 | 1,200 | 50 | 0.08 | 24 | 0.08 |
| 2100 | 10 | 20 | 1,450 | 95 | 5 | 15 | 1 | 950 | 50 | 0.5 | 10 | 0.5 |
| | | 22 | 1,450 | 95 | 4 | 20 | 0.7 | 950 | 50 | 0.3 | 15 | 0.3 |
| | | 25 | 1,450 | 95 | 4 | 20 | 0.7 | 950 | 50 | 0.3 | 15 | 0.3 |
| | | 30 | 1,450 | 95 | 3 | 25 | 0.5 | 950 | 50 | 0.2 | 20 | 0.2 |
| | | 40 | 1,450 | 95 | 1.5 | 35 | 0.2 | 950 | 50 | 0.1 | 30 | 0.1 |
| 2120 | 12 | 24 | 1,200 | 90 | 6 | 18 | 1.2 | 800 | 45 | 0.6 | 12 | 0.6 |
| | | 26 | 1,200 | 90 | 4.8 | 24 | 0.84 | 800 | 45 | 0.36 | 18 | 0.36 |
| | | 30 | 1,200 | 90 | 4.8 | 24 | 0.84 | 800 | 45 | 0.36 | 18 | 0.36 |
| | | 36 | 1,200 | 90 | 3.6 | 30 | 0.6 | 800 | 45 | 0.24 | 24 | 0.24 |
| | | 48 | 1,200 | 90 | 1.8 | 42 | 0.24 | 800 | 45 | 0.12 | 36 | 0.12 |

## Milling Conditions for C-CES（2 Flutes）

◆High speed milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| 2030 | 3 | 4.5 | 30,000 | 790 | 1.5 | 4.5 | 0.3 | 26,500 | 600 | 1.5 | 4.5 | 0.3 |
| | | 6 | 30,000 | 790 | 1.5 | 4.5 | 0.3 | 26,500 | 600 | 1.5 | 4.5 | 0.3 |
| | | 7.5 | 30,000 | 790 | 1.2 | 6 | 0.21 | 26,500 | 600 | 1.2 | 6 | 0.21 |
| | | 8 | 30,000 | 790 | 0.9 | 7.5 | 0.15 | 26,500 | 600 | 0.9 | 7.5 | 0.15 |
| | | 9 | 30,000 | 790 | 0.9 | 7.5 | 0.15 | 26,500 | 600 | 0.9 | 7.5 | 0.15 |
| | | 12 | 30,000 | 790 | 0.45 | 10.5 | 0.06 | 26,500 | 600 | 0.45 | 10.5 | 0.06 |
| 2040 | 4 | 6 | 23,800 | 930 | 2 | 6 | 0.4 | 19,800 | 750 | 2 | 6 | 0.4 |
| | | 8 | 23,800 | 930 | 2 | 6 | 0.4 | 19,800 | 750 | 2 | 6 | 0.4 |
| | | 10 | 23,800 | 930 | 1.6 | 8 | 0.28 | 19,800 | 750 | 1.6 | 8 | 0.28 |
| | | 11 | 23,800 | 930 | 1.2 | 10 | 0.2 | 19,800 | 750 | 1.2 | 10 | 0.2 |
| | | 12 | 23,800 | 930 | 1.2 | 10 | 0.2 | 19,800 | 750 | 1.2 | 10 | 0.2 |
| | | 16 | 23,800 | 930 | 0.6 | 14 | 0.08 | 19,800 | 750 | 0.6 | 14 | 0.08 |
| 2050 | 5 | 7.5 | 19,000 | 1,110 | 2.5 | 7.5 | 0.5 | 15,800 | 865 | 2.5 | 7.5 | 0.5 |
| | | 10 | 19,000 | 1,110 | 2.5 | 7.5 | 0.5 | 15,800 | 865 | 2.5 | 7.5 | 0.5 |
| | | 12.5 | 19,000 | 1,110 | 2 | 10 | 0.35 | 15,800 | 865 | 2 | 10 | 0.35 |
| | | 13 | 19,000 | 1,110 | 1.5 | 12.5 | 0.25 | 15,800 | 865 | 1.5 | 12.5 | 0.25 |
| | | 15 | 19,000 | 1,110 | 1.5 | 12.5 | 0.25 | 15,800 | 865 | 1.5 | 12.5 | 0.25 |
| | | 20 | 19,000 | 1,110 | 0.75 | 17.5 | 0.1 | 15,800 | 865 | 0.75 | 17.5 | 0.1 |
| 2060 | 6 | 9 | 15,900 | 1,110 | 3 | 9 | 0.6 | 13,200 | 865 | 3 | 9 | 0.6 |
| | | 12 | 15,900 | 1,110 | 3 | 9 | 0.6 | 13,200 | 865 | 3 | 9 | 0.6 |
| | | 13 | 15,900 | 1,110 | 2.4 | 12 | 0.42 | 13,200 | 865 | 2.4 | 12 | 0.42 |
| | | 15 | 15,900 | 1,110 | 2.4 | 12 | 0.42 | 13,200 | 865 | 2.4 | 12 | 0.42 |
| | | 18 | 15,900 | 1,110 | 1.8 | 15 | 0.3 | 13,200 | 865 | 1.8 | 15 | 0.3 |
| | | 24 | 15,900 | 1,110 | 0.9 | 21 | 0.12 | 13,200 | 865 | 0.9 | 21 | 0.12 |
| 2080 | 8 | 16 | 11,900 | 1,045 | 4 | 12 | 0.8 | 9,900 | 875 | 4 | 12 | 0.8 |
| | | 19 | 11,900 | 1,045 | 3.2 | 16 | 0.56 | 9,900 | 875 | 3.2 | 16 | 0.56 |
| | | 20 | 11,900 | 1,045 | 3.2 | 16 | 0.56 | 9,900 | 875 | 3.2 | 16 | 0.56 |
| | | 24 | 11,900 | 1,045 | 2.4 | 20 | 0.4 | 9,900 | 875 | 2.4 | 20 | 0.4 |
| | | 32 | 11,900 | 1,045 | 1.2 | 28 | 0.16 | 9,900 | 875 | 1.2 | 28 | 0.16 |
| 2100 | 10 | 20 | 9,500 | 1,005 | 5 | 15 | 1 | 7,900 | 845 | 5 | 15 | 1 |
| | | 22 | 9,500 | 1,005 | 4 | 20 | 0.7 | 7,900 | 845 | 4 | 20 | 0.7 |
| | | 25 | 9,500 | 1,005 | 4 | 20 | 0.7 | 7,900 | 845 | 4 | 20 | 0.7 |
| | | 30 | 9,500 | 1,005 | 3 | 25 | 0.5 | 7,900 | 845 | 3 | 25 | 0.5 |
| 2120 | 12 | 24 | 7,900 | 1,000 | 6 | 18 | 1.2 | 6,600 | 850 | 6 | 18 | 1.2 |
| | | 26 | 7,900 | 1,000 | 4.8 | 24 | 0.84 | 6,600 | 850 | 4.8 | 24 | 0.84 |
| | | 30 | 7,900 | 1,000 | 4.8 | 24 | 0.84 | 6,600 | 850 | 4.8 | 24 | 0.84 |
| | | 36 | 7,900 | 1,000 | 3.6 | 30 | 0.6 | 6,600 | 850 | 3.6 | 30 | 0.6 |
| | | 48 | 7,900 | 1,000 | 1.8 | 42 | 0.24 | 6,600 | 850 | 1.8 | 42 | 0.24 |

# Milling Conditions for C-CES（2 Flutes）

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) | | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| 2030 | 3 | 4.5 | 21,200 | 375 | 1.5 | 4.5 | 0.3 | 15,800 | 255 | 0.15 | 3 | 0.15 |
| | | 6 | 21,200 | 375 | 1.5 | 4.5 | 0.3 | 15,800 | 255 | 0.15 | 3 | 0.15 |
| | | 7.5 | 21,200 | 375 | 1.2 | 6 | 0.21 | 15,800 | 255 | 0.09 | 4.5 | 0.09 |
| | | 8 | 21,200 | 375 | 0.9 | 7.5 | 0.15 | 15,800 | 255 | 0.06 | 6 | 0.06 |
| | | 9 | 21,200 | 375 | 0.9 | 7.5 | 0.15 | 15,800 | 255 | 0.06 | 6 | 0.06 |
| | | 12 | 21,200 | 375 | 0.45 | 10.5 | 0.06 | 15,800 | 255 | 0.03 | 9 | 0.03 |
| 2040 | 4 | 6 | 15,800 | 405 | 2 | 6 | 0.4 | 11,900 | 275 | 0.2 | 4 | 0.2 |
| | | 8 | 15,800 | 405 | 2 | 6 | 0.4 | 11,900 | 275 | 0.2 | 4 | 0.2 |
| | | 10 | 15,800 | 405 | 1.6 | 8 | 0.28 | 11,900 | 275 | 0.12 | 6 | 0.12 |
| | | 11 | 15,800 | 405 | 1.2 | 10 | 0.2 | 11,900 | 275 | 0.08 | 8 | 0.08 |
| | | 12 | 15,800 | 405 | 1.2 | 10 | 0.2 | 11,900 | 275 | 0.08 | 8 | 0.08 |
| | | 16 | 15,800 | 405 | 0.6 | 14 | 0.08 | 11,900 | 275 | 0.04 | 12 | 0.04 |
| 2050 | 5 | 7.5 | 12,700 | 385 | 2.5 | 7.5 | 0.5 | 9,500 | 280 | 0.25 | 5 | 0.25 |
| | | 10 | 12,700 | 385 | 2.5 | 7.5 | 0.5 | 9,500 | 280 | 0.25 | 5 | 0.25 |
| | | 12.5 | 12,700 | 385 | 2 | 10 | 0.35 | 9,500 | 280 | 0.15 | 7.5 | 0.15 |
| | | 13 | 12,700 | 385 | 1.5 | 12.5 | 0.25 | 9,500 | 280 | 0.1 | 10 | 0.1 |
| | | 15 | 12,700 | 385 | 1.5 | 12.5 | 0.25 | 9,500 | 280 | 0.1 | 10 | 0.1 |
| | | 20 | 12,700 | 385 | 0.75 | 17.5 | 0.1 | 9,500 | 280 | 0.05 | 15 | 0.05 |
| 2060 | 6 | 9 | 10,600 | 435 | 3 | 9 | 0.6 | 7,900 | 290 | 0.3 | 6 | 0.3 |
| | | 12 | 10,600 | 435 | 3 | 9 | 0.6 | 7,900 | 290 | 0.3 | 6 | 0.3 |
| | | 13 | 10,600 | 435 | 2.4 | 12 | 0.42 | 7,900 | 290 | 0.18 | 9 | 0.18 |
| | | 15 | 10,600 | 435 | 2.4 | 12 | 0.42 | 7,900 | 290 | 0.18 | 9 | 0.18 |
| | | 18 | 10,600 | 435 | 1.8 | 15 | 0.3 | 7,900 | 290 | 0.12 | 12 | 0.12 |
| | | 24 | 10,600 | 435 | 0.9 | 21 | 0.12 | 7,900 | 290 | 0.06 | 18 | 0.06 |
| 2080 | 8 | 16 | 7,900 | 405 | 4 | 12 | 0.8 | 5,900 | 245 | 0.4 | 8 | 0.4 |
| | | 19 | 7,900 | 405 | 3.2 | 16 | 0.56 | 5,900 | 245 | 0.24 | 12 | 0.24 |
| | | 20 | 7,900 | 405 | 3.2 | 16 | 0.56 | 5,900 | 245 | 0.24 | 12 | 0.24 |
| | | 24 | 7,900 | 405 | 2.4 | 20 | 0.4 | 5,900 | 245 | 0.16 | 16 | 0.16 |
| | | 32 | 7,900 | 405 | 1.2 | 28 | 0.16 | 5,900 | 245 | 0.08 | 24 | 0.08 |
| 2100 | 10 | 20 | 6,300 | 415 | 5 | 15 | 1 | 4,700 | 245 | 0.5 | 10 | 0.5 |
| | | 22 | 6,300 | 415 | 4 | 20 | 0.7 | 4,700 | 245 | 0.3 | 15 | 0.3 |
| | | 25 | 6,300 | 415 | 4 | 20 | 0.7 | 4,700 | 245 | 0.3 | 15 | 0.3 |
| | | 30 | 6,300 | 415 | 3 | 25 | 0.5 | 4,700 | 245 | 0.2 | 20 | 0.2 |
| 2120 | 12 | 24 | 5,300 | 400 | 6 | 18 | 1.2 | 3,900 | 219 | 0.6 | 12 | 0.6 |
| | | 26 | 5,300 | 400 | 4.8 | 24 | 0.84 | 3,900 | 219 | 0.36 | 18 | 0.36 |
| | | 30 | 5,300 | 400 | 4.8 | 24 | 0.84 | 3,900 | 219 | 0.36 | 18 | 0.36 |
| | | 36 | 5,300 | 400 | 3.6 | 30 | 0.6 | 3,900 | 219 | 0.24 | 24 | 0.24 |
| | | 48 | 5,300 | 400 | 1.8 | 42 | 0.24 | 3,900 | 219 | 0.12 | 36 | 0.12 |

## Milling Conditions for C-CES（2 Flutes）

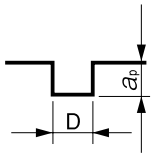
Milling amount for slotting（mm）

D＜φ1

| Work Material \ Length of Cut | 2D or below | 2.5D or below | 3D or below | 4D or below |
|---|---|---|---|---|
| 45HRC or below | $a_p$=0.1D | $a_p$=0.07D | $a_p$=0.05D | $a_p$=0.02D |
| 45HRC or above | $a_p$=0.02D | $a_p$=0.02D | $a_p$=0.01D | $a_p$=0.01D |

φ1≦D＜φ3

| Work Material \ Length of Cut | 2D or below | 2.5D or below | 3D or below | 4D or below |
|---|---|---|---|---|
| 45HRC or below | $a_p$=0.25D | $a_p$=0.2D | $a_p$=0.125D | $a_p$=0.075D |
| 45HRC or above | $a_p$=0.05D | $a_p$=0.03D | $a_p$=0.02D | $a_p$=0.01D |

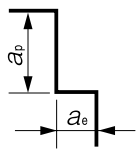



φ3≦D

| Work Material \ Length of Cut | 2D or below | 2.5D or below | 3D or below | 4D or below |
|---|---|---|---|---|
| 45HRC or below | $a_p$=0.5D | $a_p$=0.4D | $a_p$=0.3D | $a_p$=0.15D |
| 45HRC or above | $a_p$=0.05D | $a_p$=0.03D | $a_p$=0.02D | $a_p$=0.01D |

Milling amount for side milling（mm）

| Work Material \ Length of Cut | 2D or below | 2.5D or below | 3D or below | 4D or below |
|---|---|---|---|---|
| 45HRC or below | $a_p$=1.5D<br>$a_e$=0.1D | $a_p$=2D<br>$a_e$=0.07D | $a_p$=2.5D<br>$a_e$=0.05D | $a_p$=3.5D<br>$a_e$=0.02D |
| 45HRC or above | $a_p$=1D<br>$a_e$=0.05D | $a_p$=1.5D<br>$a_e$=0.03D | $a_p$=2D<br>$a_e$=0.02D | $a_p$=3D<br>$a_e$=0.01D |




D：Outside Diameter（mm）

Ex.) 2D or below : Flute Length = Diameter × 2 or below

$a_p$：Axial Depth（mm）

$a_e$：Radial Depth（mm）

Note:

・Recommend water soluble or oil coolant.

・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

Size φ0.2～φ12

# C-CES2000S

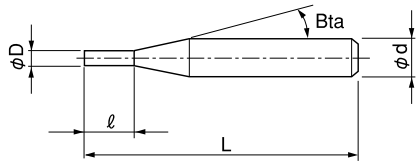
Super MG | UT COAT | 30° | Sharp Corner | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**2 flute C-CES with a sharp corner design.**
**Broad application range from Copper and Carbon Steels up to Hardened Steels (55HRC).**
**Excellent performance/quality to price ratio.**
**Refer to page 214 for 4 flute C-CES-S.**




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

Total 35 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2002-0030S | 0.2 | 0.3 | 16° | 45 | 4 | 4,680 |
| C-CES 2002-0060S | | 0.6 | | 45 | 4 | 4,680 |
| C-CES 2003-0045S | 0.3 | 0.45 | 16° | 45 | 4 | 4,080 |
| C-CES 2003-0090S | | 0.9 | | 45 | 4 | 4,080 |
| C-CES 2004-0060S | 0.4 | 0.6 | 16° | 45 | 4 | 4,560 |
| C-CES 2004-0120S | | 1.2 | | 45 | 4 | 4,560 |
| C-CES 2005-0075S | 0.5 | 0.75 | 16° | 45 | 4 | 2,280 |
| C-CES 2005-0150S | | 1.5 | | 45 | 4 | 2,280 |
| C-CES 2006-0090S | 0.6 | 0.9 | 16° | 45 | 4 | 3,480 |
| C-CES 2007-0105S | 0.7 | 1.05 | 16° | 45 | 4 | 3,840 |
| C-CES 2008-0120S | 0.8 | 1.2 | 16° | 45 | 4 | 2,280 |
| C-CES 2008-0240S | | 2.4 | | 45 | 4 | 2,280 |
| C-CES 2009-0135S | 0.9 | 1.35 | 16° | 45 | 4 | 3,840 |
| C-CES 2010-0150S | 1 | 1.5 | 16° | 45 | 4 | 2,040 |
| C-CES 2010-0300S | | 3 | | 45 | 4 | 2,040 |
| C-CES 2012-0180S | 1.2 | 1.8 | 16° | 45 | 4 | 2,280 |
| C-CES 2012-0360S | | 3.6 | | 45 | 4 | 2,280 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 2015-0225S | 1.5 | 2.25 | 16° | 45 | 4 | 2,040 |
| C-CES 2015-0450S | | 4.5 | | 45 | 4 | 2,040 |
| C-CES 2018-0270S | 1.8 | 2.7 | 16° | 45 | 4 | 2,280 |
| C-CES 2018-0540S | | 5.4 | | 45 | 4 | 2,280 |
| C-CES 2020-0300S | 2 | 3 | 16° | 45 | 4 | 2,040 |
| C-CES 2020-0600S | | 6 | | 45 | 4 | 2,040 |
| C-CES 2025-0375S | 2.5 | 3.75 | 16° | 45 | 4 | 2,040 |
| C-CES 2030-0450S | 3 | 4.5 | 16° | 45 | 6 | 2,640 |
| C-CES 2030-0900S | | 9 | | 45 | 6 | 2,640 |
| C-CES 2040-0600S | 4 | 6 | 16° | 50 | 6 | 2,880 |
| C-CES 2040-1200S | | 12 | | 50 | 6 | 2,880 |
| C-CES 2050-0750S | 5 | 7.5 | 16° | 50 | 6 | 3,120 |
| C-CES 2050-1500S | | 15 | | 50 | 6 | 3,120 |
| C-CES 2060-0900S | 6 | 9 | — | 50 | 6 | 3,360 |
| C-CES 2060-1800S | | 18 | | 50 | 6 | 3,360 |
| C-CES 2080-2400S | 8 | 24 | — | 80 | 8 | 6,320 |
| C-CES 2100-3000S | 10 | 30 | — | 80 | 10 | 7,580 |
| C-CES 2120-3600S | 12 | 36 | — | 90 | 12 | 11,170 |

## Milling Conditions for C-CES-S（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| **2002** | **0.2** | 0.3 | 27,000 | 60 | 0.02 | 0.3 | 0.02 | 27,000 | 60 | 0.02 | 0.3 | 0.02 |
| | | 0.6 | 27,000 | 60 | 0.01 | 0.5 | 0.01 | 27,000 | 60 | 0.01 | 0.5 | 0.01 |
| **2003** | **0.3** | 0.45 | 27,000 | 77 | 0.03 | 0.45 | 0.03 | 27,000 | 77 | 0.03 | 0.45 | 0.03 |
| | | 0.9 | 27,000 | 77 | 0.015 | 0.75 | 0.015 | 27,000 | 77 | 0.015 | 0.75 | 0.015 |
| **2004** | **0.4** | 0.6 | 27,000 | 84 | 0.04 | 0.6 | 0.04 | 27,000 | 84 | 0.04 | 0.6 | 0.04 |
| | | 1.2 | 27,000 | 84 | 0.02 | 1 | 0.02 | 27,000 | 84 | 0.02 | 1 | 0.02 |
| **2005** | **0.5** | 0.75 | 27,000 | 84 | 0.05 | 0.75 | 0.05 | 26,100 | 84 | 0.05 | 0.75 | 0.05 |
| | | 1.5 | 27,000 | 84 | 0.025 | 1.25 | 0.025 | 26,100 | 84 | 0.025 | 1.25 | 0.025 |
| **2006** | **0.6** | 0.9 | 27,000 | 84 | 0.06 | 0.9 | 0.06 | 21,600 | 84 | 0.06 | 0.9 | 0.06 |
| **2007** | **0.7** | 1.05 | 24,750 | 84 | 0.07 | 1.05 | 0.07 | 18,900 | 84 | 0.07 | 1.05 | 0.07 |
| **2008** | **0.8** | 1.2 | 21,600 | 84 | 0.08 | 1.2 | 0.08 | 17,100 | 84 | 0.08 | 1.2 | 0.08 |
| | | 2.4 | 21,600 | 84 | 0.04 | 2 | 0.04 | 17,100 | 84 | 0.04 | 2 | 0.04 |
| **2009** | **0.9** | 1.35 | 19,350 | 88 | 0.09 | 1.35 | 0.09 | 14,850 | 84 | 0.09 | 1.35 | 0.09 |
| **2010** | **1** | 1.5 | 18,000 | 88 | 0.25 | 1.5 | 0.1 | 13,500 | 84 | 0.25 | 1.5 | 0.1 |
| | | 3 | 18,000 | 88 | 0.125 | 2.5 | 0.05 | 13,500 | 84 | 0.125 | 2.5 | 0.05 |
| **2012** | **1.2** | 1.8 | 15,030 | 91 | 0.3 | 1.8 | 0.12 | 11,250 | 84 | 0.3 | 1.8 | 0.12 |
| | | 3.6 | 15,030 | 91 | 0.15 | 3 | 0.06 | 11,250 | 84 | 0.15 | 3 | 0.06 |
| **2015** | **1.5** | 2.25 | 12,150 | 91 | 0.375 | 2.25 | 0.15 | 9,000 | 84 | 0.375 | 2.25 | 0.15 |
| | | 4.5 | 12,150 | 91 | 0.1875 | 3.75 | 0.075 | 9,000 | 84 | 0.1875 | 3.75 | 0.075 |
| **2018** | **1.8** | 2.7 | 10,350 | 91 | 0.45 | 2.7 | 0.18 | 7,920 | 84 | 0.45 | 2.7 | 0.18 |
| | | 5.4 | 10,350 | 91 | 0.225 | 4.5 | 0.09 | 7,920 | 84 | 0.225 | 4.5 | 0.09 |
| **2020** | **2** | 3 | 9,900 | 91 | 0.5 | 3 | 0.2 | 7,650 | 84 | 0.5 | 3 | 0.2 |
| | | 6 | 9,900 | 91 | 0.25 | 5 | 0.1 | 7,650 | 84 | 0.25 | 5 | 0.1 |
| **2025** | **2.5** | 3.75 | 7,920 | 137 | 0.625 | 3.75 | 0.25 | 6,300 | 95 | 0.625 | 3.75 | 0.25 |
| **2030** | **3** | 4.5 | 6,660 | 137 | 1.5 | 4.5 | 0.3 | 5,760 | 102 | 1.5 | 4.5 | 0.3 |
| | | 9 | 6,660 | 137 | 0.9 | 7.5 | 0.15 | 5,760 | 102 | 0.9 | 7.5 | 0.15 |
| **2040** | **4** | 6 | 5,310 | 161 | 2 | 6 | 0.4 | 4,500 | 133 | 2 | 6 | 0.4 |
| | | 12 | 5,310 | 161 | 1.2 | 10 | 0.2 | 4,500 | 133 | 1.2 | 10 | 0.2 |
| **2050** | **5** | 7.5 | 4,770 | 217 | 2.5 | 7.5 | 0.5 | 3,780 | 161 | 2.5 | 7.5 | 0.5 |
| | | 15 | 4,770 | 217 | 1.5 | 12.5 | 0.25 | 3,780 | 161 | 1.5 | 12.5 | 0.25 |
| **2060** | **6** | 9 | 3,960 | 214 | 3 | 9 | 0.6 | 3,150 | 161 | 3 | 9 | 0.6 |
| | | 18 | 3,960 | 214 | 1.8 | 15 | 0.3 | 3,150 | 161 | 1.8 | 15 | 0.3 |
| **2080** | **8** | 24 | 2,970 | 203 | 2.4 | 20 | 0.4 | 2,340 | 161 | 2.4 | 20 | 0.4 |
| **2100** | **10** | 30 | 2,340 | 193 | 3 | 25 | 0.5 | 1,890 | 158 | 3 | 25 | 0.5 |
| **2120** | **12** | 36 | 1,980 | 193 | 3.6 | 30 | 0.6 | 1,575 | 158 | 3.6 | 30 | 0.6 |

## Milling Conditions for C-CES-S（2 Flutes）

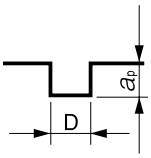
| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| **2002** | **0.2** | 0.3 | 24,000 | 21 | 0.02 | 0.3 | 0.02 | 24,000 | 18 | 0.004 | 0.2 | 0.01 |
| | | 0.6 | 24,000 | 21 | 0.01 | 0.5 | 0.01 | 24,000 | 18 | 0.002 | 0.4 | 0.004 |
| **2003** | **0.3** | 0.45 | 24,000 | 39 | 0.03 | 0.45 | 0.03 | 17,600 | 18 | 0.006 | 0.3 | 0.015 |
| | | 0.9 | 24,000 | 39 | 0.015 | 0.75 | 0.015 | 17,600 | 18 | 0.003 | 0.6 | 0.006 |
| **2004** | **0.4** | 0.6 | 21,600 | 42 | 0.04 | 0.6 | 0.04 | 13,600 | 18 | 0.008 | 0.4 | 0.02 |
| | | 1.2 | 21,600 | 42 | 0.02 | 1 | 0.02 | 13,600 | 18 | 0.004 | 0.8 | 0.008 |
| **2005** | **0.5** | 0.75 | 17,200 | 42 | 0.05 | 0.75 | 0.05 | 10,400 | 18 | 0.01 | 0.5 | 0.025 |
| | | 1.5 | 17,200 | 42 | 0.025 | 1.25 | 0.025 | 10,400 | 18 | 0.005 | 1 | 0.01 |
| **2006** | **0.6** | 0.9 | 14,400 | 42 | 0.06 | 0.9 | 0.06 | 8,800 | 18 | 0.012 | 0.6 | 0.03 |
| **2007** | **0.7** | 1.05 | 12,400 | 42 | 0.07 | 1.05 | 0.07 | 8,000 | 18 | 0.014 | 0.7 | 0.035 |
| **2008** | **0.8** | 1.2 | 11,040 | 42 | 0.08 | 1.2 | 0.08 | 7,040 | 21 | 0.016 | 0.8 | 0.04 |
| | | 2.4 | 11,040 | 42 | 0.04 | 2 | 0.04 | 7,040 | 21 | 0.008 | 1.6 | 0.016 |
| **2009** | **0.9** | 1.35 | 9,600 | 46 | 0.09 | 1.35 | 0.09 | 6,240 | 21 | 0.018 | 0.9 | 0.045 |
| **2010** | **1** | 1.5 | 8,800 | 46 | 0.25 | 1.5 | 0.1 | 5,680 | 21 | 0.05 | 1 | 0.05 |
| | | 3 | 8,800 | 46 | 0.125 | 2.5 | 0.05 | 5,680 | 21 | 0.02 | 2 | 0.02 |
| **2012** | **1.2** | 1.8 | 7,520 | 46 | 0.3 | 1.8 | 0.12 | 4,800 | 21 | 0.06 | 1.2 | 0.06 |
| | | 3.6 | 7,520 | 46 | 0.15 | 3 | 0.06 | 4,800 | 21 | 0.024 | 2.4 | 0.024 |
| **2015** | **1.5** | 2.25 | 6,400 | 49 | 0.375 | 2.25 | 0.15 | 4,080 | 25 | 0.075 | 1.5 | 0.075 |
| | | 4.5 | 6,400 | 49 | 0.1875 | 3.75 | 0.075 | 4,080 | 25 | 0.03 | 3 | 0.03 |
| **2018** | **1.8** | 2.7 | 5,600 | 49 | 0.45 | 2.7 | 0.18 | 3,520 | 25 | 0.09 | 1.8 | 0.09 |
| | | 5.4 | 5,600 | 49 | 0.225 | 4.5 | 0.09 | 3,520 | 25 | 0.036 | 3.6 | 0.036 |
| **2020** | **2** | 3 | 5,120 | 49 | 0.5 | 3 | 0.2 | 3,200 | 28 | 0.1 | 2 | 0.1 |
| | | 6 | 5,120 | 49 | 0.25 | 5 | 0.1 | 3,200 | 28 | 0.04 | 4 | 0.04 |
| **2025** | **2.5** | 3.75 | 4,000 | 49 | 0.625 | 3.75 | 0.25 | 2,560 | 28 | 0.125 | 2.5 | 0.125 |
| **2030** | **3** | 4.5 | 3,600 | 56 | 1.5 | 4.5 | 0.3 | 2,240 | 32 | 0.15 | 3 | 0.15 |
| | | 9 | 3,600 | 56 | 0.9 | 7.5 | 0.15 | 2,240 | 32 | 0.06 | 6 | 0.06 |
| **2040** | **4** | 6 | 2,800 | 63 | 2 | 6 | 0.4 | 1,720 | 35 | 0.2 | 4 | 0.2 |
| | | 12 | 2,800 | 63 | 1.2 | 10 | 0.2 | 1,720 | 35 | 0.08 | 8 | 0.08 |
| **2050** | **5** | 7.5 | 2,360 | 63 | 2.5 | 7.5 | 0.5 | 1,480 | 39 | 0.25 | 5 | 0.25 |
| | | 15 | 2,360 | 63 | 1.5 | 12.5 | 0.25 | 1,480 | 39 | 0.1 | 10 | 0.1 |
| **2060** | **6** | 9 | 1,960 | 70 | 3 | 9 | 0.6 | 1,200 | 39 | 0.3 | 6 | 0.3 |
| | | 18 | 1,960 | 70 | 1.8 | 15 | 0.3 | 1,200 | 39 | 0.12 | 12 | 0.12 |
| **2080** | **8** | 24 | 1,480 | 67 | 2.4 | 20 | 0.4 | 960 | 35 | 0.16 | 16 | 0.16 |
| **2100** | **10** | 30 | 1,160 | 67 | 3 | 25 | 0.5 | 760 | 35 | 0.2 | 20 | 0.2 |
| **2120** | **12** | 36 | 960 | 63 | 3.6 | 30 | 0.6 | 640 | 32 | 0.24 | 24 | 0.24 |

## Milling Conditions for C-CES-S（2 Flutes）

Milling amount for slotting（mm）

D＜φ1

| Work Material \ Length of Cut | 2D or below | 3D or below |
|---|---|---|
| 45HRC or below | $a_p$=0.1D | $a_p$=0.05D |
| 45HRC or above | $a_p$=0.02D | $a_p$=0.01D |




φ1≦D＜φ3

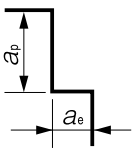
| Work Material \ Length of Cut | 2D or below | 3D or below |
|---|---|---|
| 45HRC or below | $a_p$=0.25D | $a_p$=0.125D |
| 45HRC or above | $a_p$=0.05D | $a_p$=0.02D |

φ3≦D

| Work Material \ Length of Cut | 2D or below | 3D or below |
|---|---|---|
| 45HRC or below | $a_p$=0.5D | $a_p$=0.3D |
| 45HRC or above | $a_p$=0.05D | $a_p$=0.02D |

Milling amount for side milling（mm）

| Work Material \ Length of Cut | 2D or below | 3D or below |
|---|---|---|
| 45HRC or below | $a_p$=1.5D<br>$a_e$=0.1D | $a_p$=2.5D<br>$a_e$=0.05D |
| 45HRC or above | $a_p$=1D<br>$a_e$=0.05D | $a_p$=2D<br>$a_e$=0.02D |




D：Outside Diameter（mm）

Ex.）2D or below : Flute Length = Diameter × 2 or below

$a_p$：Axial Depth（mm）

$a_e$：Radial Depth（mm）

Note:

・Recommend water soluble or oil coolant.

・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

Size $\phi$0.2～$\phi$12

# CRN-ES2000

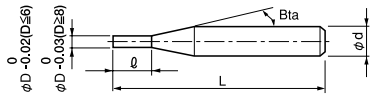
Super MG | CrN COAT | 20° | Sharp Corner | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | | ☆ | ○ | | | | | |

## Features

**CrN COAT offers longer tool life.**
**Special geometry designed for Copper offers excellent milling performance.**
**Refer to page 220 for 4 flute CRN-ES.**
**Diameter Tolerance: 0/-0.02 (D ≦ 6), 0/-0.03 (D ≧ 8)**




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

Total 26 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **CRN-ES 2002-0060** | 0.2 | 0.6 | 11° | 40 | 4 | 6,100 |
| **CRN-ES 2003-0090** | 0.3 | 0.9 | 11° | 40 | 4 | 6,100 |
| **CRN-ES 2004-0120** | 0.4 | 1.2 | 11° | 40 | 4 | 6,100 |
| **CRN-ES 2005-0150** | 0.5 | 1.5 | 11° | 40 | 4 | 3,200 |
| **CRN-ES 2005-0200** | | 2 | | 45 | 4 | 5,500 |
| **CRN-ES 2006-0180** | 0.6 | 1.8 | 11° | 40 | 4 | 5,060 |
| **CRN-ES 2006-0240** | | 2.4 | | 45 | 4 | 5,500 |
| **CRN-ES 2008-0240** | 0.8 | 2.4 | 11° | 40 | 4 | 3,200 |
| **CRN-ES 2010-0300** | 1 | 3 | 11° | 45 | 4 | 3,200 |
| **CRN-ES 2010-0400** | | 4 | | 50 | 4 | 4,950 |
| **CRN-ES 2015-0450** | 1.5 | 4.5 | 11° | 45 | 4 | 3,200 |
| **CRN-ES 2015-0600** | | 6 | | 50 | 4 | 4,950 |
| **CRN-ES 2020-0600** | 2 | 6 | 11° | 45 | 4 | 3,200 |
| **CRN-ES 2020-0800** | | 8 | | 50 | 4 | 4,950 |
| **CRN-ES 2025-0750** | 2.5 | 7.5 | 11° | 45 | 4 | 3,200 |
| **CRN-ES 2030-0900** | 3 | 9 | 11° | 50 | 6 | 3,740 |
| **CRN-ES 2030-1200** | | 12 | | 55 | 6 | 6,050 |
| **CRN-ES 2040-1200** | 4 | 12 | 11° | 50 | 6 | 3,960 |
| **CRN-ES 2040-1600** | | 16 | | 55 | 6 | 6,600 |
| **CRN-ES 2050-1500** | 5 | 15 | 11° | 55 | 6 | 4,200 |
| **CRN-ES 2060-1800** | 6 | 18 | — | 60 | 6 | 4,620 |
| **CRN-ES 2060-2400** | | 24 | | 65 | 6 | 7,480 |
| **CRN-ES 2080-2400** | 8 | 24 | — | 80 | 8 | 8,760 |
| **CRN-ES 2100-3000** | 10 | 30 | — | 100 | 10 | 10,900 |
| **CRN-ES 2100-4000** | | 40 | | 100 | 10 | 17,280 |
| **CRN-ES 2120-3600** | 12 | 36 | — | 100 | 12 | 15,000 |

# Milling Conditions for CRN-ES（2 Flutes）

◆3D flute length type

| WORK MATERIAL | | COPPER C1100 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Side Milling | | | | Slotting | | |
| Model Number | Outside Diameter (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) |
| **2002-0060** | **0.2** | 40,000 | 100 | 0.3 | 0.004 | 40,000 | 85 | 0.01 |
| **2003-0090** | **0.3** | 38,000 | 100 | 0.45 | 0.006 | 38,000 | 85 | 0.015 |
| **2004-0120** | **0.4** | 35,000 | 100 | 0.6 | 0.008 | 35,000 | 85 | 0.02 |
| **2005-0150** | **0.5** | 32,000 | 120 | 0.75 | 0.01 | 32,000 | 100 | 0.025 |
| **2006-0180** | **0.6** | 29,000 | 150 | 0.9 | 0.012 | 26,000 | 120 | 0.03 |
| **2008-0240** | **0.8** | 22,000 | 180 | 1.2 | 0.016 | 21,000 | 150 | 0.04 |
| **2010-0300** | **1** | 18,000 | 180 | 1.5 | 0.02 | 16,000 | 150 | 0.05 |
| **2015-0450** | **1.5** | 17,500 | 250 | 2.25 | 0.15 | 11,000 | 150 | 0.15 |
| **2020-0600** | **2** | 17,000 | 340 | 3 | 0.2 | 7,500 | 150 | 0.2 |
| **2025-0750** | **2.5** | 16,500 | 450 | 3.75 | 0.25 | 6,000 | 150 | 0.25 |
| **2030-0900** | **3** | 16,000 | 630 | 4.5 | 0.3 | 5,000 | 170 | 0.3 |
| **2040-1200** | **4** | 12,000 | 650 | 6 | 0.4 | 5,000 | 200 | 0.4 |
| **2050-1500** | **5** | 10,000 | 750 | 7.5 | 0.5 | 5,000 | 250 | 0.5 |
| **2060-1800** | **6** | 8,000 | 800 | 9 | 0.6 | 4,500 | 250 | 0.6 |
| **2080-2400** | **8** | 6,000 | 700 | 12 | 0.8 | 4,000 | 250 | 0.8 |
| **2100-3000** | **10** | 5,000 | 600 | 15 | 1 | 4,000 | 350 | 1 |
| **2120-3600** | **12** | 4,000 | 500 | 18 | 1.2 | 4,000 | 450 | 1.2 |

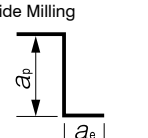
◆4D flute length type

| WORK MATERIAL | | COPPER C1100 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Side Milling | | | | Slotting | | |
| Model Number | Outside Diameter (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) |
| **2005-0200** | **0.5** | 16,000 | 60 | 1.25 | 0.005 | 16,000 | 50 | 0.025 |
| **2006-0240** | **0.6** | 14,500 | 75 | 1.5 | 0.006 | 14,500 | 65 | 0.03 |
| **2010-0400** | **1** | 9,000 | 90 | 2.5 | 0.01 | 8,000 | 75 | 0.05 |
| **2015-0600** | **1.5** | 9,000 | 150 | 3.75 | 0.075 | 8,000 | 130 | 0.15 |
| **2020-0800** | **2** | 5,000 | 140 | 5 | 0.1 | 4,500 | 120 | 0.2 |
| **2030-1200** | **3** | 3,500 | 140 | 7.5 | 0.15 | 2,500 | 85 | 0.3 |
| **2040-1600** | **4** | 3,500 | 200 | 10 | 0.2 | 2,500 | 100 | 0.4 |
| **2060-2400** | **6** | 3,000 | 200 | 15 | 0.3 | 2,500 | 150 | 0.6 |
| **2100-4000** | **10** | 2,500 | 230 | 25 | 0.5 | 2,000 | 175 | 1 |

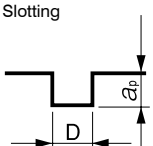
| Length of Cut / Milling | 3D Flute Length Type | 4D Flute Length Type |
|---|---|---|
| Side Milling | $a_p$ 1.5D<br>$a_e$ 0.02D(D≦φ1.0)<br>$a_e$ 0.1D(D＞φ1.0) | $a_p$ 2.5D<br>$a_e$ 0.01D(D≦φ1.0)<br>$a_e$ 0.05D(D＞φ1.0) |
| Slotting | $a_p$ 0.05D(D≦φ1.0)<br>$a_p$ 0.1D(D＞φ1.0) | $a_p$ 0.05D(D≦φ1.0)<br>$a_p$ 0.1D(D＞φ1.0) |

Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・Adjust the milling amount and feed rate in accordance with required precision.
・Recommend water soluble or oil coolant.
・Recommended for Pure Copper. Not suitable for Tungsten Copper.

Side Milling




Slotting




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Size φ0.2～φ6

# DCES2000

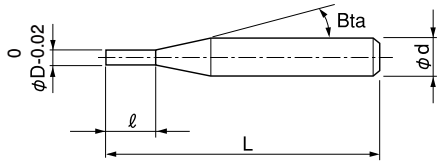
MG DIA 30° Sharp Corner Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |

## Features

**Diamond coated 2 Flute Square End Mills for Graphite Electrodes.**
**New Diamond coating, with a highly adhesive base layer, offers excellent wear resistance and longer tool life.**
**Refer to page 222 for 4 flute DCES.**




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

Total 8 models

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **DCES 2002-0060** | 0.2 | 0.6 | 16° | 45 | 4 | 17,000 |
| **DCES 2005-0150** | 0.5 | 1.5 | 16° | 45 | 4 | 14,500 |
| **DCES 2010-0300** | 1 | 3 | 16° | 45 | 4 | 14,500 |
| **DCES 2015-0450** | 1.5 | 4.5 | 16° | 45 | 4 | 14,500 |
| **DCES 2020-0600** | 2 | 6 | 16° | 45 | 4 | 14,500 |
| **DCES 2030-0900** | 3 | 9 | 16° | 45 | 6 | 17,000 |
| **DCES 2040-1200** | 4 | 12 | 16° | 50 | 6 | 18,100 |
| **DCES 2060-1800** | 6 | 18 | — | 60 | 6 | 19,300 |

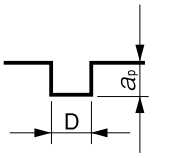
## Milling Conditions for DCES（2 Flutes）

| WORK MATERIAL | | | GRAPHITE | | | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Slotting |
| | | | | | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | $a_p$ Axial Depth (mm) |
| **2002-0060** | **0.2** | 0.6 | 30,000 | 1,000 | 0.6 | 0.01 | 0.006 |
| **2005-0150** | **0.5** | 1.5 | 30,000 | 1,100 | 1.5 | 0.025 | 0.02 |
| **2010-0300** | **1** | 3 | 28,000 | 1,300 | 3 | 0.05 | 0.05 |
| **2015-0450** | **1.5** | 4.5 | 25,000 | 1,500 | 4.5 | 0.075 | 0.12 |
| **2020-0600** | **2** | 6 | 24,000 | 1,800 | 6 | 0.1 | 0.15 |
| **2030-0900** | **3** | 9 | 25,000 | 2,600 | 9 | 0.15 | 0.3 |
| **2040-1200** | **4** | 12 | 19,000 | 2,000 | 12 | 0.24 | 0.6 |
| **2060-1800** | **6** | 18 | 13,000 | 1,500 | 18 | 0.36 | 1.2 |

Slotting

$a_p$ : Axial Depth (mm)

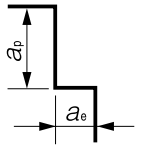
D : Outside Diameter (mm)




Side Milling

$a_p$ : Axial Depth (mm)

$a_e$ : Radial Depth (mm)




Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

Size φ0.3～φ12

# CPS

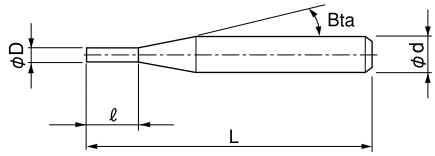
MG | 30° | Flatland | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | | ◎ | ☆ | | | | | |

## Features

**Medium length of cut design for Plastic milling.**
**Original flute design offers excellent surface finish.**
**Length of cut = outside diameter x3 (Note: outside diameter x1.5~2 is partially included).**
**Provides excellent milling surface for long overhang milling on Plastics.**




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

Total 23 models

Unit (mm)

| | Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|
| | CPS 2003 | 0.3 | 0.9 | 16° | 45 | 4 | 6,480 |
| | CPS 2004 | 0.4 | 1.2 | 16° | 45 | 4 | 7,080 |
| | CPS 2005 | 0.5 | 1.5 | 16° | 45 | 4 | 4,800 |
| | CPS 2006 | 0.6 | 1.8 | 16° | 45 | 4 | 5,520 |
| | CPS 2007 | 0.7 | 2.1 | 16° | 45 | 4 | 6,000 |
| | CPS 2008 | 0.8 | 2.4 | 16° | 45 | 4 | 5,520 |
| | CPS 2009 | 0.9 | 2.7 | 16° | 45 | 4 | 6,000 |
| | CPS 2010 | 1 | 3 | 16° | 50 | 4 | 3,840 |
| | CPS 2012 | 1.2 | 3.6 | 16° | 50 | 4 | 4,200 |
| | CPS 2015 | 1.5 | 4.5 | 16° | 50 | 4 | 4,200 |
| | CPS 2020 | 2 | 6 | 16° | 55 | 4 | 4,200 |
| | CPS 2025 | 2.5 | 7.5 | 16° | 55 | 4 | 4,300 |
| | CPS 2030 | 3 | 9 | 16° | 60 | 6 | 5,400 |
| ◎ | CPS 2030SS | | 4.5 | — | 60 | 3 | 5,200 |
| ◎ | CPS 2030SSL | | 6 | | 100 | 3 | 7,800 |
| | CPS 2040 | 4 | 12 | 16° | 60 | 6 | 5,400 |
| ◎ | CPS 2040SS | | 6 | — | 60 | 4 | 5,200 |
| ◎ | CPS 2040SSL | | 8 | | 100 | 4 | 9,600 |
| | CPS 2050 | 5 | 15 | 16° | 60 | 6 | 6,240 |
| ◎ | CPS 2060 | 6 | 18 | — | 60 | 6 | 6,600 |
| ◎ | CPS 2080 | 8 | 24 | — | 80 | 8 | 12,100 |
| ◎ | CPS 2100 | 10 | 30 | — | 80 | 10 | 14,850 |
| ◎ | CPS 2120 | 12 | 36 | — | 90 | 12 | 22,000 |

◎ Straight shank type

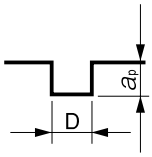
# Milling Conditions for CPS

| WORK MATERIAL | | | ABS / MC NYLON | | | ACRYLIC / POLYACETAL | | | POLYCARBONATE | | | GLASS FIBER REINFORCED POLYCARBONATE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2003** | **0.3** | 0.9 | 20,000 | 320 | 0.3 | 16,000 | 160 | 0.3 | 16,000 | 130 | 0.2 | 16,000 | 260 | 0.2 |
| **2004** | **0.4** | 1.2 | 20,000 | 400 | 0.4 | 16,000 | 160 | 0.4 | 16,000 | 130 | 0.2 | 16,000 | 260 | 0.3 |
| **2005** | **0.5** | 1.5 | 20,000 | 480 | 0.5 | 16,000 | 160 | 0.5 | 16,000 | 130 | 0.3 | 16,000 | 320 | 0.4 |
| **2006** | **0.6** | 1.8 | 20,000 | 600 | 0.6 | 16,000 | 200 | 0.5 | 16,000 | 130 | 0.3 | 16,000 | 390 | 0.5 |
| **2007** | **0.7** | 2.1 | 20,000 | 720 | 0.7 | 16,000 | 260 | 0.6 | 16,000 | 160 | 0.4 | 16,000 | 390 | 0.6 |
| **2008** | **0.8** | 2.4 | 20,000 | 800 | 0.8 | 16,000 | 320 | 0.7 | 16,000 | 160 | 0.4 | 15,200 | 430 | 0.6 |
| **2009** | **0.9** | 2.7 | 20,000 | 880 | 0.9 | 14,200 | 340 | 0.8 | 14,200 | 170 | 0.5 | 14,200 | 460 | 0.7 |
| **2010** | **1** | 3 | 20,000 | 1,000 | 1 | 14,100 | 430 | 0.9 | 14,100 | 290 | 0.5 | 14,100 | 510 | 0.8 |
| **2012** | **1.2** | 3.6 | 20,000 | 1,080 | 1.2 | 14,100 | 480 | 1.1 | 14,100 | 340 | 0.6 | 14,100 | 650 | 1 |
| **2015** | **1.5** | 4.5 | 20,000 | 1,160 | 1.5 | 12,800 | 460 | 1.4 | 12,800 | 390 | 0.8 | 13,200 | 740 | 1.2 |
| **2020** | **2** | 6 | 20,000 | 1,200 | 2 | 12,800 | 510 | 1.6 | 12,500 | 430 | 0.6 | 13,100 | 740 | 1.4 |
| **2025** | **2.5** | 7.5 | 20,000 | 1,200 | 2.5 | 12,800 | 570 | 2 | 10,200 | 450 | 0.8 | 12,700 | 760 | 1.8 |
| **2030** | **3** | 9 | 20,000 | 1,200 | 3 | 12,800 | 640 | 2.4 | 9,600 | 430 | 0.9 | 10,700 | 810 | 2.1 |
| **2030SS** | **3** | 4.5 | 20,000 | 1,200 | 3 | 12,800 | 640 | 2.4 | 9,600 | 430 | 0.9 | 10,700 | 810 | 2.1 |
| **2030SSL** | **3** | 6 | 20,000 | 1,200 | 3 | 12,800 | 640 | 2.4 | 9,600 | 430 | 0.9 | 10,700 | 810 | 2.1 |
| **2040** | **4** | 12 | 14,900 | 1,200 | 4 | 12,000 | 600 | 3.2 | 8,000 | 400 | 1.2 | 8,000 | 770 | 2.8 |
| **2040SS** | **4** | 6 | 14,900 | 1,200 | 4 | 12,000 | 600 | 3.2 | 8,000 | 400 | 1.2 | 8,000 | 770 | 2.8 |
| **2040SSL** | **4** | 8 | 14,900 | 1,200 | 4 | 12,000 | 600 | 3.2 | 8,000 | 400 | 1.2 | 8,000 | 770 | 2.8 |
| **2050** | **5** | 15 | 12,000 | 960 | 5 | 9,600 | 480 | 4 | 6,400 | 320 | 1.5 | 6,400 | 620 | 3.5 |
| **2060** | **6** | 18 | 10,000 | 800 | 6 | 8,000 | 400 | 4.8 | 5,400 | 270 | 1.8 | 5,400 | 510 | 4.2 |
| **2080** | **8** | 24 | 7,500 | 600 | 8 | 6,000 | 300 | 6.4 | 4,000 | 200 | 2.4 | 4,000 | 390 | 5.6 |
| **2100** | **10** | 30 | 6,000 | 480 | 10 | 4,800 | 240 | 8 | 3,200 | 160 | 3 | 3,200 | 310 | 7 |
| **2120** | **12** | 36 | 5,000 | 400 | 12 | 4,000 | 200 | 9.6 | 2,700 | 140 | 3.6 | 2,700 | 260 | 8.4 |

Milling Amount for Slotting (mm)

$a_p$ : Axial Depth (mm)

D : Outside Diameter (mm)




## CPS finishing conditions for side milling

Refer to the slotting parameters for spindle speed and feet rate.
Set the milling amount as below during side milling finishing.

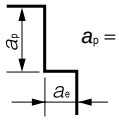
Milling Amount for Side Finishing (mm)

$a_p$ : Axial Depth (mm)

$a_e$ : Radial Depth (mm)

$a_e$ : 0.01 ~ 0.015D (Min 0.01 mm)

D : Outside Diameter (mm)




$a_p$ = 2D
length of cut or below

Note:

- Control the radial depth ($a_e$) by approximately 0.01-0.015 times of the outside diameter or set to 0.01 mm the minimum during side milling finishing.
- Increase the feed rate per flute to reduce burring on surface of softer materials.
- Chattering may occur when using a spindle with low rigidity or when milling unstable work piece. Reduce the milling amount in this case.
- Recommend to reduce the milling amount when using a machine with low spindle speed. Not recommend to reduce the feed rate.
- Adjust the milling parameters based on the overhang length.
- Recommend water soluble coolant for Aluminum Alloys and Copper.
- Recommend air blow for Plastics.
- Remove chips from the work piece to keep the milling surface quality.
- If chips clog on the tool, stop the operation and remove them accordingly.
- Straight shank type (2030SS, 2030SSL, 2040SS, 2040SSL, etc.) has smaller outside diameter than shank diameter. Prevent the shank making contact with the work piece.

**Size $\phi$0.5～$\phi$12**

# CAS

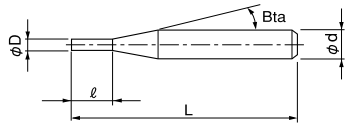
MG | 45° | Sharp Corner | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ☆ | | ○ | | | | | | |

## Features

**Designed especially for Aluminum milling.**
**45° helix angle design offers excellent cutting performance and outstanding chip evacuation.**




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

Total 19 models

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CAS 2005-0075 | 0.5 | 0.75 | 16° | 45 | 4 | 4,030 |
| CAS 2010-0150 | 1 | 1.5 | 16° | 45 | 4 | 3,480 |
| CAS 2015-0225 | 1.5 | 2.25 | 16° | 45 | 4 | 3,480 |
| CAS 2020-0300 | 2 | 3 | 16° | 45 | 4 | 3,480 |
| CAS 2025-0375 | 2.5 | 3.75 | 16° | 50 | 6 | 4,560 |
| CAS 2030-0450 | 3 | 4.5 | 16° | 50 | 6 | 4,560 |
| CAS 2030-0900 | | 9 | | 50 | 6 | 6,300 |
| CAS 2040-0600 | 4 | 6 | 16° | 50 | 6 | 4,680 |
| CAS 2040-1200 | | 12 | | 50 | 6 | 6,510 |
| CAS 2050-0750 | 5 | 7.5 | 16° | 50 | 6 | 5,160 |
| CAS 2050-1500 | | 15 | | 50 | 6 | 7,440 |
| CAS 2060-0900 | 6 | 9 | — | 50 | 6 | 5,400 |
| CAS 2060-1500 | | 15 | | 50 | 6 | 7,560 |
| CAS 2080-1200 | 8 | 12 | — | 80 | 8 | 7,680 |
| CAS 2080-2000 | | 20 | | 80 | 8 | 10,440 |
| CAS 2100-1500 | 10 | 15 | — | 80 | 10 | 10,080 |
| CAS 2100-2500 | | 25 | | 80 | 10 | 13,200 |
| CAS 2120-1800 | 12 | 18 | — | 90 | 12 | 14,640 |
| CAS 2120-3000 | | 30 | | 90 | 12 | 18,600 |

# Milling Conditions for CAS

◆Slotting

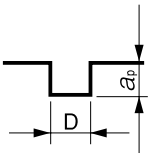
| WORK MATERIAL | | ALUMINUM ALLOYS etc. A5052 etc. | | |
|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2005-0075** | **0.5** | 25,000 | 250 | 0.75 |
| **2010-0150** | **1** | 25,000 | 500 | 1.5 |
| **2015-0225** | **1.5** | 25,000 | 750 | 2.25 |
| **2020-0300** | **2** | 22,000 | 880 | 3 |
| **2025-0375** | **2.5** | 19,000 | 950 | 3.75 |
| **2030-0450** | **3** | 16,000 | 1,600 | 1.5 |
| **2040-0600** | **4** | 12,000 | 1,200 | 2 |
| **2050-0750** | **5** | 9,600 | 1,920 | 2.5 |
| **2060-0900** | **6** | 8,000 | 1,600 | 3 |
| **2080-1200** | **8** | 6,000 | 1,200 | 4 |
| **2100-1500** | **10** | 12,000 | 2,400 | 5 |
| **2120-1800** | **12** | 10,000 | 2,000 | 6 |
| Milling Amount (mm) | | D≦2.5 $a_p$=1.5D<br>D≧3 $a_p$=0.5D | | |

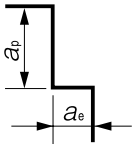
◆High speed milling

| WORK MATERIAL | | ALUMINUM ALLOYS etc. A5052 etc. | | | |
|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2005-0075** | **0.5** | 25,000 | 1,000 | 0.75 | 0.1 |
| **2010-0150** | **1** | 25,000 | 1,250 | 1.5 | 0.2 |
| **2015-0225** | **1.5** | 25,000 | 1,500 | 2.25 | 0.3 |
| **2020-0300** | **2** | 22,000 | 1,760 | 3 | 0.4 |
| **2025-0375** | **2.5** | 19,000 | 1,900 | 3.75 | 0.5 |
| **2030-0450** | **3** | 20,000 | 4,000 | 4.5 | 0.6 |
| **2040-0600** | **4** | 18,200 | 3,640 | 6 | 0.8 |
| **2050-0750** | **5** | 17,000 | 3,400 | 7.5 | 1 |
| **2060-0900** | **6** | 16,000 | 3,200 | 9 | 1.2 |
| **2080-1200** | **8** | 14,400 | 2,880 | 12 | 1.6 |
| **2100-1500** | **10** | 13,200 | 2,640 | 15 | 2 |
| **2120-1800** | **12** | 12,000 | 2,400 | 18 | 2.4 |
| Milling Amount (mm) | | $a_p$=1.5D<br>$a_e$=0.2D | | | |

◆Side milling

| WORK MATERIAL | | | ALUMINUM ALLOYS etc. A5052 etc. | | | |
|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2005-0075** | **0.5** | 0.75 | 25,000 | 1,000 | 0.75 | 0.15 |
| **2010-0150** | **1** | 1.5 | 25,000 | 1,250 | 1.5 | 0.3 |
| **2015-0225** | **1.5** | 2.25 | 25,000 | 1,500 | 2.25 | 0.45 |
| **2020-0300** | **2** | 3 | 22,000 | 1,760 | 3 | 0.6 |
| **2025-0375** | **2.5** | 3.75 | 19,000 | 1,900 | 3.75 | 0.75 |
| **2030-0450** | **3** | 4.5 | 16,000 | 3,200 | 4.5 | 0.6 |
| **2030-0900** | | 9 | | | 4.5 | 0.6 |
| **2040-0600** | **4** | 6 | 12,000 | 2,400 | 6 | 0.8 |
| **2040-1200** | | 12 | | | 6 | 0.8 |
| **2050-0750** | **5** | 7.5 | 9,600 | 1,920 | 7.5 | 1 |
| **2050-1500** | | 15 | | | 7.5 | 1 |
| **2060-0900** | **6** | 9 | 8,000 | 1,600 | 9 | 1.2 |
| **2060-1500** | | 15 | | | 9 | 1.2 |
| **2080-1200** | **8** | 12 | 6,000 | 1,200 | 12 | 1.6 |
| **2080-2000** | | 20 | | | 12 | 1.6 |
| **2100-1500** | **10** | 15 | 4,800 | 960 | 15 | 2 |
| **2100-2500** | | 25 | | | 15 | 2 |
| **2120-1800** | **12** | 18 | 4,000 | 800 | 18 | 2.4 |
| **2120-3000** | | 30 | | | 18 | 2.4 |
| Milling Amount (mm) | | | Length of Cut 1.5D | $a_p$=1.5D D≦2.5 $a_e$=0.3D D≧3 $a_e$=0.2D | Length of Cut 2.5、3D | $a_p$=1.5D $a_e$=0.2D |




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Note:
・Recommend using a non-contact measuring device to avoid damaging the sharp corner.
・Recommend side milling for finishing.
・Recommend water soluble coolant.

## Size φ1～φ20

# CZS

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

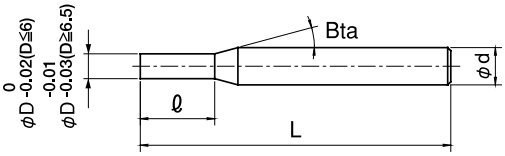
Patented in Japan, China, Korea, Taiwan, Germany, Switzerland, Liechtenstein, and Thailand

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | ○ | | ◎ | | | ○ | ○ | | |

## Features

**The new tip geometry is ideal for vertical milling on horizontal surfaces.**
**The selected carbide grade offers excellent resistance to chipping.**
**The low friction characteristics of the coating offers excellent chip evacuation and wear resistance.**




The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece. Actual measurement is necessary when using longer length of cut than the written length.

Total 89 models

Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CZS 4010-0150 | 1 | 1.5 | 16° | 50 | 4 | 6,900 |
| CZS 4010-0250 | | 2.5 | | 50 | 4 | 6,900 |
| CZS 4011-0250 | 1.1 | 2.5 | 16° | 50 | 4 | 8,630 |
| CZS 4012-0250 | 1.2 | 2.5 | 16° | 50 | 4 | 8,630 |
| CZS 4013-0300 | 1.3 | 3 | 16° | 50 | 4 | 8,630 |
| CZS 4014-0300 | 1.4 | 3 | 16° | 50 | 4 | 8,630 |
| CZS 4015-0225 | 1.5 | 2.25 | 16° | 50 | 4 | 6,900 |
| CZS 4015-0400 | | 4 | | 50 | 4 | 6,900 |
| CZS 4016-0400 | 1.6 | 4 | 16° | 50 | 4 | 8,630 |
| CZS 4017-0400 | 1.7 | 4 | 16° | 50 | 4 | 8,630 |
| CZS 4018-0400 | 1.8 | 4 | 16° | 50 | 4 | 8,630 |
| CZS 4019-0400 | 1.9 | 4 | 16° | 50 | 4 | 8,630 |

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Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CZS 4020-0300 | 2 | 3 | 16° | 50 | 4 | 6,300 |
| CZS 4020-0600 | | 6 | | 50 | 4 | 6,300 |
| CZS 4021-0600 | 2.1 | 6 | 16° | 50 | 4 | 7,870 |
| CZS 4022-0600 | 2.2 | 6 | 16° | 50 | 4 | 7,870 |
| CZS 4023-0600 | 2.3 | 6 | 16° | 50 | 4 | 7,870 |
| CZS 4024-0600 | 2.4 | 6 | 16° | 50 | 4 | 7,870 |
| CZS 4025-0375 | 2.5 | 3.75 | 16° | 50 | 4 | 6,300 |
| CZS 4025-0800 | | 8 | | 50 | 4 | 6,300 |
| CZS 4026-0800 | 2.6 | 8 | 16° | 50 | 4 | 7,870 |
| CZS 4027-0800 | 2.7 | 8 | 16° | 50 | 4 | 7,870 |
| CZS 4028-0800 | 2.8 | 8 | 16° | 50 | 4 | 7,870 |
| CZS 4029-0800 | 2.9 | 8 | 16° | 50 | 4 | 7,870 |
| CZS 4030-0450 | 3 | 4.5 | 16° | 60 | 6 | 7,500 |
| CZS 4030-0800 | | 8 | | 60 | 6 | 7,500 |
| CZS 4031-0800 | 3.1 | 8 | 16° | 60 | 6 | 9,400 |
| CZS 4032-0800 | 3.2 | 8 | 16° | 60 | 6 | 9,400 |
| CZS 4033-0800 | 3.3 | 8 | 16° | 60 | 6 | 9,400 |
| CZS 4034-0800 | 3.4 | 8 | 16° | 60 | 6 | 9,400 |
| CZS 4035-1000 | 3.5 | 10 | 16° | 60 | 6 | 8,700 |
| CZS 4036-1000 | 3.6 | 10 | 16° | 60 | 6 | 9,400 |
| CZS 4037-1000 | 3.7 | 10 | 16° | 60 | 6 | 9,400 |
| CZS 4038-1000 | 3.8 | 10 | 16° | 60 | 6 | 9,400 |
| CZS 4039-1000 | 3.9 | 10 | 16° | 60 | 6 | 9,400 |
| CZS 4040-0600 | 4 | 6 | 16° | 60 | 6 | 7,800 |
| CZS 4040-1100 | | 11 | | 60 | 6 | 7,800 |
| CZS 4041-1100 | 4.1 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4042-1100 | 4.2 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4043-1100 | 4.3 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4044-1100 | 4.4 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4045-1100 | 4.5 | 11 | 16° | 60 | 6 | 9,300 |
| CZS 4046-1100 | 4.6 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4047-1100 | 4.7 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4048-1100 | 4.8 | 11 | 16° | 60 | 6 | 9,750 |
| CZS 4049-1100 | 4.9 | 11 | 16° | 60 | 6 | 9,750 |

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Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CZS 4050-0750 | 5 | 7.5 | 16° | 60 | 6 | 8,400 |
| CZS 4050-1300 | | 13 | | 60 | 6 | 8,400 |
| CZS 4051-1300 | 5.1 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4052-1300 | 5.2 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4053-1300 | 5.3 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4054-1300 | 5.4 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4055-1300 | 5.5 | 13 | 16° | 60 | 6 | 9,600 |
| CZS 4056-1300 | 5.6 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4057-1300 | 5.7 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4058-1300 | 5.8 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4059-1300 | 5.9 | 13 | 16° | 60 | 6 | 10,500 |
| CZS 4060-0900 | 6 | 9 | — | 60 | 6 | 8,700 |
| CZS 4060-1300 | | 13 | | 60 | 6 | 8,700 |
| CZS 4060-1800 | | 18 | | 60 | 6 | 9,600 |
| CZS 4065-1600 | 6.5 | 16 | 16° | 70 | 8 | 12,600 |
| CZS 4070-1050 | 7 | 10.5 | 16° | 70 | 8 | 11,300 |
| CZS 4070-1600 | | 16 | | 70 | 8 | 11,300 |
| CZS 4070-2100 | | 21 | | 70 | 8 | 12,500 |
| CZS 4075-1600 | 7.5 | 16 | 16° | 70 | 8 | 12,600 |
| CZS 4080-1200 | 8 | 12 | — | 70 | 8 | 11,300 |
| CZS 4080-1900 | | 19 | | 70 | 8 | 11,300 |
| CZS 4080-2400 | | 24 | | 70 | 8 | 12,500 |
| CZS 4085-1900 | 8.5 | 19 | 16° | 80 | 10 | 14,600 |
| CZS 4090-1350 | 9 | 13.5 | 16° | 80 | 10 | 13,200 |
| CZS 4090-1900 | | 19 | | 80 | 10 | 13,200 |
| CZS 4090-2700 | | 27 | | 80 | 10 | 16,700 |
| CZS 4095-1900 | 9.5 | 19 | 16° | 80 | 10 | 14,600 |
| CZS 4100-1500 | 10 | 15 | — | 80 | 10 | 13,200 |
| CZS 4100-2200 | | 22 | | 80 | 10 | 13,200 |
| CZS 4100-3000 | | 30 | | 80 | 10 | 14,600 |
| CZS 4105-2200 | 10.5 | 22 | 16° | 100 | 12 | 21,000 |
| CZS 4110-1650 | 11 | 16.5 | 16° | 100 | 12 | 19,300 |
| CZS 4110-2200 | | 22 | | 100 | 12 | 19,300 |
| CZS 4110-3300 | | 33 | | 100 | 12 | 23,000 |

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Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **CZS 4115-2200** | 11.5 | 22 | 16° | 100 | 12 | 21,000 |
| **CZS 4120-1800** | 12 | 18 | — | 100 | 12 | 19,300 |
| **CZS 4120-2600** | | 26 | | 100 | 12 | 19,300 |
| **CZS 4120-3600** | | 36 | | 100 | 12 | 21,300 |
| **CZS 4130-2600** | 13 | 26 | — | 110 | 12 | 26,500 |
| **CZS 4160-2400** | 16 | 24 | — | 110 | 16 | 54,200 |
| **CZS 4160-3200** | | 32 | | 110 | 16 | 57,000 |
| **CZS 4200-3000** | 20 | 30 | — | 125 | 20 | 79,800 |
| **CZS 4200-4000** | | 40 | | 125 | 20 | 84,000 |

**CZS Series S50C Milling Video**

## Milling Conditions for CZS

◆1.5D flute length type

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0150** | **1** | 1.5 | 18,000 | 150 | 1 | 200 | 1 | 1,200 | 1.5 | 0.1※ |
| **4015-0225** | **1.5** | 2.25 | 16,000 | 200 | 1.5 | 550 | 1.5 | 1,800 | 2.25 | 0.15※ |
| **4020-0300** | **2** | 3 | 12,000 | 200 | 2 | 550 | 2 | 1,800 | 3 | 0.2※ |
| **4025-0375** | **2.5** | 3.75 | 10,000 | 300 | 2.5 | 950 | 2.5 | 2,400 | 3.75 | 0.25※ |
| **4030-0450** | **3** | 4.5 | 8,500 | 300 | 3 | 950 | 3 | 2,400 | 4.5 | 0.3※ |
| **4040-0600** | **4** | 6 | 7,200 | 300 | 4 | 950 | 4 | 1,350 | 6 | 0.8 |
| **4050-0750** | **5** | 7.5 | 6,000 | 300 | 5 | 1,000 | 5 | 1,500 | 7.5 | 1 |
| **4060-0900** | **6** | 9 | 5,000 | 300 | 6 | 1,000 | 6 | 1,600 | 9 | 1.2 |
| **4070-1050** | **7** | 10.5 | 4,200 | 300 | 7 | 1,000 | 7 | 1,500 | 10.5 | 1.4 |
| **4080-1200** | **8** | 12 | 3,500 | 300 | 8 | 950 | 8 | 1,400 | 12 | 1.6 |
| **4090-1350** | **9** | 13.5 | 2,900 | 300 | 9 | 950 | 9 | 1,300 | 13.5 | 1.8 |
| **4100-1500** | **10** | 15 | 2,300 | 300 | 10 | 900 | 10 | 1,200 | 15 | 2 |
| **4110-1650** | **11** | 16.5 | 2,050 | 280 | 11 | 900 | 11 | 1,150 | 16.5 | 2.2 |
| **4120-1800** | **12** | 18 | 1,850 | 260 | 12 | 850 | 12 | 1,100 | 18 | 2.4 |
| **4160-2400** | **16** | 24 | 1,380 | 150 | Step Amount: 1.6 Max depth 10※ | 830 | 8※ | 550 | 24 | 3.2 |
| **4200-3000** | **20** | 30 | 1,000 | 150 | Step Amount: 2 Max depth 10※ | 830 | 10※ | 500 | 30 | 4 |
| Milling Amount (mm) | | | | ※ Depth: 1D Depth: 0.1D (Max 10 mm) | | ※ $a_p$:1D $a_p$:0.5D | | ※ $a_p$:Length of Cut $a_e$:0.2D $a_e$:0.1D | | |

| WORK MATERIAL | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0150** | **1** | 1.5 | 14,500 | 50 | 1 | 150 | 1 | 900 | 1.5 | 0.1※ |
| **4015-0225** | **1.5** | 2.25 | 13,000 | 80 | 1.5 | 400 | 1.5 | 1,200 | 2.25 | 0.15※ |
| **4020-0300** | **2** | 3 | 10,000 | 80 | 2 | 400 | 2 | 1,200 | 3 | 0.2※ |
| **4025-0375** | **2.5** | 3.75 | 8,000 | 100 | 2.5 | 650 | 2.5 | 1,800 | 3.75 | 0.25※ |
| **4030-0450** | **3** | 4.5 | 6,800 | 100 | 3 | 650 | 3 | 1,800 | 4.5 | 0.3※ |
| **4040-0600** | **4** | 6 | 5,700 | 110 | 4 | 650 | 4 | 1,000 | 6 | 0.8 |
| **4050-0750** | **5** | 7.5 | 4,800 | 110 | 5 | 700 | 5 | 1,100 | 7.5 | 1 |
| **4060-0900** | **6** | 9 | 4,000 | 120 | 6 | 700 | 6 | 1,200 | 9 | 1.2 |
| **4070-1050** | **7** | 10.5 | 3,400 | 110 | 6※1 | 700 | 7 | 1,150 | 10.5 | 1.4 |
| **4080-1200** | **8** | 12 | 2,700 | 110 | 6※1 | 700 | 8 | 1,050 | 12 | 1.6 |
| **4090-1350** | **9** | 13.5 | 2,300 | 100 | 6※1 | 700 | 9 | 1,000 | 13.5 | 1.8 |
| **4100-1500** | **10** | 15 | 1,900 | 100 | 6※1 | 650 | 10 | 900 | 15 | 2 |
| **4110-1650** | **11** | 16.5 | 1,700 | 90 | 6※1 | 650 | 11 | 850 | 16.5 | 2.2 |
| **4120-1800** | **12** | 18 | 1,550 | 80 | 6※1 | 600 | 12 | 800 | 18 | 2.4 |
| **4160-2400** | **16** | 24 | 1,100 | 150 | Step Amount: 1.6 Max 10 depth※2 | 400 | 8※ | 440 | 24 | 3.2 |
| **4200-3000** | **20** | 30 | 880 | 150 | Step Amount: 2 Max 10 depth※2 | 400 | 10※ | 440 | 30 | 4 |
| Milling Amount (mm) | | | | ※1 Depth: 1D Max 6 mm ※2 0.1D depth (Max 10 mm) | | ※ $a_p$:1D $a_p$:0.5D | | ※ $a_p$:Length of Cut $a_e$:0.2D $a_e$:0.1D | | |

# Milling Conditions for CZS

| WORK MATERIAL | | | STRUCTURAL STEELS SS400 Recommend water soluble or oil coolant. (Use cutting oils for vertical milling.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0150** | **1** | 1.5 | 18,000 | 100 | 0.25※1 | 400 | 0.25※1 | 1,200 | 1.5 | 0.1※ |
| **4015-0225** | **1.5** | 2.25 | 16,000 | 100 | 0.375※1 | 600 | 0.375※1 | 1,800 | 2.25 | 0.15※ |
| **4020-0300** | **2** | 3 | 12,000 | 200 | 0.5※1 | 600 | 0.5※1 | 1,800 | 3 | 0.2※ |
| **4025-0375** | **2.5** | 3.75 | 10,000 | 300 | 1.25 | 950 | 2.5 | 2,400 | 3.75 | 0.25※ |
| **4030-0450** | **3** | 4.5 | 8,500 | 300 | 1.5 | 950 | 3 | 2,400 | 4.5 | 0.3※ |
| **4040-0600** | **4** | 6 | 7,200 | 300 | 2 | 950 | 4 | 1,350 | 6 | 0.8 |
| **4050-0750** | **5** | 7.5 | 6,000 | 300 | 2.5 | 1,000 | 5 | 1,500 | 7.5 | 1 |
| **4060-0900** | **6** | 9 | 5,000 | 300 | 3 | 1,000 | 6 | 1,600 | 9 | 1.2 |
| **4070-1050** | **7** | 10.5 | 4,200 | 300 | 3.5 | 900 | 7 | 1,500 | 10.5 | 1.4 |
| **4080-1200** | **8** | 12 | 3,500 | 250 | 4 | 850 | 8 | 1,400 | 12 | 1.6 |
| **4090-1350** | **9** | 13.5 | 2,900 | 250 | 4.5 | 800 | 9 | 1,300 | 13.5 | 1.8 |
| **4100-1500** | **10** | 15 | 2,300 | 200 | 5 | 750 | 10 | 1,200 | 15 | 2 |
| **4110-1650** | **11** | 16.5 | 2,050 | 200 | 5.5 | 750 | 11 | 1,150 | 16.5 | 2.2 |
| **4120-1800** | **12** | 18 | 1,850 | 180 | 6 | 700 | 12 | 1,100 | 18 | 2.4 |
| **4160-2400** | **16** | 24 | 1,380 | 150 | Step Amount: 1.6 Max 10 depth※2 | 830 | 8※2 | 550 | 24 | 3.2 |
| **4200-3000** | **20** | 30 | 1,000 | 150 | Step Amount: 2 Max 10 depth※2 | 830 | 10※2 | 500 | 30 | 4 |
| Milling Amount (mm) | | | | Depth: 0.5D<br>※1 Depth: 0.25D<br>※2 Depth: 0.1D<br>(Max 10 mm) | | $a_p$:1D<br>※1 $a_p$:0.25D<br>※2 $a_p$:0.5D | | $a_p$:Length of Cut<br>$a_e$:0.2D<br>※ $a_e$:0.1D | | |

| WORK MATERIAL | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0150** | **1** | 1.5 | 14,500 | 150 | 0.25 | 250 | 1 | 1,000 | 1.5 | 0.05※ |
| **4015-0225** | **1.5** | 2.25 | 13,000 | 150 | 0.375 | 270 | 1.5 | 1,500 | 2.25 | 0.075※ |
| **4020-0300** | **2** | 3 | 10,000 | 100 | 0.5 | 270 | 2 | 1,500 | 3 | 0.1※ |
| **4025-0375** | **2.5** | 3.75 | 8,000 | 100 | 0.625 | 300 | 2.5 | 2,000 | 3.75 | 0.125※ |
| **4030-0450** | **3** | 4.5 | 6,800 | 80 | 0.75 | 300 | 3 | 2,000 | 4.5 | 0.15※ |
| **4040-0600** | **4** | 6 | 5,700 | 90 | 1 | 350 | 4 | 1,150 | 6 | 0.4 |
| **4050-0750** | **5** | 7.5 | 4,800 | 100 | 1.25 | 400 | 5 | 1,300 | 7.5 | 0.5 |
| **4060-0900** | **6** | 9 | 4,000 | 100 | 1.5 | 400 | 6 | 1,300 | 9 | 0.6 |
| **4070-1050** | **7** | 10.5 | 3,200 | 100 | 1.75 | 350 | 7 | 1,300 | 10.5 | 0.7 |
| **4080-1200** | **8** | 12 | 2,400 | 90 | 2※ | 300 | 8 | 1,200 | 12 | 0.8 |
| **4090-1350** | **9** | 13.5 | 1,800 | 90 | 2※ | 250 | 9 | 1,100 | 13.5 | 0.9 |
| **4100-1500** | **10** | 15 | 1,400 | 80 | 2※ | 200 | 10 | 1,000 | 15 | 1 |
| **4110-1650** | **11** | 16.5 | 1,250 | 80 | 2※ | 200 | 11 | 900 | 16.5 | 1.1 |
| **4120-1800** | **12** | 18 | 1,250 | 70 | 2※ | 180 | 12 | 900 | 18 | 1.2 |
| **4160-2400** | **16** | 24 | 1,250 | 70 | 2※ | 450 | 6.4※ | 440 | 24 | 1.6 |
| **4200-3000** | **20** | 30 | 1,000 | 70 | 2※ | 450 | 8※ | 440 | 30 | 2 |
| Milling Amount (mm) | | | | Depth: 0.25D<br>※ Max 2 mm depth | | $a_p$:1D<br>※ $a_p$:0.4D | | $a_p$:Length of Cut<br>$a_e$:0.1D<br>※ $a_e$:0.05D | | |

## Milling Conditions for CZS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0150** | **1** | 1.5 | 14,500 | 100 | 0.5 | 120 | 1 | 600 | 1.5 | 0.05※ |
| **4015-0225** | **1.5** | 2.25 | 12,000 | 150 | 0.75 | 320 | 1.5 | 900 | 2.25 | 0.075※ |
| **4020-0300** | **2** | 3 | 9,000 | 150 | 1 | 320 | 2 | 900 | 3 | 0.1※ |
| **4025-0375** | **2.5** | 3.75 | 7,500 | 200 | 1.25 | 520 | 2.5 | 1,200 | 3.75 | 0.125※ |
| **4030-0450** | **3** | 4.5 | 6,800 | 200 | 1.5 | 520 | 3 | 1,200 | 4.5 | 0.15※ |
| **4040-0600** | **4** | 6 | 5,100 | 220 | 2 | 520 | 4 | 700 | 6 | 0.4 |
| **4050-0750** | **5** | 7.5 | 4,050 | 240 | 2.5 | 520 | 5 | 850 | 7.5 | 0.5 |
| **4060-0900** | **6** | 9 | 3,300 | 240 | 3 | 520 | 6 | 1,000 | 9 | 0.6 |
| **4070-1050** | **7** | 10.5 | 2,900 | 240 | 3※ | 500 | 6※1 | 1,000 | 10.5 | 0.7 |
| **4080-1200** | **8** | 12 | 2,300 | 220 | 3※ | 470 | 6※1 | 900 | 12 | 0.8 |
| **4090-1350** | **9** | 13.5 | 1,900 | 220 | 3※ | 470 | 6※1 | 900 | 13.5 | 0.9 |
| **4100-1500** | **10** | 15 | 1,500 | 200 | 3※ | 450 | 6※1 | 900 | 15 | 1 |
| **4110-1650** | **11** | 16.5 | 1,350 | 200 | 3※ | 450 | 6※1 | 850 | 16.5 | 1.1 |
| **4120-1800** | **12** | 18 | 1,200 | 180 | 3※ | 420 | 6※1 | 800 | 18 | 1.2 |
| **4160-2400** | **16** | 24 | 1,110 | 150 | 3※ | 400 | 4~8※2 | 440 | 24 | 0.8※ |
| **4200-3000** | **20** | 30 | 880 | 150 | 3※ | 400 | 5~10※2 | 440 | 30 | 1※ |
| Milling Amount (mm) | | | | ※ Depth: 0.5D Max 3 mm depth | | $a_p$:1D ※1 $a_p$:Max 6 mm ※2 $a_p$:0.25~0.5D | | $a_p$:Length of Cut $a_e$:0.1D ※ $a_e$:0.05D | | |

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0150** | **1** | 1.5 | 12,900 | 80 | 0.25 | 50 | 0.25※1 | 300 | 1.5 | 0.05※ |
| **4015-0225** | **1.5** | 2.25 | 10,000 | 150 | 0.375 | 100 | 0.375※1 | 650 | 2.25 | 0.075※ |
| **4020-0300** | **2** | 3 | 8,200 | 150 | 0.5 | 150 | 0.5※1 | 650 | 3 | 0.1※ |
| **4025-0375** | **2.5** | 3.75 | 7,000 | 250 | 0.625 | 300 | 2.5 | 1,000 | 3.75 | 0.125※ |
| **4030-0450** | **3** | 4.5 | 6,120 | 250 | 0.75 | 300 | 3 | 1,000 | 4.5 | 0.15※ |
| **4040-0600** | **4** | 6 | 5,000 | 220 | 1 | 320 | 4 | 600 | 6 | 0.4 |
| **4050-0750** | **5** | 7.5 | 4,300 | 180 | 1.25 | 340 | 5 | 800 | 7.5 | 0.5 |
| **4060-0900** | **6** | 9 | 3,600 | 160 | 1.5 | 360 | 6 | 1,000 | 9 | 0.6 |
| **4070-1050** | **7** | 10.5 | 2,800 | 160 | 1.5※ | 320 | 7 | 1,000 | 10.5 | 0.7 |
| **4080-1200** | **8** | 12 | 2,100 | 150 | 1.5※ | 280 | 8 | 1,000 | 12 | 0.8 |
| **4090-1350** | **9** | 13.5 | 1,600 | 130 | 1.5※ | 240 | 9 | 950 | 13.5 | 0.9 |
| **4100-1500** | **10** | 15 | 1,250 | 120 | 1.5※ | 200 | 10 | 750 | 15 | 1 |
| **4110-1650** | **11** | 16.5 | 1,150 | 110 | 1.5※ | 190 | 11 | 720 | 16.5 | 1.1 |
| **4120-1800** | **12** | 18 | 1,050 | 110 | 1.5※ | 180 | 12 | 700 | 18 | 1.2 |
| **4160-2400** | **16** | 24 | 800 | 50 | 1.5※ | 300 | 1.6※2 | 320 | 24 | 0.8※ |
| **4200-3000** | **20** | 30 | 630 | 50 | 1.5※ | 300 | 2※2 | 320 | 30 | 1※ |
| Milling Amount (mm) | | | | ※ Depth: 0.25D Max 1.5 mm | | $a_p$:1D ※1 $a_p$:0.25D ※2 $a_p$:0.1D | | $a_p$:Length of Cut $a_e$:0.1D ※ $a_e$:0.05D | | |

# Milling Conditions for CZS

◆Standard flute length type

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 18,000 | 100 | 1 | 200 | 0.5※ | 1,200 | 1.5 | 0.1※ |
| **4020-0600** | **2** | 6 | 12,000 | 150 | 2 | 400 | 1※ | 1,800 | 3 | 0.2※ |
| **4030-0800** | **3** | 8 | 8,500 | 250 | 3 | 600 | 3 | 2,400 | 4.5 | 0.3※ |
| **4040-1100** | **4** | 11 | 7,200 | 270 | 4 | 650 | 4 | 1,350 | 6 | 0.8 |
| **4050-1300** | **5** | 13 | 6,000 | 300 | 5 | 700 | 5 | 1,500 | 7.5 | 1 |
| **4060-1300** | **6** | 13 | 5,000 | 300 | 6 | 700 | 6 | 1,600 | 9 | 1.2 |
| **4070-1600** | **7** | 16 | 4,200 | 300 | 7 | 700 | 7 | 1,500 | 10.5 | 1.4 |
| **4080-1900** | **8** | 19 | 3,500 | 300 | 8 | 700 | 8 | 1,400 | 12 | 1.6 |
| **4090-1900** | **9** | 19 | 2,900 | 300 | 9 | 700 | 9 | 1,300 | 13.5 | 1.8 |
| **4100-2200** | **10** | 22 | 2,300 | 300 | 10 | 700 | 10 | 1,200 | 15 | 2 |
| **4110-2200** | **11** | 22 | 2,050 | 280 | 11 | 670 | 11 | 1,150 | 16.5 | 2.2 |
| **4120-2600** | **12** | 26 | 1,850 | 260 | 12 | 650 | 12 | 1,100 | 18 | 2.4 |
| **4130-2600** | **13** | 26 | 1,400 | 80 | 13 | 300 | 13 | 700 | 19.5 | 1.3※ |
| **4160-3200** | **16** | 32 | 1,380 | 150 | Step Amount: 1.6 Max 10 depth※ | 830 | 8※ | 550 | 24 | 3.2 |
| **4200-4000** | **20** | 40 | 1,000 | 150 | Step Amount: 2 Max 10 depth※ | 830 | 10※ | 500 | 30 | 4 |
| Milling Amount (mm) | | | | ※ Depth: 1D Depth: 0.1D (Max 10 mm) | | $a_p$:1D ※ $a_p$:0.5D | | $a_p$:1.5D $a_e$:0.2D ※ $a_e$:0.1D | | |

| WORK MATERIAL | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 14,500 | 50 | 1 | 150 | 0.5※ | 900 | 1.5 | 0.1※ |
| **4020-0600** | **2** | 6 | 10,000 | 80 | 2 | 300 | 1※ | 1,200 | 3 | 0.2※ |
| **4030-0800** | **3** | 8 | 6,800 | 100 | 3 | 400 | 3 | 1,800 | 4.5 | 0.3※ |
| **4040-1100** | **4** | 11 | 5,700 | 110 | 4 | 450 | 4 | 1,000 | 6 | 0.8 |
| **4050-1300** | **5** | 13 | 4,800 | 110 | 5 | 500 | 5 | 1,100 | 7.5 | 1 |
| **4060-1300** | **6** | 13 | 4,000 | 120 | 6 | 500 | 6 | 1,200 | 9 | 1.2 |
| **4070-1600** | **7** | 16 | 3,400 | 110 | 6※1 | 500 | 7 | 1,150 | 10.5 | 1.4 |
| **4080-1900** | **8** | 19 | 2,700 | 110 | 6※1 | 500 | 8 | 1,050 | 12 | 1.6 |
| **4090-1900** | **9** | 19 | 2,300 | 100 | 6※1 | 500 | 9 | 1,000 | 13.5 | 1.8 |
| **4100-2200** | **10** | 22 | 1,900 | 100 | 6※1 | 500 | 10 | 900 | 15 | 2 |
| **4110-2200** | **11** | 22 | 1,700 | 90 | 6※1 | 450 | 11 | 850 | 16.5 | 2.2 |
| **4120-2600** | **12** | 26 | 1,550 | 80 | 6※1 | 450 | 12 | 800 | 18 | 2.4 |
| **4130-2600** | **13** | 26 | 1,100 | 25 | 6※1 | 180 | 13 | 550 | 19.5 | 1.3※ |
| **4160-3200** | **16** | 32 | 1,100 | 150 | Step Amount: 1.6 Max 10 depth※2 | 300 | 8※ | 440 | 24 | 3.2 |
| **4200-4000** | **20** | 40 | 880 | 150 | Step Amount: 2 Max 10 depth※2 | 300 | 10※ | 440 | 30 | 4 |
| Milling Amount (mm) | | | | ※1 Depth: 1D Max 6 mm ※2 Depth: 0.1D (Max 10 mm) | | $a_p$:1D ※ $a_p$:0.5D | | $a_p$:1.5D $a_e$:0.2D ※ $a_e$:0.1D | | |

## Milling Conditions for CZS

| WORK MATERIAL | | | STRUCTURAL STEELS SS400 Recommend water soluble or oil coolant. (Use cutting oils for vertical milling.) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 18,000 | 100 | 0.25※1 | 400 | 0.25※1 | 1,200 | 1.5 | 0.1※ |
| **4020-0600** | **2** | 6 | 12,000 | 200 | 0.5※1 | 600 | 0.5※1 | 1,800 | 3 | 0.2※ |
| **4030-0800** | **3** | 8 | 8,500 | 300 | 1.5 | 600 | 3 | 2,400 | 4.5 | 0.3※ |
| **4040-1100** | **4** | 11 | 7,200 | 300 | 2 | 650 | 4 | 1,350 | 6 | 0.8 |
| **4050-1300** | **5** | 13 | 6,000 | 300 | 2.5 | 700 | 5 | 1,500 | 7.5 | 1 |
| **4060-1300** | **6** | 13 | 5,000 | 300 | 3 | 700 | 6 | 1,600 | 9 | 1.2 |
| **4070-1600** | **7** | 16 | 4,200 | 270 | 3.5 | 700 | 7 | 1,500 | 10.5 | 1.4 |
| **4080-1900** | **8** | 19 | 3,500 | 250 | 4 | 700 | 8 | 1,400 | 12 | 1.6 |
| **4090-1900** | **9** | 19 | 2,900 | 220 | 4.5 | 700 | 9 | 1,300 | 13.5 | 1.8 |
| **4100-2200** | **10** | 22 | 2,300 | 200 | 5 | 700 | 10 | 1,200 | 15 | 2 |
| **4110-2200** | **11** | 22 | 2,050 | 190 | 5.5 | 680 | 11 | 1,150 | 16.5 | 2.2 |
| **4120-2600** | **12** | 26 | 1,850 | 180 | 6 | 650 | 12 | 1,100 | 18 | 2.4 |
| **4130-2600** | **13** | 26 | 1,100 | 55 | 6.5 | 180 | 13 | 550 | 19.5 | 1.3※ |
| **4160-3200** | **16** | 32 | 1,380 | 150 | Step Amount: 1.6 Max 10 depth※2 | 830 | 8※2 | 550 | 24 | 3.2 |
| **4200-4000** | **20** | 40 | 1,000 | 150 | Step Amount: 2 Max 10 depth※2 | 830 | 10※2 | 500 | 30 | 4 |
| Milling Amount (mm) | | | | Depth: 0.5D<br>※1 Depth: 0.25D<br>※2 Depth: 0.1D<br>(Max 10 mm) | | $a_p$:1D<br>※1 $a_p$:0.25D<br>※2 $a_p$:0.5D | | $a_p$:1.5D<br>$a_e$:0.2D<br>※ $a_e$:0.1D | | |

| WORK MATERIAL | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 14,500 | 150 | 0.25 | 250 | 0.5 | 1,000 | 1.5 | 0.05※ |
| **4020-0600** | **2** | 6 | 10,000 | 100 | 0.5 | 270 | 1 | 1,500 | 3 | 0.1※ |
| **4030-0800** | **3** | 8 | 6,800 | 80 | 0.75 | 300 | 1.5 | 2,000 | 4.5 | 0.15※ |
| **4040-1100** | **4** | 11 | 5,700 | 90 | 1 | 350 | 2 | 1,150 | 6 | 0.4 |
| **4050-1300** | **5** | 13 | 4,800 | 100 | 1.25 | 400 | 2.5 | 1,300 | 7.5 | 0.5 |
| **4060-1300** | **6** | 13 | 4,000 | 100 | 1.5 | 400 | 3 | 1,300 | 9 | 0.6 |
| **4070-1600** | **7** | 16 | 3,200 | 100 | 1.75 | 350 | 3.5 | 1,300 | 10.5 | 0.7 |
| **4080-1900** | **8** | 19 | 2,400 | 90 | 2※1 | 300 | 4 | 1,200 | 12 | 0.8 |
| **4090-1900** | **9** | 19 | 1,800 | 90 | 2※1 | 250 | 4.5 | 1,100 | 13.5 | 0.9 |
| **4100-2200** | **10** | 22 | 1,400 | 80 | 2※1 | 200 | 5 | 1,000 | 15 | 1 |
| **4110-2200** | **11** | 22 | 1,250 | 80 | 2※1 | 200 | 5.5 | 900 | 16.5 | 1.1 |
| **4120-2600** | **12** | 26 | 1,250 | 70 | 2※1 | 180 | 6 | 900 | 18 | 1.2 |
| **4130-2600** | **13** | 26 | 1,050 | 20 | 1.5※2 | 120 | 6.5 | 900 | 19.5 | 0.65※ |
| **4160-3200** | **16** | 32 | 1,250 | 70 | 2※1 | 450 | 1.6※ | 440 | 24 | 1.6 |
| **4200-4000** | **20** | 40 | 1,000 | 70 | 2※1 | 450 | 2※ | 440 | 30 | 2 |
| Milling Amount (mm) | | | | Depth: 0.25D<br>※1 Max 2 mm depth<br>※2 Max 1.5 mm depth | | $a_p$:0.5D<br>※ $a_p$:0.1D | | $a_p$:1.5D<br>$a_e$:0.1D<br>※ $a_e$:0.05D | | |

# Milling Conditions for CZS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 12,900 | 80 | 0.5 | 140 | 1 | 270 | 1.5 | 0.2 |
| **4020-0600** | **2** | 6 | 9,350 | 110 | 1 | 230 | 2 | 400 | 3 | 0.4 |
| **4030-0800** | **3** | 8 | 6,120 | 120 | 1.5 | 270 | 3 | 450 | 4.5 | 0.6 |
| **4040-1100** | **4** | 11 | 5,250 | 130 | 2 | 320 | 4 | 500 | 6 | 0.8 |
| **4050-1300** | **5** | 13 | 4,460 | 150 | 2.5 | 360 | 5 | 540 | 7.5 | 1 |
| **4060-1300** | **6** | 13 | 3,600 | 160 | 3 | 360 | 6 | 540 | 9 | 1.2 |
| **4070-1600** | **7** | 16 | 2,850 | 140 | 2※ | 340 | 7 | 540 | 10.5 | 1.4 |
| **4080-1900** | **8** | 19 | 2,320 | 90 | 2※ | 320 | 8 | 480 | 12 | 1.6 |
| **4090-1900** | **9** | 19 | 1,700 | 80 | 2※ | 250 | 9 | 410 | 13.5 | 1.8 |
| **4100-2200** | **10** | 22 | 1,250 | 60 | 2※ | 180 | 10 | 340 | 15 | 2 |
| **4110-2200** | **11** | 22 | 1,100 | 55 | 2※ | 170 | 11 | 320 | 16.5 | 2.2 |
| **4120-2600** | **12** | 26 | 1,050 | 50 | 2※ | 160 | 12 | 320 | 18 | 2.4 |
| **4130-2600** | **13** | 26 | 1,000 | setting disable | setting disable | 100 | 6.5※ | 300 | 19.5 | 1.3※ |
| **4160-3200** | **16** | 32 | 960 | 40 | 2※ | 350 | 8※ | 380 | 24 | 1.6※ |
| **4200-4000** | **20** | 40 | 770 | 40 | 2※ | 350 | 10※ | 380 | 30 | 2※ |
| Milling Amount (mm) | | | | ※ Depth: 0.5D Max 2 mm depth | | $a_p$:1D<br>※ $a_p$:0.5D | | $a_p$:1.5D<br>$a_e$:0.2D<br>※ $a_e$:0.1D | | |

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 12,900 | 80 | 0.25 | 50 | 0.25※1 | 300 | 1.5 | 0.05※ |
| **4020-0600** | **2** | 6 | 8,200 | 150 | 0.5 | 150 | 0.5※1 | 650 | 3 | 0.1※ |
| **4030-0800** | **3** | 8 | 6,120 | 250 | 0.75 | 300 | 1.5 | 1,000 | 4.5 | 0.15※ |
| **4040-1100** | **4** | 11 | 5,000 | 220 | 1 | 320 | 2 | 500 | 6 | 0.4 |
| **4050-1300** | **5** | 13 | 4,300 | 180 | 1.25 | 340 | 2.5 | 520 | 7.5 | 0.5 |
| **4060-1300** | **6** | 13 | 3,600 | 160 | 1.5 | 360 | 3 | 540 | 9 | 0.6 |
| **4070-1600** | **7** | 16 | 2,800 | 160 | 1.5※1 | 320 | 3.5 | 520 | 10.5 | 0.7 |
| **4080-1900** | **8** | 19 | 2,100 | 150 | 1.5※1 | 280 | 4 | 500 | 12 | 0.8 |
| **4090-1900** | **9** | 19 | 1,600 | 130 | 1.5※1 | 240 | 4.5 | 470 | 13.5 | 0.9 |
| **4100-2200** | **10** | 22 | 1,250 | 120 | 1.5※1 | 200 | 5 | 450 | 15 | 1 |
| **4110-2200** | **11** | 22 | 1,150 | 110 | 1.5※1 | 190 | 5.5 | 440 | 16.5 | 1.1 |
| **4120-2600** | **12** | 26 | 1,050 | 110 | 1.5※1 | 180 | 6 | 420 | 18 | 1.2 |
| **4130-2600** | **13** | 26 | 900 | setting disable | setting disable | setting disable | setting disable | 370 | 19.5 | 0.65※ |
| **4160-3200** | **16** | 32 | 800 | 50 | Step Amount: 1.6<br>Max 10 depth※2 | 300 | 1.6※2 | 320 | 24 | 0.8※ |
| **4200-4000** | **20** | 40 | 630 | 50 | Step Amount: 2<br>Max 10 depth※2 | 300 | 2※2 | 320 | 30 | 1※ |
| Milling Amount (mm) | | | | ※1 Depth: 0.25D Max 1.5 mm<br>※2 Depth: 0.1D (Max 10 mm) | | $a_p$:0.5D<br>※1 $a_p$:0.25D<br>※2 $a_p$:0.1D | | $a_p$:1.5D<br>$a_e$:0.1D<br>※ $a_e$:0.05D | | |

## Milling Conditions for CZS

◆3D flute length type

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-1800** | **6** | 18 | 5,000 | 200 | 6 | 500 | 6 | 1,600 | 18 | 0.6 |
| **4070-2100** | **7** | 21 | 4,100 | 200 | 7 | 450 | 7 | 1,450 | 21 | 0.7 |
| **4080-2400** | **8** | 24 | 3,200 | 150 | 8 | 400 | 8 | 1,300 | 24 | 0.8 |
| **4090-2700** | **9** | 27 | 2,400 | 140 | 9 | 350 | 9 | 1,150 | 27 | 0.9 |
| **4100-3000** | **10** | 30 | 1,850 | 120 | 10 | 320 | 10 | 1,000 | 30 | 1 |
| **4110-3300** | **11** | 33 | 1,650 | 100 | 11 | 300 | 11 | 900 | 33 | 1.1 |
| **4120-3600** | **12** | 36 | 1,500 | 90 | 12 | 300 | 12 | 800 | 36 | 1.2 |
| Milling Amount (mm) | | | | Depth: 1D | | $a_p$:1D | | $a_p$:Length of Cut<br>$a_e$:0.1D | | |

| WORK MATERIAL | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-1800** | **6** | 18 | 4,000 | 60 | 6 | 350 | 6 | 1,200 | 18 | 0.6 |
| **4070-2100** | **7** | 21 | 3,400 | 60 | 6 | 330 | 7 | 1,150 | 21 | 0.7 |
| **4080-2400** | **8** | 24 | 2,700 | 50 | 6 | 300 | 8 | 1,050 | 24 | 0.8 |
| **4090-2700** | **9** | 27 | 2,050 | 50 | 6 | 270 | 9 | 1,000 | 27 | 0.9 |
| **4100-3000** | **10** | 30 | 1,500 | 40 | 6 | 240 | 10 | 900 | 30 | 1 |
| **4110-3300** | **11** | 33 | 1,350 | 40 | 6 | 220 | 11 | 850 | 33 | 1.1 |
| **4120-3600** | **12** | 36 | 1,200 | 30 | 6 | 200 | 12 | 750 | 36 | 1.2 |
| Milling Amount (mm) | | | | Max 6 mm depth | | $a_p$:1D | | $a_p$:Length of Cut<br>$a_e$:0.1D | | |

| WORK MATERIAL | | | STRUCTURAL STEELS SS400 Recommend water soluble or oil coolant. (Use cutting oils for vertical milling.) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Vertical | | Slotting | | Side Milling | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-1800** | **6** | 18 | 4,000 | 120 | 3 | 300 | 6 | 1,300 | 18 | 0.6 |
| **4070-2100** | **7** | 21 | 3,400 | 110 | 3.5 | 280 | 7 | 1,200 | 21 | 0.7 |
| **4080-2400** | **8** | 24 | 2,700 | 90 | 4 | 250 | 8 | 1,150 | 24 | 0.8 |
| **4090-2700** | **9** | 27 | 2,100 | 80 | 4.5 | 230 | 9 | 1,050 | 27 | 0.9 |
| **4100-3000** | **10** | 30 | 1,500 | 70 | 5 | 200 | 10 | 1,000 | 30 | 1 |
| **4110-3300** | **11** | 33 | 1,350 | 65 | 5.5 | 190 | 11 | 950 | 33 | 1.1 |
| **4120-3600** | **12** | 36 | 1,200 | 60 | 6 | 190 | 12 | 900 | 36 | 1.2 |
| Milling Amount (mm) | | | | Depth: 0.5D | | $a_p$:1D | | $a_p$:Length of Cut<br>$a_e$:0.1D | | |

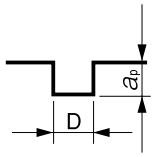
# Milling Conditions for CZS

| WORK MATERIAL | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-1800** | **6** | 18 | 2,800 | 40 | 1.5 | 200 | 3 | 900 | 18 | 0.3 |
| **4070-2100** | **7** | 21 | 2,450 | 40 | 1.5 | 190 | 3.5 | 950 | 21 | 0.35 |
| **4080-2400** | **8** | 24 | 2,100 | 40 | 1.5 | 180 | 4 | 950 | 24 | 0.4 |
| **4090-2700** | **9** | 27 | 1,700 | 30 | 1.5 | 170 | 4.5 | 1,000 | 27 | 0.45 |
| **4100-3000** | **10** | 30 | 1,400 | 30 | 1.5 | 150 | 5 | 1,000 | 30 | 0.5 |
| **4110-3300** | **11** | 33 | 1,250 | 30 | 1.5 | 140 | 5.5 | 1,000 | 33 | 0.55 |
| **4120-3600** | **12** | 36 | 1,150 | 25 | 1.5 | 130 | 6 | 950 | 36 | 0.6 |
| Milling Amount (mm) | | | | Max 1.5 mm depth | | $a_p$:0.5D | | $a_p$:Length of Cut<br>$a_e$:0.05D | | |

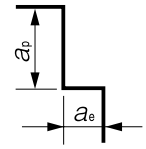
| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-1800** | **6** | 18 | 3,000 | — | — | 160 | 6 | 600 | 18 | 0.3 |
| **4070-2100** | **7** | 21 | 2,500 | — | — | 160 | 6 | 700 | 21 | 0.35 |
| **4080-2400** | **8** | 24 | 2,150 | — | — | 150 | 6 | 750 | 24 | 0.4 |
| **4090-2700** | **9** | 27 | 1,850 | — | — | 150 | 6 | 800 | 27 | 0.45 |
| **4100-3000** | **10** | 30 | 1,500 | — | — | 140 | 6 | 900 | 30 | 0.5 |
| **4110-3300** | **11** | 33 | 1,350 | — | — | 130 | 6 | 850 | 33 | 0.55 |
| **4120-3600** | **12** | 36 | 1,200 | — | — | 120 | 6 | 800 | 36 | 0.6 |
| Milling Amount (mm) | | | | setting disable | | $a_p$:Max 6 mm | | $a_p$:Length of Cut<br>$a_e$:0.05D | | |

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-1800** | **6** | 18 | 3,600 | — | — | — | — | 540 | 18 | 0.3 |
| **4070-2100** | **7** | 21 | 2,900 | — | — | — | — | 520 | 21 | 0.35 |
| **4080-2400** | **8** | 24 | 2,300 | — | — | — | — | 500 | 24 | 0.4 |
| **4090-2700** | **9** | 27 | 1,700 | — | — | — | — | 470 | 27 | 0.45 |
| **4100-3000** | **10** | 30 | 1,250 | — | — | — | — | 450 | 30 | 0.5 |
| **4110-3300** | **11** | 33 | 1,100 | — | — | — | — | 420 | 33 | 0.55 |
| **4120-3600** | **12** | 36 | 1,000 | — | — | — | — | 400 | 36 | 0.6 |
| Milling Amount (mm) | | | | setting disable | | setting disable | | $a_p$:Length of Cut<br>$a_e$:0.05D | | |

## Milling Conditions for CZS




Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Spindle rigidity should be considered when setting milling parameters, especially for Z-Axis drilling.
- When slotting, using Z-Axis drilling, the milling parameters should promote good chip evacuation.
- Reduce the milling amount when chips clog on the tool during Z-Axis drilling.
- The milling parameter of outside diameter 16 and 20 is calculated based on BT50 spindle type. Decrease 50% milling amount for BT40 spindle type.
- Recommend water soluble or oil coolant.
- Recommend water soluble coolant (through spindle type) for Stainless Steels and Aluminum Alloys.
- Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

4 Flute UTCOAT Square End Mills for Part Milling

# CZS The 2 in 1 Advantage

Patented special tip profile design

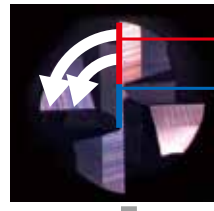
### Drilling and Milling in a Single Tool! ½ Cycle Time!

Drilling and Milling in a Single Tool

### Special Tip Profile Design for Smooth Chip Evacuation

**Normal 4 Flutes**

Conventional End Profile



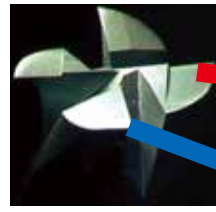
Chips made by the outer edge→ Bigger

Chips made by the inner edge →Trapped

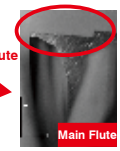
Normal 4 flute end mill easily clogs →
**Impossible to Drill**

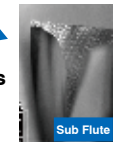
**Drilling Mechanism**

**CZS**



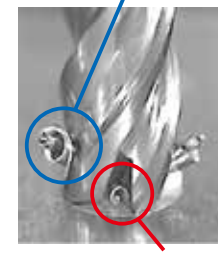
Gap on Main Flute




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

Big chips come from the sub flute



Small chips come from the main flute

Good chip evacuation from the inner edge

**Allowing for High Speed Drilling**

## Pocket Milling Example
CZS φ8 × Length of Cut 12

SCM420H

Pocket Size : 9 × 15 × Depth 4 mm

| | |
|---|---|
| Spindle Speed | 2,700 $min^{-1}$ |
| Z-Drilling Feed Rate | 220 mm/min |
| X-Y Milling Feed Rate | 500 mm/min |
| Number of holes | 864 holes |
| Coolant | Water Soluble |

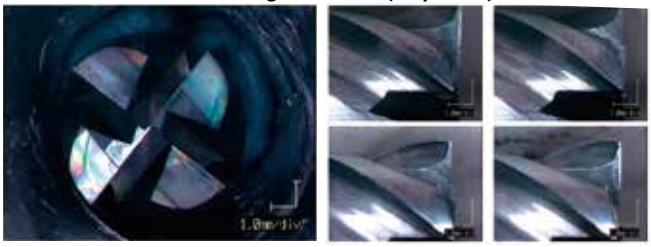
Z-drilling Depth 1 mm × 4 times Dwell 0.1 sec

Drilling and Milling → 144 min

**CZS → 72 min**

**1/2 Cycle Time!**

**After milling 864 holes (32 pieces)**



**Less cycle time! More tool life left after milling 864 holes!**

## Comparison with Conventional Model
CZS φ6.5 × Length of Cut 16

S45C

**CZS**

**Conventional 4 Flute Square**

| | |
|---|---|
| Spindle Speed | 2,200 $min^{-1}$ |
| Z-Drilling Feed Rate | 100 mm/min |
| Slotting Feed Rate | 400 mm/min |
| Axial Depth $a_p$ | 3 mm |
| Overhang Length | 25 mm |
| Coolant | Air Blow (Through Spindle) |
| Milled Size | Slitting 6.5 × 24.5 × 3 mm<br>Spot Facing 6.5 × 3 mm |

**Variable Pitch Prevents Chattering!**

Size φ1～φ16

# CXES

Super MG | UT COAT | 37°~40° | Flatland | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Additional 12 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

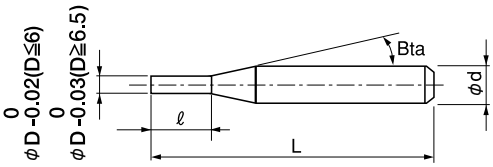
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

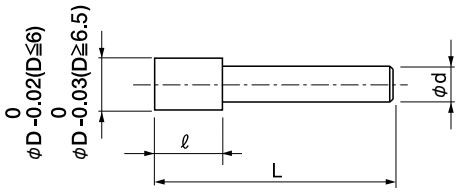
**Variable Division & Helix design minimizes vibration and chattering.**
**Selected high toughness and chip resistant carbide material.**
**Optimized flute design offers outstandingly high efficiency milling and fine finishing.**
**Low friction coating resulting in excellent chip evacuation and resistance to wear.**

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece. Actual measurement is necessary when using longer length of cut than the written length.

**Shape A**




**Shape B**




Total 55 models

Unit (mm)

| | Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| | **CXES 4010-0250** | 1 | 2.5 | 16° | 50 | 4 | A | 6,520 |
| | **CXES 4010-0300** | | 3 | | 60 | 4 | | 7,180 |
| | **CXES 4010-0400** | | 4 | | 60 | 4 | | 7,900 |
| ※ | **CXES 4010-0500** | | 5 | | 60 | 4 | | 10,270 |
| | **CXES 4015-0375** | 1.5 | 3.75 | 16° | 50 | 4 | A | 6,520 |
| | **CXES 4015-0600** | | 6 | | 50 | 4 | | 7,900 |
| | **CXES 4020-0500** | 2 | 5 | 16° | 50 | 4 | A | 6,100 |
| | **CXES 4020-0600** | | 6 | | 60 | 4 | | 6,710 |
| | **CXES 4020-0800** | | 8 | | 60 | 4 | | 7,390 |
| ※ | **CXES 4020-1000** | | 10 | | 60 | 4 | | 9,610 |
| | **CXES 4025-0625** | 2.5 | 6.25 | 16° | 50 | 4 | A | 6,100 |
| | **CXES 4025-1000** | | 10 | | 50 | 4 | | 7,390 |

※Additional model

Next Page ➡

Unit（mm）

| | Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| | CXES 4030-0750 | 3 | 7.5 | 16° | 50 | 6 | A | 7,000 |
| | CXES 4030-0900 | | 9 | | 60 | 6 | | 7,700 |
| | CXES 4030-1200 | | 12 | | 60 | 6 | | 8,470 |
| ※ | CXES 4030-1500 | | 15 | | 60 | 6 | | 11,020 |
| | CXES 4035-0900 | 3.5 | 9 | 16° | 60 | 6 | A | 8,270 |
| | CXES 4040-1000 | 4 | 10 | 16° | 50 | 6 | A | 7,350 |
| | CXES 4040-1200 | | 12 | | 60 | 6 | | 8,090 |
| | CXES 4040-1600 | | 16 | | 60 | 6 | | 8,900 |
| ※ | CXES 4040-2000 | | 20 | | 60 | 6 | | 11,570 |
| | CXES 4045-1150 | 4.5 | 11.5 | 16° | 60 | 6 | A | 8,840 |
| | CXES 4050-1250 | 5 | 12.5 | 16° | 50 | 6 | A | 7,900 |
| | CXES 4050-1500 | | 15 | | 60 | 6 | | 8,690 |
| | CXES 4050-2000 | | 20 | | 60 | 6 | | 9,560 |
| ※ | CXES 4050-2500 | | 25 | | 70 | 6 | | 12,430 |
| | CXES 4055-1400 | 5.5 | 14 | 16° | 60 | 6 | A | 9,120 |
| | CXES 4060-1500 | 6 | 15 | — | 50 | 6 | A | 8,500 |
| | CXES 4060-1800 | | 18 | | 60 | 6 | | 9,350 |
| | CXES 4060-2400 | | 24 | | 70 | 6 | | 10,760 |
| ※ | CXES 4060-3000 | | 30 | | 80 | 6 | | 13,990 |
| | CXES 4065-1650 | 6.5 | 16.5 | 16° | 60 | 8 | A | 11,970 |
| | CXES 4070-1050 | 7 | 10.5 | — | 100 | 6 | B | 14,880 |
| ※ | CXES 4070-1750 | | 17.5 | 16° | 70 | 8 | A | 10,500 |
| | CXES 4075-1900 | 7.5 | 19 | 16° | 60 | 8 | A | 11,970 |
| | CXES 4080-2000 | 8 | 20 | — | 60 | 8 | A | 10,500 |
| | CXES 4080-2400 | | 24 | | 70 | 8 | | 11,550 |
| | CXES 4080-3200 | | 32 | | 80 | 8 | | 15,600 |
| ※ | CXES 4080-4000 | | 40 | | 90 | 8 | | 20,280 |
| | CXES 4085-2150 | 8.5 | 21.5 | 16° | 70 | 10 | A | 13,870 |
| | CXES 4090-1350 | 9 | 13.5 | — | 140 | 8 | B | 19,390 |
| ※ | CXES 4090-2250 | | 22.5 | 16° | 80 | 10 | A | 12,500 |
| | CXES 4095-2400 | 9.5 | 24 | 16° | 70 | 10 | A | 13,870 |
| | CXES 4100-2500 | 10 | 25 | — | 70 | 10 | A | 12,500 |
| | CXES 4100-3000 | | 30 | | 80 | 10 | | 13,750 |
| | CXES 4100-4000 | | 40 | | 90 | 10 | | 18,570 |
| ※ | CXES 4100-5000 | | 50 | | 100 | 10 | | 24,150 |
| | CXES 4110-1650 | 11 | 16.5 | — | 150 | 10 | B | 24,200 |
| ※ | CXES 4110-2750 | | 27.5 | 16° | 100 | 12 | A | 17,800 |
| | CXES 4120-3000 | 12 | 30 | — | 90 | 12 | A | 17,800 |
| | CXES 4120-3600 | | 36 | | 100 | 12 | | 19,580 |
| | CXES 4120-4800 | | 48 | | 110 | 12 | | 26,440 |
| ※ | CXES 4120-6000 | | 60 | | 120 | 12 | | 34,380 |
| | CXES 4130-1950 | 13 | 19.5 | — | 160 | 12 | B | 30,390 |
| | CXES 4160-4000 | 16 | 40 | — | 110 | 16 | A | 54,150 |

※Additional model

## Milling Conditions for CXES

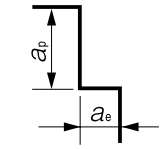
Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 18,000 | 620 | 2.5 | 0.2 | 18,000 | 460 | 2.5 | 0.2 | 14,500 | 320 | 2.5 | 0.1 |
| **4010-0300** | | 3 | 18,000 | 620 | 3 | 0.03 | 18,000 | 460 | 3 | 0.03 | 14,300 | 310 | 3 | 0.015 |
| **4010-0400** | | 4 | 18,000 | 620 | 4 | 0.02 | 18,000 | 460 | 4 | 0.02 | 13,900 | 290 | 4 | 0.01 |
| **4010-0500** | | 5 | 18,000 | 620 | 5 | 0.02 | 18,000 | 460 | 5 | 0.02 | 13,900 | 290 | 5 | 0.01 |
| **4015-0375** | **1.5** | 3.75 | 13,500 | 770 | 3.75 | 0.3 | 13,500 | 570 | 3.75 | 0.3 | 13,300 | 340 | 3.75 | 0.15 |
| **4015-0600** | | 6 | 13,500 | 770 | 6 | 0.03 | 13,500 | 570 | 6 | 0.03 | 12,700 | 310 | 6 | 0.015 |
| **4020-0500** | **2** | 5 | 11,000 | 930 | 5 | 0.4 | 11,000 | 690 | 5 | 0.4 | 12,200 | 360 | 5 | 0.2 |
| **4020-0600** | | 6 | 11,000 | 930 | 6 | 0.06 | 11,000 | 690 | 6 | 0.06 | 12,000 | 340 | 6 | 0.03 |
| **4020-0800** | | 8 | 11,000 | 930 | 8 | 0.04 | 11,000 | 690 | 8 | 0.04 | 11,600 | 300 | 8 | 0.02 |
| **4020-1000** | | 10 | 11,000 | 930 | 10 | 0.04 | 11,000 | 690 | 10 | 0.04 | 11,600 | 300 | 10 | 0.02 |
| **4025-0625** | **2.5** | 6.25 | 9,500 | 1,060 | 6.25 | 0.5 | 9,500 | 800 | 6.25 | 0.5 | 11,000 | 490 | 6.25 | 0.25 |
| **4025-1000** | | 10 | 9,500 | 1,060 | 10 | 0.05 | 9,500 | 800 | 10 | 0.05 | 10,400 | 430 | 10 | 0.025 |
| **4030-0750** | **3** | 7.5 | 8,500 | 1,200 | 7.5 | 0.6 | 8,500 | 900 | 7.5 | 0.6 | 10,000 | 640 | 7.5 | 0.3 |
| **4030-0900** | | 9 | 8,500 | 1,200 | 9 | 0.3 | 8,500 | 900 | 9 | 0.3 | 9,100 | 580 | 9 | 0.15 |
| **4030-1200** | | 12 | 8,500 | 1,200 | 12 | 0.06 | 8,500 | 900 | 12 | 0.06 | 7,300 | 460 | 12 | 0.03 |
| **4030-1500** | | 15 | 8,500 | 1,200 | 15 | 0.06 | 8,500 | 900 | 15 | 0.06 | 7,300 | 460 | 15 | 0.03 |
| **4035-0900** | **3.5** | 9 | 7,800 | 1,250 | 9 | 0.7 | 7,500 | 950 | 9 | 0.7 | 8,600 | 680 | 9 | 0.35 |
| **4040-1000** | **4** | 10 | 7,200 | 1,350 | 10 | 0.8 | 6,700 | 1,000 | 10 | 0.8 | 7,500 | 730 | 10 | 0.4 |
| **4040-1200** | | 12 | 7,200 | 1,350 | 12 | 0.4 | 6,700 | 1,000 | 12 | 0.4 | 6,600 | 640 | 12 | 0.2 |
| **4040-1600** | | 16 | 7,200 | 1,350 | 16 | 0.08 | 6,700 | 1,000 | 16 | 0.08 | 4,800 | 460 | 16 | 0.08 |
| **4040-2000** | | 20 | 7,200 | 1,350 | 20 | 0.08 | 6,700 | 1,000 | 20 | 0.08 | 4,800 | 460 | 20 | 0.08 |
| **4045-1150** | **4.5** | 11.5 | 6,550 | 1,400 | 11.5 | 0.9 | 6,000 | 1,050 | 11.5 | 0.9 | 6,300 | 770 | 11.5 | 0.45 |
| **4050-1250** | **5** | 12.5 | 6,000 | 1,500 | 12.5 | 1 | 5,400 | 1,100 | 12.5 | 1 | 5,400 | 810 | 12.5 | 0.5 |
| **4050-1500** | | 15 | 6,000 | 1,500 | 15 | 0.5 | 5,400 | 1,100 | 15 | 0.5 | 4,600 | 690 | 15 | 0.25 |
| **4050-2000** | | 20 | 6,000 | 1,500 | 20 | 0.1 | 5,400 | 1,100 | 20 | 0.1 | 3,700 | 450 | 20 | 0.1 |
| **4050-2500** | | 25 | 6,000 | 1,500 | 25 | 0.1 | 5,400 | 1,100 | 25 | 0.1 | 3,700 | 450 | 25 | 0.1 |
| **4055-1400** | **5.5** | 14 | 5,450 | 1,550 | 14 | 1.1 | 4,900 | 1,150 | 14 | 1.1 | 4,900 | 810 | 14 | 0.55 |
| **4060-1500** | **6** | 15 | 5,000 | 1,600 | 15 | 1.2 | 4,500 | 1,200 | 15 | 1.2 | 4,500 | 810 | 15 | 0.6 |
| **4060-1800** | | 18 | 5,000 | 1,600 | 18 | 0.6 | 4,500 | 1,200 | 18 | 0.6 | 3,700 | 660 | 18 | 0.3 |
| **4060-2400** | | 24 | 5,000 | 1,400 | 24 | 0.12 | 4,500 | 1,050 | 24 | 0.12 | 2,900 | 360 | 24 | 0.12 |
| **4060-3000** | | 30 | 5,000 | 1,400 | 30 | 0.12 | 4,500 | 1,050 | 30 | 0.12 | 2,900 | 360 | 30 | 0.12 |
| **4065-1650** | **6.5** | 16.5 | 4,400 | 1,500 | 16.5 | 1.3 | 3,950 | 1,150 | 16.5 | 1.3 | 3,950 | 780 | 16.5 | 0.65 |

# Milling Conditions for CXES



| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 12,900 | 320 | 2.5 | 0.2 | 12,900 | 180 | 2.5 | 0.05 |
| **4010-0300** | | 3 | 12,800 | 320 | 3 | 0.03 | 12,900 | 180 | 3 | 0.015 |
| **4010-0400** | | 4 | 12,600 | 320 | 4 | 0.02 | 12,900 | 180 | 4 | 0.01 |
| **4010-0500** | | 5 | 12,600 | 320 | 5 | 0.01 | 12,900 | 180 | 5 | 0.005 |
| **4015-0375** | **1.5** | 3.75 | 10,500 | 390 | 3.75 | 0.3 | 9,300 | 280 | 3.75 | 0.075 |
| **4015-0600** | | 6 | 10,200 | 390 | 6 | 0.03 | 9,300 | 280 | 6 | 0.015 |
| **4020-0500** | **2** | 5 | 9,350 | 450 | 5 | 0.4 | 7,600 | 390 | 5 | 0.1 |
| **4020-0600** | | 6 | 9,250 | 450 | 6 | 0.06 | 7,600 | 390 | 6 | 0.03 |
| **4020-0800** | | 8 | 9,050 | 450 | 8 | 0.04 | 7,600 | 390 | 8 | 0.02 |
| **4020-1000** | | 10 | 9,050 | 450 | 10 | 0.01 | 7,600 | 390 | 10 | 0.01 |
| **4025-0625** | **2.5** | 6.25 | 8,300 | 540 | 6.25 | 0.5 | 6,500 | 510 | 6.25 | 0.125 |
| **4025-1000** | | 10 | 8,000 | 540 | 10 | 0.05 | 6,500 | 510 | 10 | 0.025 |
| **4030-0750** | **3** | 7.5 | 7,400 | 630 | 7.5 | 0.6 | 5,900 | 500 | 7.5 | 0.3 |
| **4030-0900** | | 9 | 7,050 | 630 | 9 | 0.3 | 5,900 | 500 | 9 | 0.15 |
| **4030-1200** | | 12 | 6,350 | 630 | 12 | 0.06 | 5,900 | 500 | 12 | 0.03 |
| **4030-1500** | | 15 | 6,350 | 630 | 15 | 0.03 | 5,900 | 500 | 15 | 0.015 |
| **4035-0900** | **3.5** | 9 | 6,500 | 640 | 9 | 0.7 | 5,200 | 510 | 9 | 0.35 |
| **4040-1000** | **4** | 10 | 5,900 | 650 | 10 | 0.8 | 4,700 | 520 | 10 | 0.4 |
| **4040-1200** | | 12 | 5,500 | 650 | 12 | 0.4 | 4,700 | 520 | 12 | 0.2 |
| **4040-1600** | | 16 | 4,700 | 580 | 16 | 0.08 | 4,700 | 520 | 16 | 0.04 |
| **4040-2000** | | 20 | 4,700 | 580 | 20 | 0.04 | 4,700 | 520 | 20 | 0.02 |
| **4045-1150** | **4.5** | 11.5 | 5,300 | 660 | 11.5 | 0.9 | 4,250 | 520 | 11.5 | 0.45 |
| **4050-1250** | **5** | 12.5 | 4,800 | 680 | 12.5 | 1 | 3,850 | 530 | 12.5 | 0.5 |
| **4050-1500** | | 15 | 4,400 | 680 | 15 | 0.5 | 3,850 | 530 | 15 | 0.25 |
| **4050-2000** | | 20 | 3,600 | 580 | 20 | 0.1 | 3,850 | 530 | 20 | 0.05 |
| **4050-2500** | | 25 | 3,600 | 580 | 25 | 0.05 | 3,850 | 530 | 25 | 0.025 |
| **4055-1400** | **5.5** | 14 | 4,350 | 680 | 14 | 1.1 | 3,500 | 530 | 14 | 0.55 |
| **4060-1500** | **6** | 15 | 4,000 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4060-1800** | | 18 | 3,600 | 680 | 18 | 0.6 | 3,200 | 540 | 18 | 0.3 |
| **4060-2400** | | 24 | 2,800 | 560 | 24 | 0.12 | 3,200 | 540 | 24 | 0.06 |
| **4060-3000** | | 30 | 2,800 | 560 | 30 | 0.06 | 3,200 | 540 | 30 | 0.03 |
| **4065-1650** | **6.5** | 16.5 | 3,500 | 660 | 16.5 | 1.3 | 2,850 | 530 | 16.5 | 0.65 |




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

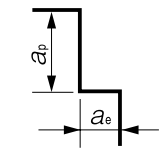
## Milling Conditions for CXES

Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4070-1050** | **7** | 10.5 | 3,900 | 1,450 | 10.5 | 0.7 | 3,550 | 1,120 | 10.5 | 0.7 | 3,550 | 760 | 10.5 | 0.35 |
| **4070-1750** | | 17.5 | 3,900 | 1,450 | 17.5 | 1.4 | 3,550 | 1,120 | 17.5 | 1.4 | 3,550 | 760 | 17.5 | 0.7 |
| **4075-1900** | **7.5** | 19 | 3,500 | 1,400 | 19 | 1.5 | 3,250 | 1,100 | 19 | 1.5 | 3,250 | 750 | 19 | 0.75 |
| **4080-2000** | **8** | 20 | 3,000 | 1,300 | 20 | 1.6 | 2,900 | 1,050 | 20 | 1.6 | 2,900 | 720 | 20 | 0.8 |
| **4080-2400** | | 24 | 2,800 | 1,230 | 24 | 0.8 | 2,600 | 1,050 | 24 | 0.8 | 2,600 | 600 | 24 | 0.4 |
| **4080-3200** | | 32 | 2,400 | 1,090 | 32 | 0.16 | 2,000 | 800 | 32 | 0.16 | 2,100 | 360 | 32 | 0.16 |
| **4080-4000** | | 40 | 2,400 | 1,090 | 40 | 0.16 | 2,000 | 800 | 40 | 0.16 | 2,100 | 360 | 40 | 0.16 |
| **4085-2150** | **8.5** | 21.5 | 2,550 | 1,200 | 21.5 | 1.7 | 2,450 | 1,000 | 21.5 | 1.7 | 2,450 | 680 | 21.5 | 0.85 |
| **4090-1350** | **9** | 13.5 | 2,250 | 1,150 | 13.5 | 0.9 | 2,150 | 980 | 13.5 | 0.9 | 2,150 | 650 | 13.5 | 0.45 |
| **4090-2250** | | 22.5 | 2,250 | 1,150 | 22.5 | 1.8 | 2,150 | 980 | 22.5 | 1.8 | 2,150 | 650 | 22.5 | 0.9 |
| **4095-2400** | **9.5** | 24 | 1,950 | 1,050 | 24 | 1.9 | 1,900 | 950 | 24 | 1.9 | 1,900 | 620 | 24 | 0.95 |
| **4100-2500** | **10** | 25 | 1,600 | 1,000 | 25 | 2 | 1,500 | 900 | 25 | 2 | 1,500 | 580 | 25 | 1 |
| **4100-3000** | | 30 | 1,500 | 900 | 30 | 1 | 1,500 | 850 | 30 | 1 | 1,500 | 580 | 30 | 0.5 |
| **4100-4000** | | 40 | 1,300 | 800 | 40 | 0.2 | 1,500 | 750 | 40 | 0.2 | 1,500 | 580 | 40 | 0.2 |
| **4100-5000** | | 50 | 1,300 | 800 | 50 | 0.2 | 1,500 | 750 | 50 | 0.2 | 1,500 | 580 | 50 | 0.2 |
| **4110-1650** | **11** | 16.5 | 1,400 | 900 | 16.5 | 1.1 | 1,350 | 830 | 16.5 | 1.1 | 1,350 | 560 | 16.5 | 0.55 |
| **4110-2750** | | 27.5 | 1,400 | 900 | 27.5 | 2.2 | 1,350 | 830 | 27.5 | 2.2 | 1,350 | 560 | 27.5 | 1.1 |
| **4120-3000** | **12** | 30 | 1,200 | 800 | 30 | 2.4 | 1,200 | 750 | 30 | 2.4 | 1,200 | 540 | 30 | 1.2 |
| **4120-3600** | | 36 | 1,150 | 750 | 36 | 1.2 | 1,150 | 720 | 36 | 1.2 | 1,150 | 540 | 36 | 0.6 |
| **4120-4800** | | 48 | 1,050 | 700 | 48 | 0.24 | 1,050 | 660 | 48 | 0.24 | 1,050 | 500 | 48 | 0.24 |
| **4120-6000** | | 60 | 1,050 | 700 | 60 | 0.24 | 1,050 | 660 | 60 | 0.24 | 1,050 | 500 | 60 | 0.24 |
| **4130-1950** | **13** | 19.5 | 1,100 | 650 | 19.5 | 1.3 | 1,100 | 600 | 19.5 | 1.3 | 1,000 | 460 | 19.5 | 0.65 |
| **4160-4000** | **16** | 40 | 1,000 | 500 | 40 | 3.2 | 1,000 | 440 | 40 | 3.2 | 720 | 340 | 40 | 1.6 |

# Milling Conditions for CXES

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4070-1050** | **7** | 10.5 | 3,150 | 640 | 10.5 | 0.7 | 2,550 | 520 | 10.5 | 0.35 |
| **4070-1750** | | 17.5 | 3,150 | 640 | 17.5 | 1.4 | 2,550 | 520 | 17.5 | 0.7 |
| **4075-1900** | **7.5** | 19 | 2,850 | 620 | 19 | 1.5 | 2,250 | 510 | 19 | 0.75 |
| **4080-2000** | **8** | 20 | 2,500 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-2400** | | 24 | 2,350 | 600 | 24 | 0.8 | 2,150 | 500 | 24 | 0.4 |
| **4080-3200** | | 32 | 2,050 | 530 | 32 | 0.16 | 2,150 | 400 | 32 | 0.08 |
| **4080-4000** | | 40 | 2,050 | 530 | 40 | 0.08 | 2,150 | 400 | 40 | 0.04 |
| **4085-2150** | **8.5** | 21.5 | 2,150 | 550 | 21.5 | 1.7 | 1,700 | 490 | 21.5 | 0.85 |
| **4090-1350** | **9** | 13.5 | 1,950 | 520 | 13.5 | 0.9 | 1,500 | 480 | 13.5 | 0.45 |
| **4090-2250** | | 22.5 | 1,950 | 520 | 22.5 | 1.8 | 1,500 | 480 | 22.5 | 0.9 |
| **4095-2400** | **9.5** | 24 | 1,750 | 480 | 24 | 1.9 | 1,350 | 470 | 24 | 0.95 |
| **4100-2500** | **10** | 25 | 1,500 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-3000** | | 30 | 1,500 | 430 | 30 | 1 | 1,200 | 450 | 30 | 0.5 |
| **4100-4000** | | 40 | 1,500 | 430 | 40 | 0.2 | 1,200 | 450 | 40 | 0.1 |
| **4100-5000** | | 50 | 1,500 | 430 | 50 | 0.1 | 1,200 | 450 | 50 | 0.05 |
| **4110-1650** | **11** | 16.5 | 1,250 | 380 | 16.5 | 1.1 | 1,060 | 430 | 16.5 | 0.55 |
| **4110-2750** | | 27.5 | 1,250 | 380 | 27.5 | 2.2 | 1,060 | 430 | 27.5 | 1.1 |
| **4120-3000** | **12** | 30 | 1,000 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-3600** | | 36 | 1,000 | 320 | 36 | 1.2 | 930 | 400 | 36 | 0.6 |
| **4120-4800** | | 48 | 1,000 | 320 | 48 | 0.24 | 870 | 360 | 48 | 0.12 |
| **4120-6000** | | 60 | 1,000 | 320 | 60 | 0.12 | 870 | 360 | 60 | 0.06 |
| **4130-1950** | **13** | 19.5 | 1,000 | 260 | 19.5 | 1.3 | 890 | 350 | 19.5 | 0.65 |
| **4160-4000** | **16** | 40 | 1,000 | 220 | 40 | 3.2 | 720 | 280 | 40 | 1.6 |




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

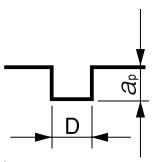
## Milling Conditions for CXES

Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 18,000 | 200 | 1 | 18,000 | 200 | 1 | 14,500 | 220 | 0.5 |
| **4010-0300** | | 3 | 18,000 | 190 | 0.5※ | 18,000 | 190 | 0.5※ | 14,300 | 210 | 0.25※ |
| **4010-0400** | | 4 | 18,000 | 170 | 0.5※ | 18,000 | 170 | 0.5※ | 12,500 | 190 | 0.25※ |
| **4010-0500** | | 5 | 18,000 | 170 | 0.5※ | 18,000 | 170 | 0.5※ | 12,500 | 190 | 0.25※ |
| **4015-0375** | **1.5** | 3.75 | 13,500 | 320 | 1.5 | 13,500 | 280 | 1.5 | 13,300 | 240 | 0.75 |
| **4015-0600** | | 6 | 13,500 | 290 | 0.75※ | 13,500 | 250 | 0.75※ | 12,700 | 210 | 0.375※ |
| **4020-0500** | **2** | 5 | 11,000 | 460 | 2 | 11,000 | 320 | 2 | 12,200 | 260 | 1 |
| **4020-0600** | | 6 | 11,000 | 440 | 1※ | 11,000 | 310 | 1※ | 12,000 | 240 | 0.5※ |
| **4020-0800** | | 8 | 11,000 | 400 | 1※ | 11,000 | 290 | 1※ | 11,600 | 200 | 0.5※ |
| **4020-1000** | | 10 | 11,000 | 400 | 1※ | 11,000 | 290 | 1※ | 11,600 | 200 | 0.5※ |
| **4025-0625** | **2.5** | 6.25 | 9,500 | 540 | 2.5 | 9,500 | 360 | 2.5 | 11,000 | 310 | 1.25 |
| **4025-1000** | | 10 | 9,500 | 480 | 1.25※ | 9,500 | 330 | 1.25※ | 10,400 | 250 | 0.625※ |
| **4030-0750** | **3** | 7.5 | 8,500 | 600 | 3 | 8,500 | 400 | 3 | 10,000 | 360 | 1.5 |
| **4030-0900** | | 9 | 8,500 | 550 | 3 | 8,500 | 360 | 3 | 9,100 | 310 | 1.5 |
| **4030-1200** | | 12 | 8,500 | 450 | 1.5※ | 8,500 | 280 | 1.5※ | 7,300 | 210 | 0.75※ |
| **4030-1500** | | 15 | 8,500 | 450 | 1.5※ | 8,500 | 280 | 1.5※ | 7,300 | 210 | 0.75※ |
| **4035-0900** | **3.5** | 9 | 7,800 | 620 | 3.5 | 7,500 | 420 | 3.5 | 8,600 | 380 | 1.75 |
| **4040-1000** | **4** | 10 | 7,200 | 650 | 4 | 6,700 | 450 | 4 | 7,500 | 400 | 2 |
| **4040-1200** | | 12 | 7,200 | 580 | 4 | 6,700 | 400 | 4 | 6,600 | 320 | 2 |
| **4040-1600** | | 16 | 7,200 | 440 | 2※ | 6,700 | 300 | 2※ | 4,800 | 200 | 1※ |
| **4040-2000** | | 20 | 7,200 | 440 | 2※ | 6,700 | 300 | 2※ | 4,800 | 200 | 1※ |
| **4045-1150** | **4.5** | 11.5 | 6,550 | 670 | 4.5 | 6,000 | 470 | 4.5 | 6,300 | 430 | 2.25 |
| **4050-1250** | **5** | 12.5 | 6,000 | 700 | 5 | 5,400 | 500 | 5 | 5,400 | 460 | 2.5 |
| **4050-1500** | | 15 | 6,000 | 600 | 5 | 5,400 | 430 | 5 | 4,600 | 350 | 2.5 |
| **4050-2000** | | 20 | 6,000 | 400 | 2.5※ | 5,400 | 290 | 2.5※ | 3,000 | 170 | 1.25※ |
| **4050-2500** | | 25 | 6,000 | 400 | 2.5※ | 5,400 | 290 | 2.5※ | 3,000 | 170 | 1.25※ |
| **4055-1400** | **5.5** | 14 | 5,450 | 700 | 5.5 | 4,900 | 500 | 5.5 | 4,900 | 460 | 2.75 |
| Milling Amount (mm) | | | $a_p$=1D ※$a_p$=0.5D | | | $a_p$=1D ※$a_p$=0.5D | | | $a_p$=0.5D ※$a_p$=0.25D | | |

# Milling Conditions for CXES

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4010-0250** | **1** | 2.5 | 12,900 | 130 | 1 | 12,900 | 50 | 0.3※ |
| **4010-0300** | | 3 | 12,800 | 120 | 0.5※2 | N/A | N/A | N/A |
| **4010-0400** | | 4 | 12,100 | 100 | 0.5※2 | N/A | N/A | N/A |
| **4010-0500** | | 5 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4015-0375** | **1.5** | 3.75 | 10,500 | 180 | 1.5 | 10,500 | 100 | 0.45※ |
| **4015-0600** | | 6 | 10,200 | 150 | 0.75※2 | N/A | N/A | N/A |
| **4020-0500** | **2** | 5 | 9,350 | 220 | 2 | 9,350 | 150 | 0.6※ |
| **4020-0600** | | 6 | 9,300 | 200 | 1※2 | N/A | N/A | N/A |
| **4020-0800** | | 8 | 8,600 | 160 | 1※2 | N/A | N/A | N/A |
| **4020-1000** | | 10 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4025-0625** | **2.5** | 6.25 | 8,300 | 270 | 2.5 | 8,300 | 240 | 0.75※ |
| **4025-1000** | | 10 | 8,000 | 210 | 1.25※2 | N/A | N/A | N/A |
| **4030-0750** | **3** | 7.5 | 7,400 | 320 | 3 | 7,400 | 360 | 1.5 |
| **4030-0900** | | 9 | 7,050 | 270 | 3 | N/A | N/A | N/A |
| **4030-1200** | | 12 | 6,350 | 170 | 1.5※2 | N/A | N/A | N/A |
| **4030-1500** | | 15 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4035-0900** | **3.5** | 9 | 6,500 | 350 | 3.5 | 6,500 | 370 | 1.75 |
| **4040-1000** | **4** | 10 | 5,900 | 390 | 4 | 5,900 | 380 | 2 |
| **4040-1200** | | 12 | 5,500 | 300 | 4 | N/A | N/A | N/A |
| **4040-1600** | | 16 | 4,700 | 160 | 2※2 | N/A | N/A | N/A |
| **4040-2000** | | 20 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4045-1150** | **4.5** | 11.5 | 5,300 | 410 | 4.5 | 5,300 | 390 | 2.25 |
| **4050-1250** | **5** | 12.5 | 4,800 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4050-1500** | | 15 | 4,400 | 320 | 5 | N/A | N/A | N/A |
| **4050-2000** | | 20 | 3,600 | 160 | 2.5※2 | N/A | N/A | N/A |
| **4050-2500** | | 25 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4055-1400** | **5.5** | 14 | 4,350 | 440 | 5.5 | 4,350 | 420 | 2.75 |
| Milling Amount (mm) | | | ※1 $a_p$=1D<br>※2 $a_p$=0.8D<br>※2 $a_p$=0.5D | | | $a_p$=0.5D<br>※$a_p$=0.3D | | |




Slotting
$a_p$ : Axial Depth(mm)
D : Outside Diameter(mm)

## Milling Conditions for CXES

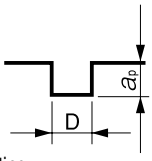
Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4060-1500** | **6** | 15 | 5,000 | 700 | 6 | 4,500 | 500 | 6 | 4,500 | 460 | 3 |
| **4060-1800** | | 18 | 5,000 | 560 | 6 | 4,500 | 410 | 6 | 3,700 | 320 | 3 |
| **4060-2400** | | 24 | 5,000 | 280 | 3※ | 4,500 | 230 | 3※ | 2,100 | 150 | 1.5※ |
| **4060-3000** | | 30 | 5,000 | 280 | 3※ | 4,500 | 230 | 3※ | 2,100 | 150 | 1.5※ |
| **4065-1650** | **6.5** | 16.5 | 4,400 | 650 | 6.5 | 3,950 | 450 | 6.5 | 3,950 | 420 | 3.25 |
| **4070-1050** | **7** | 10.5 | 3,900 | 300 | 7 | 3,550 | 200 | 7 | 3,550 | 200 | 3.5 |
| **4070-1750** | | 17.5 | 3,900 | 600 | 7 | 3,550 | 400 | 7 | 3,550 | 390 | 3.5 |
| **4075-1900** | **7.5** | 19 | 3,500 | 550 | 7.5 | 3,250 | 380 | 7.5 | 3,250 | 380 | 3.75 |
| **4080-2000** | **8** | 20 | 3,000 | 500 | 8 | 2,900 | 360 | 8 | 2,900 | 360 | 4 |
| **4080-2400** | | 24 | 2,800 | 330 | 8 | 2,600 | 260 | 8 | 2,600 | 240 | 4 |
| **4080-3200** | | 32 | 2,400 | 230 | 4※ | 2,000 | 180 | 4※ | 2,000 | 130 | 2※ |
| **4080-4000** | | 40 | 2,400 | 230 | 4※ | 2,000 | 180 | 4※ | 2,000 | 130 | 2※ |
| **4085-2150** | **8.5** | 21.5 | 2,550 | 450 | 8.5 | 2,450 | 330 | 8.5 | 2,450 | 310 | 4.25 |
| **4090-1350** | **9** | 13.5 | 2,250 | 210 | 9 | 2,150 | 160 | 9 | 2,150 | 140 | 4.5 |
| **4090-2250** | | 22.5 | 2,250 | 420 | 9 | 2,150 | 300 | 9 | 2,150 | 260 | 4.5 |
| **4095-2400** | **9.5** | 24 | 1,950 | 400 | 9.5 | 1,900 | 300 | 9.5 | 1,900 | 250 | 4.75 |
| **4100-2500** | **10** | 25 | 1,600 | 380 | 10 | 1,500 | 270 | 10 | 1,500 | 220 | 5 |
| **4100-3000** | | 30 | 1,500 | 250 | 10 | 1,500 | 180 | 10 | 1,500 | 190 | 5 |
| **4100-4000** | | 40 | 1,300 | 180 | 5※ | 1,500 | 150 | 5※ | 1,500 | 130 | 2.5※ |
| **4100-5000** | | 50 | 1,300 | 180 | 5※ | 1,500 | 150 | 5※ | 1,500 | 130 | 2.5※ |
| **4110-1650** | **11** | 16.5 | 1,400 | 170 | 11 | 1,350 | 120 | 11 | 1,350 | 100 | 5.5 |
| **4110-2750** | | 27.5 | 1,400 | 340 | 11 | 1,350 | 240 | 11 | 1,350 | 200 | 5.5 |
| **4120-3000** | **12** | 30 | 1,200 | 300 | 12 | 1,200 | 210 | 12 | 1,200 | 180 | 6 |
| **4120-3600** | | 36 | 1,150 | 200 | 12 | 1,150 | 140 | 12 | 1,150 | 150 | 6 |
| **4120-4800** | | 48 | 1,050 | 160 | 6※ | 1,050 | 120 | 6※ | 1,050 | 100 | 3※ |
| **4120-6000** | | 60 | 1,050 | 160 | 6※ | 1,050 | 120 | 6※ | 1,050 | 100 | 3※ |
| **4130-1950** | **13** | 19.5 | 1,100 | 190 | 13 | 1,100 | 90 | 13 | 1,000 | 80 | 6.5 |
| **4160-4000** | **16** | 40 | 1,000 | 400 | 8※ | 1,000 | 280 | 8※ | 720 | 240 | 4※ |
| Milling Amount (mm) | | | $a_p$=1D ※$a_p$=0.5D | | | $a_p$=1D ※$a_p$=0.5D | | | $a_p$=0.5D ※$a_p$=0.25D | | |

# Milling Conditions for CXES



| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4060-1500** | **6** | 15 | 4,000 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-1800** | | 18 | 3,600 | 290 | 6 | N/A | N/A | N/A |
| **4060-2400** | | 24 | 2,800 | 140 | 3※2 | N/A | N/A | N/A |
| **4060-3000** | | 30 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4065-1650** | **6.5** | 16.5 | 3,500 | 420 | 6.5 | 3,500 | 400 | 3.25 |
| **4070-1050** | **7** | 10.5 | 3,150 | 190 | 7 | 3,150 | 190 | 3.5 |
| **4070-1750** | | 17.5 | 3,150 | 410 | 7 | 3,150 | 380 | 3.5 |
| **4075-1900** | **7.5** | 19 | 2,850 | 400 | 7.5 | 2,850 | 370 | 3.75 |
| **4080-2000** | **8** | 20 | 2,500 | 390 | 8 | 2,500 | 340 | 4 |
| **4080-2400** | | 24 | 2,350 | 200 | 8 | N/A | N/A | N/A |
| **4080-3200** | | 32 | 2,050 | 110 | 4※2 | N/A | N/A | N/A |
| **4080-4000** | | 40 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4085-2150** | **8.5** | 21.5 | 2,150 | 330 | 8.5 | 2,150 | 300 | 4.25 |
| **4090-1350** | **9** | 13.5 | 1,950 | 150 | 9 | 1,950 | 140 | 4.5 |
| **4090-2250** | | 22.5 | 1,950 | 300 | 9 | 1,950 | 270 | 4.5 |
| **4095-2400** | **9.5** | 24 | 1,750 | 270 | 9.5 | 1,750 | 270 | 4.75 |
| **4100-2500** | **10** | 25 | 1,500 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-3000** | | 30 | 1,500 | 180 | 8※1 | N/A | N/A | N/A |
| **4100-4000** | | 40 | 1,200 | 90 | 5※2 | N/A | N/A | N/A |
| **4100-5000** | | 50 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4110-1650** | **11** | 16.5 | 1,250 | 100 | 11 | 1,350 | 110 | 5.5 |
| **4110-2750** | | 27.5 | 1,250 | 200 | 11 | 1,350 | 230 | 5.5 |
| **4120-3000** | **12** | 30 | 1,000 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-3600** | | 36 | 1,000 | 140 | 9.6※1 | N/A | N/A | N/A |
| **4120-4800** | | 48 | 800 | 70 | 6※2 | N/A | N/A | N/A |
| **4120-6000** | | 60 | N/A | N/A | N/A | N/A | N/A | N/A |
| **4130-1950** | **13** | 19.5 | 1,000 | 80 | 13 | 1,100 | 90 | 6.5 |
| **4160-4000** | **16** | 40 | 1,000 | 240 | 8※2 | 1,000 | 220 | 4.8※ |
| Milling Amount (mm) | | | ※1 $a_p$=1D<br>※2 $a_p$=0.8D<br>$a_p$=0.5D | | | $a_p$=0.5D<br>※$a_p$=0.3D | | |




Slotting
$a_p$ : Axial Depth(mm)
D : Outside Diameter(mm)

Note:
- Decrease both spindle speed and feed rate proportionally in case of chattering.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Every coolant offers stable milling.
- Recommend water soluble or oil coolant for Stainless Steels and Copper.

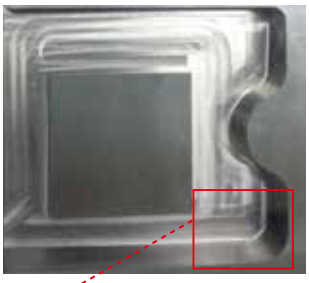
## Milling Example CXES ϕ 10 S55C

Roughing and finishing with a single tool

| | Roughing | | Finishing | |
|---|---|---|---|---|
| Tool | Conventional 4 Flutes | CXES 4100-2500 | CXES 4100-2500 | |
| Milling Part | Side / Groove | | Bottom | Side |
| Spindle Speed | 2,600 min$^{-1}$ | 2,500 min$^{-1}$ | 1,600 min$^{-1}$ | |
| Feed Rate | 525 mm/min | 1,500 mm/min | 380 mm/min | 1,000 mm/min |
| Axial Depth $a_p$ | 20 mm | 19.9 mm | 0.1 mm | 0.1 mm |
| Radial Depth $a_e$ | 0.7 mm | 1.2 mm | 0.4 mm | 0.1 mm |
| Coolant | Oil | | Oil | |
| Milling Distance | — | 11.5 m | 1.5 m | 0.7 m |
| Efficiency * | 1 | 4.8 | — | |

* Efficiency : Feed Rate × Axial Depth × Radial Depth

Size : 105 mm × 92 mm × 20 mm



Enlarged view

Finishing surface

Bottom

Side

No surface burrs after finishing process

4.8 times milling efficiency compared to conventional 4 flutes when roughing

Total Milling Distance 21 m

## Milling Example CXES ϕ 6 SUS304

| Tool | CXES4060-1500 | |
|---|---|---|
| Milling Method | Roughing | Finishing |
| Spindle Speed | 4,500 min$^{-1}$ | 4,500 min$^{-1}$ |
| Feed Rate | 810 mm/min | 400 mm/min |
| Axial Depth $a_p$ | 15 mm | 15 mm |
| Radial Depth $a_e$ | 0.6 mm | 2.5 mm (Standing Wall Finishing Allowance 0.1mm) |
| Overhang Length | 20 mm | 20 mm |
| Coolant | Water Soluble (Through Spindle) | Water Soluble (Through Spindle) |
| Cycle Time | 1:11:29 | 0:18:43 |

CXES Milling Video

① Roughing Surface

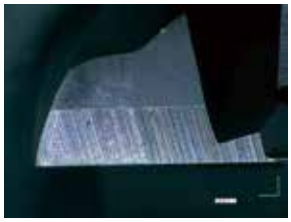
② Finishing Surface

Enlarged view

Smooth Side Finishing

Tool Wearing after Roughing Process

End Profile



Peripheral Cutting Edge

Size φ1～φ20

# C-CES4000

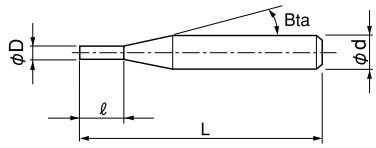
Super MG | UT COAT | 30° | Flatland | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**Broad application range from Copper and Carbon Steels up to Hardened Steels (55HRC).**
**Excellent performance/quality to price ratio.**
**Refer to page 154 for 2 flute C-CES.**




The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece. Actual measurement is necessary when using longer length of cut than the written length.

Total 56 models　　Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 4010 | 1 | 2.5 | 16° | 45 | 4 | 5,160 |
| C-CES 4010-0300 | | 3 | | 45 | 4 | 5,160 |
| C-CES 4010-0400 | | 4 | | 45 | 4 | 5,400 |
| C-CES 4015 | 1.5 | 3.75 | 16° | 45 | 4 | 5,160 |
| C-CES 4015-0450 | | 4.5 | | 45 | 4 | 5,160 |
| C-CES 4015-0600 | | 6 | | 45 | 4 | 5,400 |
| C-CES 4020 | 2 | 5 | 16° | 45 | 4 | 3,300 |
| C-CES 4020-0600 | | 6 | | 45 | 4 | 3,300 |
| C-CES 4020-0800 | | 8 | | 45 | 4 | 4,440 |
| C-CES 4025 | 2.5 | 6.25 | 16° | 45 | 4 | 3,300 |
| C-CES 4025-0750 | | 7.5 | | 50 | 4 | 3,300 |
| C-CES 4025-1000 | | 10 | | 50 | 4 | 4,440 |
| C-CES 4030-0750 | 3 | 7.5 | 16° | 45 | 6 | 3,420 |
| C-CES 4030 | | 8 | | 45 | 6 | 3,420 |
| C-CES 4030-0900 | | 9 | | 50 | 6 | 3,420 |
| C-CES 4030-1200 | | 12 | | 50 | 6 | 4,320 |
| C-CES 4035 | 3.5 | 10 | 16° | 45 | 6 | 7,150 |

Next Page ➡

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| C-CES 4040 | 4 | 11 | 16° | 45 | 6 | 3,860 |
| C-CES 4040-1200 | | 12 | | 60 | 6 | 3,860 |
| C-CES 4040-1600 | | 16 | | 60 | 6 | 5,160 |
| C-CES 4045 | 4.5 | 11 | 16° | 45 | 6 | 8,400 |
| C-CES 4050-1250 | 5 | 12.5 | 16° | 50 | 6 | 3,970 |
| C-CES 4050 | | 13 | | 50 | 6 | 3,970 |
| C-CES 4050-1500 | | 15 | | 60 | 6 | 3,970 |
| C-CES 4050-2000 | | 20 | | 60 | 6 | 5,520 |
| C-CES 4055 | 5.5 | 13 | 16° | 50 | 6 | 8,610 |
| C-CES 4060 | 6 | 13 | — | 50 | 6 | 4,170 |
| C-CES 4060-1500 | | 15 | | 50 | 6 | 4,170 |
| C-CES 4060-1800 | | 18 | | 60 | 6 | 4,170 |
| C-CES 4060-2400 | | 24 | | 60 | 6 | 6,000 |
| C-CES 4065 | 6.5 | 16 | 16° | 60 | 8 | 11,660 |
| C-CES 4070 | 7 | 16 | 16° | 60 | 8 | 10,360 |
| C-CES 4075 | 7.5 | 16 | 16° | 60 | 8 | 12,540 |
| C-CES 4080 | 8 | 19 | — | 60 | 8 | 7,090 |
| C-CES 4080-2000 | | 20 | | 60 | 8 | 7,090 |
| C-CES 4080-2400 | | 24 | | 80 | 8 | 7,090 |
| C-CES 4080-3200 | | 32 | | 80 | 8 | 15,000 |
| C-CES 4085 | 8.5 | 19 | 16° | 70 | 10 | 15,180 |
| C-CES 4090 | 9 | 19 | 16° | 70 | 10 | 13,650 |
| C-CES 4095 | 9.5 | 19 | 16° | 70 | 10 | 17,160 |
| C-CES 4100 | 10 | 22 | — | 70 | 10 | 9,460 |
| C-CES 4100-2500 | | 25 | | 70 | 10 | 9,460 |
| C-CES 4100-3000 | | 30 | | 90 | 10 | 9,460 |
| C-CES 4100-4000 | | 40 | | 90 | 10 | 16,560 |
| C-CES 4105 | 10.5 | 22 | 16° | 75 | 12 | 20,900 |
| C-CES 4110 | 11 | 22 | 16° | 75 | 12 | 20,900 |
| C-CES 4115 | 11.5 | 22 | 16° | 75 | 12 | 22,440 |
| C-CES 4120 | 12 | 26 | — | 75 | 12 | 11,880 |
| C-CES 4120-3000 | | 30 | | 75 | 12 | 11,880 |
| C-CES 4120-3600 | | 36 | | 90 | 12 | 11,880 |
| C-CES 4120-4800 | | 48 | | 100 | 12 | 25,200 |
| C-CES 4120-5000 | | 50 | | 100 | 12 | 25,200 |
| C-CES 4140 | 14 | 26 | — | 80 | 12 | 29,150 |
| C-CES 4160 | 16 | 32 | — | 110 | 16 | 46,200 |
| C-CES 4180 | 18 | 32 | 16° | 110 | 20 | 62,150 |
| C-CES 4200 | 20 | 38 | — | 110 | 20 | 68,200 |

## Milling Conditions for C-CES（4 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) Side Milling | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) Side Milling | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010** | **1** | 2.5 | 20,000 | 240 | 2 | 0.07 | 15,000 | 215 | 2 | 0.07 |
| | | 3 | | | 2.5 | 0.05 | | | 2.5 | 0.05 |
| | | 4 | | | 3.5 | 0.02 | | | 3.5 | 0.02 |
| **4015** | **1.5** | 3.75 | 13,500 | 245 | 3 | 0.105 | 10,000 | 215 | 3 | 0.105 |
| | | 4.5 | | | 3.75 | 0.075 | | | 3.75 | 0.075 |
| | | 6 | | | 5.25 | 0.03 | | | 5.25 | 0.03 |
| **4020** | **2** | 5 | 11,000 | 245 | 4 | 0.14 | 8,500 | 215 | 4 | 0.14 |
| | | 6 | | | 5 | 0.1 | | | 5 | 0.1 |
| | | 8 | | | 7 | 0.04 | | | 7 | 0.04 |
| **4025** | **2.5** | 6.25 | 8,800 | 370 | 5 | 0.175 | 7,000 | 245 | 5 | 0.175 |
| | | 7.5 | | | 6.25 | 0.125 | | | 6.25 | 0.125 |
| | | 10 | | | 8.75 | 0.05 | | | 8.75 | 0.05 |
| **4030** | **3** | 7.5 | 7,400 | 370 | 6 | 0.21 | 6,400 | 260 | 6 | 0.21 |
| | | 8 | | | 7.5 | 0.15 | | | 7.5 | 0.15 |
| | | 9 | | | 7.5 | 0.15 | | | 7.5 | 0.15 |
| | | 12 | | | 10.5 | 0.06 | | | 10.5 | 0.06 |
| **4040** | **4** | 11 | 5,900 | 435 | 10 | 0.2 | 5,000 | 340 | 10 | 0.2 |
| | | 12 | | | 10 | 0.2 | | | 10 | 0.2 |
| | | 16 | | | 14 | 0.08 | | | 14 | 0.08 |
| **4050** | **5** | 12.5 | 5,300 | 590 | 10 | 0.35 | 4,200 | 415 | 10 | 0.35 |
| | | 13 | | | 12.5 | 0.25 | | | 12.5 | 0.25 |
| | | 15 | | | 12.5 | 0.25 | | | 12.5 | 0.25 |
| | | 20 | | | 17.5 | 0.1 | | | 17.5 | 0.1 |
| **4060** | **6** | 13 | 4,400 | 580 | 12 | 0.42 | 3,500 | 415 | 12 | 0.42 |
| | | 15 | | | 12 | 0.42 | | | 12 | 0.42 |
| | | 18 | | | 15 | 0.3 | | | 15 | 0.3 |
| | | 24 | | | 21 | 0.12 | | | 21 | 0.12 |
| **4080** | **8** | 19 | 3,300 | 550 | 16 | 0.56 | 2,600 | 415 | 16 | 0.56 |
| | | 20 | | | 16 | 0.56 | | | 16 | 0.56 |
| | | 24 | | | 20 | 0.4 | | | 20 | 0.4 |
| | | 32 | | | 28 | 0.16 | | | 28 | 0.16 |
| **4100** | **10** | 22 | 2,600 | 525 | 20 | 0.7 | 2,100 | 405 | 20 | 0.7 |
| | | 25 | | | 20 | 0.7 | | | 20 | 0.7 |
| | | 30 | | | 25 | 0.5 | | | 25 | 0.5 |
| | | 40 | | | 35 | 0.2 | | | 35 | 0.2 |
| **4120** | **12** | 26 | 2,200 | 525 | 24 | 0.84 | 1,750 | 405 | 24 | 0.84 |
| | | 30 | | | 24 | 0.84 | | | 24 | 0.84 |
| | | 36 | | | 30 | 0.6 | | | 30 | 0.6 |
| | | 48 | | | 42 | 0.24 | | | 42 | 0.24 |
| | | 50 | | | 42 | 0.24 | | | 42 | 0.24 |

## Milling Conditions for C-CES（4 Flutes）

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) Side Milling | | | | HARDENED STEELS SKD / SKT (45～55HRC) Side Milling | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010** | **1** | 2.5 | 11,000 | 85 | 2 | 0.07 | 7,100 | 40 | 1.5 | 0.03 |
| | | 3 | | | 2.5 | 0.05 | | | 2 | 0.02 |
| | | 4 | | | 3.5 | 0.02 | | | 3 | 0.01 |
| **4015** | **1.5** | 3.75 | 8,000 | 90 | 3 | 0.105 | 5,100 | 50 | 2.25 | 0.045 |
| | | 4.5 | | | 3.75 | 0.075 | | | 3 | 0.03 |
| | | 6 | | | 5.25 | 0.03 | | | 4.5 | 0.015 |
| **4020** | **2** | 5 | 6,400 | 90 | 4 | 0.14 | 4,000 | 55 | 3 | 0.06 |
| | | 6 | | | 5 | 0.1 | | | 4 | 0.04 |
| | | 8 | | | 7 | 0.04 | | | 6 | 0.02 |
| **4025** | **2.5** | 6.25 | 5,000 | 90 | 5 | 0.175 | 3,200 | 55 | 3.75 | 0.075 |
| | | 7.5 | | | 6.25 | 0.125 | | | 5 | 0.05 |
| | | 10 | | | 8.75 | 0.05 | | | 7.5 | 0.025 |
| **4030** | **3** | 7.5 | 4,500 | 105 | 6 | 0.21 | 2,800 | 65 | 4.5 | 0.09 |
| | | 8 | | | 7.5 | 0.15 | | | 6 | 0.06 |
| | | 9 | | | 7.5 | 0.15 | | | 6 | 0.06 |
| | | 12 | | | 10.5 | 0.06 | | | 9 | 0.03 |
| **4040** | **4** | 11 | 3,500 | 120 | 10 | 0.2 | 2,150 | 70 | 8 | 0.08 |
| | | 12 | | | 10 | 0.2 | | | 8 | 0.08 |
| | | 16 | | | 14 | 0.08 | | | 12 | 0.04 |
| **4050** | **5** | 12.5 | 2,950 | 120 | 10 | 0.35 | 1,850 | 75 | 7.5 | 0.15 |
| | | 13 | | | 12.5 | 0.25 | | | 10 | 0.1 |
| | | 15 | | | 12.5 | 0.25 | | | 10 | 0.1 |
| | | 20 | | | 17.5 | 0.1 | | | 15 | 0.05 |
| **4060** | **6** | 13 | 2,450 | 130 | 12 | 0.42 | 1,500 | 70 | 9 | 0.18 |
| | | 15 | | | 12 | 0.42 | | | 9 | 0.18 |
| | | 18 | | | 15 | 0.3 | | | 12 | 0.12 |
| | | 24 | | | 21 | 0.12 | | | 18 | 0.06 |
| **4080** | **8** | 19 | 1,850 | 125 | 16 | 0.56 | 1,200 | 70 | 12 | 0.24 |
| | | 20 | | | 16 | 0.56 | | | 12 | 0.24 |
| | | 24 | | | 20 | 0.4 | | | 16 | 0.16 |
| | | 32 | | | 28 | 0.16 | | | 24 | 0.08 |
| **4100** | **10** | 22 | 1,450 | 125 | 20 | 0.7 | 950 | 65 | 15 | 0.3 |
| | | 25 | | | 20 | 0.7 | | | 15 | 0.3 |
| | | 30 | | | 25 | 0.5 | | | 20 | 0.2 |
| | | 40 | | | 35 | 0.2 | | | 30 | 0.1 |
| **4120** | **12** | 26 | 1,200 | 120 | 24 | 0.84 | 800 | 60 | 18 | 0.36 |
| | | 30 | | | 24 | 0.84 | | | 18 | 0.36 |
| | | 36 | | | 30 | 0.6 | | | 24 | 0.24 |
| | | 48 | | | 42 | 0.24 | | | 36 | 0.12 |
| | | 50 | | | 42 | 0.24 | | | 36 | 0.12 |

## Milling Conditions for C-CES（4 Flutes）

◆High speed milling

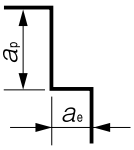
| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Side Milling | | | | Side Milling | | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4030** | **3** | 7.5 | 30,000 | 1,500 | 6 | 0.21 | 26,500 | 1,075 | 6 | 0.21 |
| | | 8 | | | 7.5 | 0.15 | | | 7.5 | 0.15 |
| | | 9 | | | 7.5 | 0.15 | | | 7.5 | 0.15 |
| | | 12 | | | 10.5 | 0.06 | | | 10.5 | 0.06 |
| **4040** | **4** | 11 | 23,800 | 1,755 | 10 | 0.2 | 19,800 | 1,345 | 10 | 0.2 |
| | | 12 | | | 10 | 0.2 | | | 10 | 0.2 |
| | | 16 | | | 14 | 0.08 | | | 14 | 0.08 |
| **4050** | **5** | 12.5 | 19,000 | 2,115 | 10 | 0.35 | 15,800 | 1,560 | 10 | 0.35 |
| | | 13 | | | 12.5 | 0.25 | | | 12.5 | 0.25 |
| | | 15 | | | 12.5 | 0.25 | | | 12.5 | 0.25 |
| | | 20 | | | 17.5 | 0.1 | | | 17.5 | 0.1 |
| **4060** | **6** | 13 | 15,900 | 2,095 | 12 | 0.42 | 13,200 | 1,565 | 12 | 0.42 |
| | | 15 | | | 12 | 0.42 | | | 12 | 0.42 |
| | | 18 | | | 15 | 0.3 | | | 15 | 0.3 |
| | | 24 | | | 21 | 0.12 | | | 21 | 0.12 |
| **4080** | **8** | 19 | 11,900 | 1,985 | 16 | 0.56 | 9,900 | 1,580 | 16 | 0.56 |
| | | 20 | | | 16 | 0.56 | | | 16 | 0.56 |
| | | 24 | | | 20 | 0.4 | | | 20 | 0.4 |
| | | 32 | | | 28 | 0.16 | | | 28 | 0.16 |
| **4100** | **10** | 22 | 9,500 | 1,920 | 20 | 0.7 | 7,900 | 1,525 | 20 | 0.7 |
| | | 25 | | | 20 | 0.7 | | | 20 | 0.7 |
| | | 30 | | | 25 | 0.5 | | | 25 | 0.5 |
| | | 40 | | | 35 | 0.2 | | | 35 | 0.2 |
| **4120** | **12** | 26 | 7,900 | 1,885 | 24 | 0.84 | 6,600 | 1,525 | 24 | 0.84 |
| | | 30 | | | 24 | 0.84 | | | 24 | 0.84 |
| | | 36 | | | 30 | 0.6 | | | 30 | 0.6 |
| | | 48 | | | 42 | 0.24 | | | 42 | 0.24 |
| | | 50 | | | 42 | 0.24 | | | 42 | 0.24 |

# Milling Conditions for C-CES（4 Flutes）

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Side Milling | | | | Side Milling | | | |
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4030** | **3** | 7.5 | 21,200 | 495 | 6 | 0.21 | 15,800 | 365 | 4.5 | 0.09 |
| | | 8 | | | 7.5 | 0.15 | | | 6 | 0.06 |
| | | 9 | | | 7.5 | 0.15 | | | 6 | 0.06 |
| | | 12 | | | 10.5 | 0.06 | | | 9 | 0.03 |
| **4040** | **4** | 11 | 15,800 | 540 | 10 | 0.2 | 11,900 | 385 | 8 | 0.08 |
| | | 12 | | | 10 | 0.2 | | | 8 | 0.08 |
| | | 16 | | | 14 | 0.08 | | | 12 | 0.04 |
| **4050** | **5** | 12.5 | 12,700 | 515 | 10 | 0.35 | 9,500 | 385 | 7.5 | 0.15 |
| | | 13 | | | 12.5 | 0.25 | | | 10 | 0.1 |
| | | 15 | | | 12.5 | 0.25 | | | 10 | 0.1 |
| | | 20 | | | 17.5 | 0.1 | | | 15 | 0.05 |
| **4060** | **6** | 13 | 10,600 | 560 | 12 | 0.42 | 7,900 | 370 | 9 | 0.18 |
| | | 15 | | | 12 | 0.42 | | | 9 | 0.18 |
| | | 18 | | | 15 | 0.3 | | | 12 | 0.12 |
| | | 24 | | | 21 | 0.12 | | | 18 | 0.06 |
| **4080** | **8** | 19 | 7,900 | 535 | 16 | 0.56 | 5,900 | 345 | 12 | 0.24 |
| | | 20 | | | 16 | 0.56 | | | 12 | 0.24 |
| | | 24 | | | 20 | 0.4 | | | 16 | 0.16 |
| | | 32 | | | 28 | 0.16 | | | 24 | 0.08 |
| **4100** | **10** | 22 | 6,300 | 545 | 20 | 0.7 | 4,700 | 320 | 15 | 0.3 |
| | | 25 | | | 20 | 0.7 | | | 15 | 0.3 |
| | | 30 | | | 25 | 0.5 | | | 20 | 0.2 |
| | | 40 | | | 35 | 0.2 | | | 30 | 0.1 |
| **4120** | **12** | 26 | 5,300 | 530 | 24 | 0.84 | 3,900 | 295 | 18 | 0.36 |
| | | 30 | | | 24 | 0.84 | | | 18 | 0.36 |
| | | 36 | | | 30 | 0.6 | | | 24 | 0.24 |
| | | 48 | | | 42 | 0.24 | | | 36 | 0.12 |
| | | 50 | | | 42 | 0.24 | | | 36 | 0.12 |

Milling amount（mm）

| Length of Cut / Work Material | 2.5D or below | 3D or below | 4D or above |
|---|---|---|---|
| 45HRC or below | $a_p$=2D<br>$a_e$=0.07D | $a_p$=2.5D<br>$a_e$=0.05D | $a_p$=3.5D<br>$a_e$=0.02D |
| 45HRC or above | $a_p$=1.5D<br>$a_e$=0.03D | $a_p$=2D<br>$a_e$=0.02D | $a_p$=3D<br>$a_e$=0.01D |




D：Outside Diameter（mm）

Ex.）2D or below : Flute Length = Diameter × 2 or below

$a_p$：Axial Depth（mm）

$a_e$：Radial Depth（mm）

Note:
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

Size φ1～φ12

# C-CES4000S

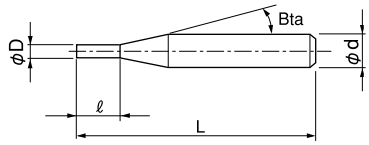
Super MG | UT COAT | 30° | Sharp Corner | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**4 flute C-CES with a sharp corner design.**
**Broad application range from Copper and Carbon Steels up to Hardened Steels (55HRC).**
**Excellent performance / quality to price ratio.**
**Refer to page 168 for 2 flute C-CES-S.**




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

Length of Cut for C-CES 4020S has been changed from 5 mm to 6 mm.
Change Date: from production in November 2012.

Total 11 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **C-CES 4010S** | 1 | 2.5 | 16° | 45 | 4 | 5,160 |
| **C-CES 4015S** | 1.5 | 3.75 | 16° | 45 | 4 | 5,160 |
| **C-CES 4020S** | 2 | 6 | 16° | 45 | 4 | 3,300 |
| **C-CES 4025S** | 2.5 | 6.25 | 16° | 45 | 4 | 3,300 |
| **C-CES 4030S** | 3 | 8 | 16° | 45 | 6 | 3,420 |
| **C-CES 4040S** | 4 | 11 | 16° | 45 | 6 | 3,860 |
| **C-CES 4050S** | 5 | 13 | 16° | 50 | 6 | 3,970 |
| **C-CES 4060S** | 6 | 13 | — | 50 | 6 | 4,170 |
| **C-CES 4080S** | 8 | 19 | — | 60 | 8 | 7,090 |
| **C-CES 4100S** | 10 | 22 | — | 70 | 10 | 9,460 |
| **C-CES 4120S** | 12 | 26 | — | 75 | 12 | 11,880 |

## Milling Conditions for C-CES-S（4 Flutes）

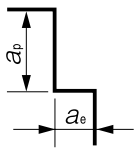
| WORK MATERIAL | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Side Milling | | | | Side Milling | | | |
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial 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) |
| **4010S** | **1** | 20,000 | 170 | 2 | 0.07 | 13,700 | 150 | 2 | 0.07 |
| **4015S** | **1.5** | 13,400 | 190 | 3 | 0.105 | 9,100 | 160 | 3 | 0.105 |
| **4020S** | **2** | 11,600 | 200 | 4 | 0.14 | 5,600 | 170 | 4 | 0.14 |
| **4025S** | **2.5** | 9,300 | 300 | 5 | 0.175 | 4,200 | 190 | 5 | 0.175 |
| **4030S** | **3** | 8,800 | 340 | 6 | 0.21 | 6,700 | 210 | 6 | 0.21 |
| **4040S** | **4** | 6,600 | 370 | 8 | 0.28 | 5,000 | 270 | 8 | 0.28 |
| **4050S** | **5** | 5,300 | 450 | 10 | 0.35 | 4,000 | 320 | 10 | 0.35 |
| **4060S** | **6** | 4,400 | 450 | 12 | 0.42 | 3,300 | 320 | 12 | 0.42 |
| **4080S** | **8** | 3,300 | 420 | 16 | 0.56 | 2,500 | 300 | 16 | 0.56 |
| **4100S** | **10** | 2,650 | 410 | 20 | 0.7 | 2,000 | 300 | 20 | 0.7 |
| **4120S** | **12** | 2,200 | 400 | 24 | 0.84 | 1,700 | 300 | 24 | 0.84 |

| WORK MATERIAL | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Side Milling | | | | Side Milling | | | |
| Model Number | Outside Diameter (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) |
| **4010S** | **1** | 7,300 | 55 | 2 | 0.07 | 1,600 | 15 | 1.5 | 0.03 |
| **4015S** | **1.5** | 4,900 | 60 | 3 | 0.105 | 1,100 | 15 | 2.25 | 0.045 |
| **4020S** | **2** | 5,300 | 65 | 4 | 0.14 | 2,400 | 30 | 3 | 0.06 |
| **4025S** | **2.5** | 4,200 | 70 | 5 | 0.175 | 1,900 | 35 | 3.75 | 0.075 |
| **4030S** | **3** | 4,600 | 90 | 6 | 0.21 | 2,700 | 50 | 4.5 | 0.09 |
| **4040S** | **4** | 3,400 | 100 | 8 | 0.28 | 2,000 | 55 | 6 | 0.12 |
| **4050S** | **5** | 2,700 | 110 | 10 | 0.35 | 1,600 | 60 | 7.5 | 0.15 |
| **4060S** | **6** | 2,300 | 110 | 12 | 0.42 | 1,300 | 60 | 9 | 0.18 |
| **4080S** | **8** | 1,700 | 100 | 16 | 0.56 | 1,000 | 50 | 12 | 0.24 |
| **4100S** | **10** | 1,400 | 100 | 20 | 0.7 | 800 | 50 | 15 | 0.3 |
| **4120S** | **12** | 1,150 | 90 | 24 | 0.84 | 700 | 45 | 18 | 0.36 |

Milling Amount for side milling（mm）

| | |
|---|---|
| 45HRC or below | $a_p$=2D<br>$a_e$=0.07D |
| 45HRC or above | $a_p$=1.5D<br>$a_e$=0.03D |

D：Outside Diameter（mm）




$a_p$：Axial Depth（mm）
$a_e$：Radial Depth（mm）

Note:
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

**Size φ6～φ12**

# CESUS

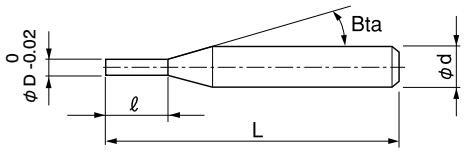
Super MG | UTS COAT | 40°~42° | Flatland | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ☆ | ○ | | | | ○ | | | ○ | | | ○ | ○ | | |

## Features

**4 Flute Highly Efficient Square End Mills for stainless steels.**
**Variable pitch & variable helix designed for milling stainless steels offers higher efficiency milling.**
**New coating 'UTSCOAT' with excellent adhesion offers high resistance to breakage.**

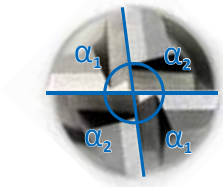



The shank taper angle shown is not an exact value and to avoid contact with the workpiece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

## Design features

Variable pitch & variable helix designed for milling stainless steels.

Variable pitch




$\alpha_1 \neq \alpha_2$

Variable helix

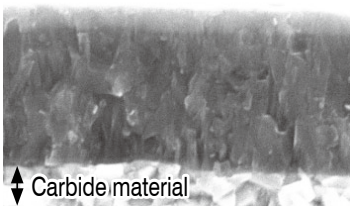
$\beta_1 \neq \beta_2$

Minimizes chattering

Stable milling under highly efficient conditions

## Features of UTSCOAT

Improve the resistance to adhesion by adding a highly lubricant layer onto the high hardness and high toughness UTCOAT.




★ Ultra lubricant layer
◆ Ultra hard layer
◆ High toughness and adhesion layer

Reduce adhesion

High resistance to breakage with high lubricity

Total 21 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **CESUS 4060-0900** | 6 | 9 | — | 60 | 6 | 8,500 |
| **CESUS 4060-1300** | | 13 | | 60 | 6 | 8,500 |
| **CESUS 4060-1800** | | 18 | | 60 | 6 | 9,350 |
| **CESUS 4070-1050** | 7 | 10.5 | 16° | 70 | 8 | 10,500 |
| **CESUS 4070-1600** | | 16 | | 70 | 8 | 10,500 |
| **CESUS 4070-2100** | | 21 | | 70 | 8 | 11,550 |
| **CESUS 4080-1200** | 8 | 12 | — | 70 | 8 | 10,500 |
| **CESUS 4080-1900** | | 19 | | 70 | 8 | 10,500 |
| **CESUS 4080-2400** | | 24 | | 70 | 8 | 11,550 |
| **CESUS 4090-1350** | 9 | 13.5 | 16° | 80 | 10 | 12,500 |
| **CESUS 4090-1900** | | 19 | | 80 | 10 | 12,500 |
| **CESUS 4090-2700** | | 27 | | 80 | 10 | 13,750 |
| **CESUS 4100-1500** | 10 | 15 | — | 80 | 10 | 12,500 |
| **CESUS 4100-2200** | | 22 | | 80 | 10 | 12,500 |
| **CESUS 4100-3000** | | 30 | | 80 | 10 | 13,750 |
| **CESUS 4110-1650** | 11 | 16.5 | 16° | 100 | 12 | 17,800 |
| **CESUS 4110-2200** | | 22 | | 100 | 12 | 17,800 |
| **CESUS 4110-3300** | | 33 | | 100 | 12 | 19,580 |
| **CESUS 4120-1800** | 12 | 18 | — | 100 | 12 | 17,800 |
| **CESUS 4120-2600** | | 26 | | 100 | 12 | 17,800 |
| **CESUS 4120-3600** | | 36 | | 100 | 12 | 19,580 |

## Milling Conditions for CESUS

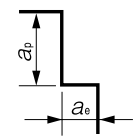
Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-0900** | **6** | 9 | 6,000 | 1,600 | 9 | 1.2 | 6,000 | 1,100 | 9 | 1.2 | 6,000 | 1,100 | 9 | 1.2 |
| **4060-1300** | | 13 | 6,000 | 1,600 | 13 | 1.2 | 6,000 | 1,100 | 13 | 1.2 | 6,000 | 1,100 | 13 | 1.2 |
| **4060-1800** | | 18 | 6,000 | 1,170 | 18 | 1.2 | 4,800 | 800 | 18 | 1.2 | 4,800 | 800 | 18 | 1.2 |
| **4070-1050** | **7** | 10.5 | 5,000 | 1,450 | 10.5 | 1.4 | 5,000 | 1,025 | 10.5 | 1.4 | 5,000 | 1,025 | 10.5 | 1.4 |
| **4070-1600** | | 16 | 5,000 | 1,450 | 16 | 1.4 | 5,000 | 1,025 | 16 | 1.4 | 5,000 | 1,025 | 16 | 1.4 |
| **4070-2100** | | 21 | 5,000 | 1,060 | 21 | 1.4 | 4,000 | 750 | 21 | 1.4 | 4,000 | 750 | 21 | 1.4 |
| **4080-1200** | **8** | 12 | 4,300 | 1,300 | 12 | 1.6 | 4,300 | 950 | 12 | 1.6 | 4,300 | 950 | 12 | 1.6 |
| **4080-1900** | | 19 | 4,300 | 1,300 | 19 | 1.6 | 4,300 | 950 | 19 | 1.6 | 4,300 | 950 | 19 | 1.6 |
| **4080-2400** | | 24 | 4,300 | 950 | 24 | 1.6 | 3,440 | 695 | 24 | 1.6 | 3,440 | 695 | 24 | 1.6 |
| **4090-1350** | **9** | 13.5 | 3,700 | 1,150 | 13.5 | 1.8 | 3,700 | 875 | 13.5 | 1.8 | 3,700 | 875 | 13.5 | 1.8 |
| **4090-1900** | | 19 | 3,700 | 1,150 | 19 | 1.8 | 3,700 | 875 | 19 | 1.8 | 3,700 | 875 | 19 | 1.8 |
| **4090-2700** | | 27 | 3,700 | 840 | 27 | 1.8 | 2,960 | 640 | 27 | 1.8 | 2,960 | 640 | 27 | 1.8 |
| **4100-1500** | **10** | 15 | 3,200 | 1,000 | 15 | 2 | 3,200 | 800 | 15 | 2 | 3,200 | 800 | 15 | 2 |
| **4100-2200** | | 22 | 3,200 | 1,000 | 22 | 2 | 3,200 | 800 | 22 | 2 | 3,200 | 800 | 22 | 2 |
| **4100-3000** | | 30 | 3,200 | 730 | 30 | 2 | 2,650 | 580 | 30 | 2 | 2,650 | 580 | 30 | 2 |
| **4110-1650** | **11** | 16.5 | 2,900 | 900 | 16.5 | 2.2 | 2,900 | 725 | 16.5 | 2.2 | 2,900 | 725 | 16.5 | 2.2 |
| **4110-2200** | | 22 | 2,900 | 900 | 22 | 2.2 | 2,900 | 725 | 22 | 2.2 | 2,900 | 725 | 22 | 2.2 |
| **4110-3300** | | 33 | 2,900 | 650 | 33 | 2.2 | 2,400 | 530 | 33 | 2.2 | 2,400 | 530 | 33 | 2.2 |
| **4120-1800** | **12** | 18 | 2,650 | 800 | 18 | 2.4 | 2,650 | 650 | 18 | 2.4 | 2,650 | 650 | 18 | 2.4 |
| **4120-2600** | | 26 | 2,650 | 800 | 26 | 2.4 | 2,650 | 650 | 26 | 2.4 | 2,650 | 650 | 26 | 2.4 |
| **4120-3600** | | 36 | 2,650 | 580 | 36 | 2.4 | 2,200 | 475 | 36 | 2.4 | 2,200 | 475 | 36 | 2.4 |
| Milling Amount (mm) | | | $a_p$:All Flute $a_e$:0.2D | | | | $a_p$:All Flute $a_e$:0.2D | | | | $a_p$:All Flute $a_e$:0.2D | | | |

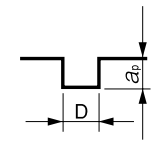
Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4060-0900** | **6** | 9 | 6,000 | 700 | 6 | 6,000 | 700 | 6 | 6,000 | 700 | 6 |
| **4060-1300** | | 13 | 6,000 | 700 | 6 | 6,000 | 700 | 6 | 6,000 | 700 | 6 |
| **4060-1800** | | 18 | 6,000 | 560 | 6 | 4,200 | 350 | 6 | 4,200 | 350 | 6 |
| **4070-1050** | **7** | 10.5 | 5,000 | 625 | 7 | 5,000 | 625 | 7 | 5,000 | 625 | 7 |
| **4070-1600** | | 16 | 5,000 | 625 | 7 | 5,000 | 625 | 7 | 5,000 | 625 | 7 |
| **4070-2100** | | 21 | 5,000 | 500 | 7 | 3,500 | 300 | 7 | 3,500 | 300 | 7 |
| **4080-1200** | **8** | 12 | 4,300 | 550 | 8 | 4,300 | 550 | 8 | 4,000 | 500 | 8 |
| **4080-1900** | | 19 | 4,300 | 550 | 8 | 4,300 | 550 | 8 | 4,000 | 500 | 8 |
| **4080-2400** | | 24 | 4,300 | 440 | 8 | 3,000 | 275 | 8 | 3,000 | 275 | 8 |
| **4090-1350** | **9** | 13.5 | 3,500 | 475 | 9 | 3,500 | 475 | 9 | 3,150 | 430 | 9 |
| **4090-1900** | | 19 | 3,500 | 475 | 9 | 3,500 | 475 | 9 | 3,150 | 430 | 9 |
| **4090-2700** | | 27 | 3,500 | 380 | 9 | 2,450 | 240 | 9 | 2,450 | 240 | 9 |
| **4100-1500** | **10** | 15 | 2,900 | 400 | 10 | 2,900 | 400 | 10 | 2,900 | 400 | 10 |
| **4100-2200** | | 22 | 2,900 | 400 | 10 | 2,900 | 400 | 10 | 2,900 | 400 | 10 |
| **4100-3000** | | 30 | 2,900 | 320 | 10 | 2,000 | 200 | 10 | 2,000 | 200 | 10 |
| **4110-1650** | **11** | 16.5 | 2,650 | 340 | 11 | 2,650 | 340 | 11 | 2,380 | 300 | 11 |
| **4110-2200** | | 22 | 2,650 | 340 | 11 | 2,650 | 340 | 11 | 2,380 | 300 | 11 |
| **4110-3300** | | 33 | 2,650 | 270 | 11 | 1,820 | 170 | 11 | 1,820 | 170 | 11 |
| **4120-1800** | **12** | 18 | 2,420 | 300 | 12 | 2,420 | 300 | 12 | 2,420 | 300 | 12 |
| **4120-2600** | | 26 | 2,420 | 300 | 12 | 2,420 | 300 | 12 | 2,420 | 300 | 12 |
| **4120-3600** | | 36 | 2,420 | 240 | 12 | 1,650 | 150 | 12 | 1,650 | 150 | 12 |
| Milling Amount (mm) | | | $a_p$:1D | | | $a_p$:1D | | | $a_p$:1D | | |

Note:
- Decrease both spindle speed and feed rate proportionally in case of chattering.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Every coolant offers stable milling.
- Recommend water soluble or oil coolant for Stainless Steels.




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

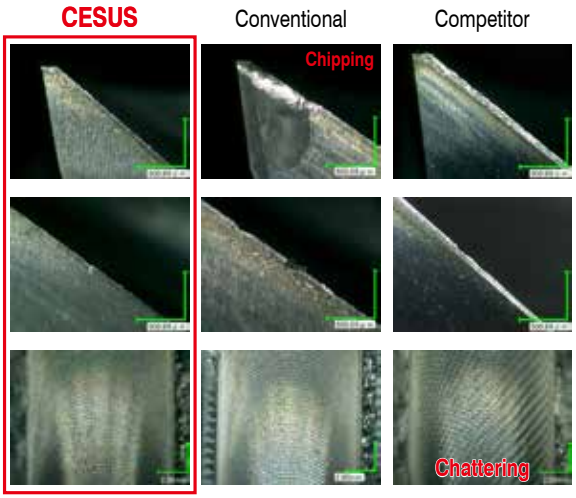



Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

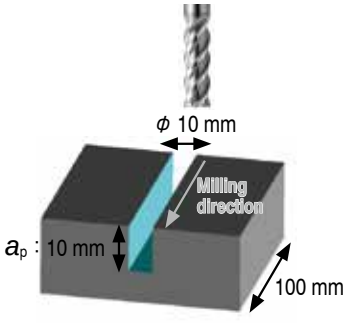
## Milling Example for Slotting CESUS $\phi$10 × Length of Cut 22 SUS304

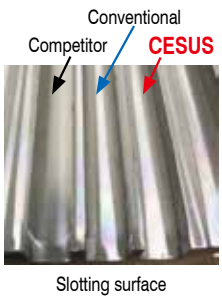
| Tool | CESUS 4100-2200 |
|---|---|
| Spindle Speed | 3,200 min$^{-1}$ |
| Feed Rate | 900 mm/min * |
| Axial Depth $a_p$ | 10 mm |
| Coolant | Water Soluble |
| Milling Distance | 100 mm |

*Milled by higher efficiency conditions than catalogue conditions to evaluate the tool performance.




Milling image

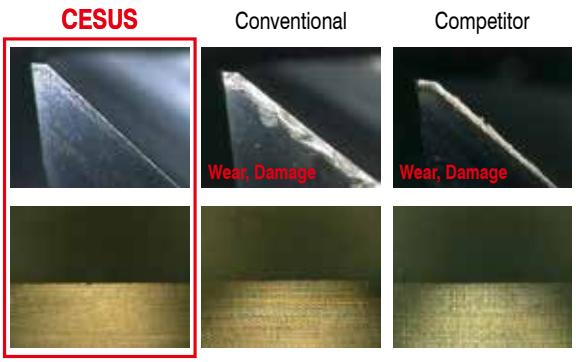


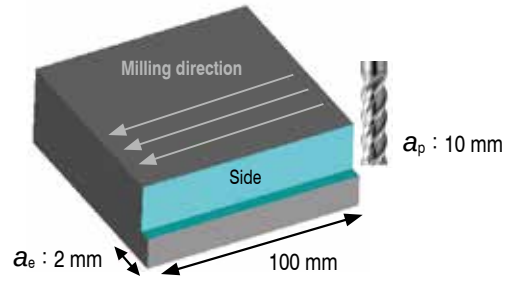

**CESUS offers stable milling with less chattering under highly efficient conditions.**

## Milling Example for Side Milling CESUS $\phi$10 × Length of Cut 22 SUS304

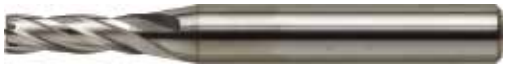
| Tool | CESUS 4100-2200 |
|---|---|
| Spindle Speed | 2,560 min$^{-1}$ |
| Feed Rate | 580 mm/min |
| Axial Depth $a_p$ | 10 mm |
| Radial Depth $a_e$ | 2 mm |
| Coolant | Water Soluble |
| Milling Distance | 64.8 m |
| Cycle Time | 120 min |




Milling image




**CESUS offers longer tool life with less wear and damage after 120 min of milling!**
**Great surface finish without chattering!**



Size φ3～φ12

# CRN-ES4000

Super MG | CrN COAT | 25° | Sharp Corner | Shank Dia 0/-0.005

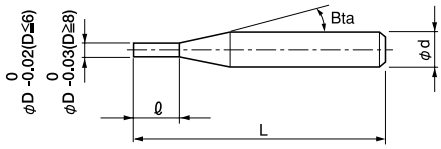
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | | ☆ | ○ | | | | | |

UDC Series
CBN Series
Square
Long Neck Square
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Long Neck Ball
Taper Neck Ball
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data

## Features

**CrN COAT offers longer tool life.**
**Special geometry designed for Copper offers excellent milling performance.**
**Refer to page 174 for 2 flute CRN-ES.**
**Diameter Tolerance: 0/-0.02(D ≦ 6), 0/-0.03(D ≧ 8)**




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

Total 10 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CRN-ES 4030-0900 | 3 | 9 | 11° | 50 | 6 | 4,620 |
| CRN-ES 4030-1200 | | 12 | 11° | 55 | 6 | 6,820 |
| CRN-ES 4040-1200 | 4 | 12 | 11° | 50 | 6 | 4,950 |
| CRN-ES 4040-1600 | | 16 | 11° | 55 | 6 | 7,150 |
| CRN-ES 4050-1500 | 5 | 15 | 11° | 55 | 6 | 5,060 |
| CRN-ES 4060-1800 | 6 | 18 | — | 60 | 6 | 5,390 |
| CRN-ES 4060-2400 | | 24 | — | 65 | 6 | 8,250 |
| CRN-ES 4080-2400 | 8 | 24 | — | 80 | 8 | 9,480 |
| CRN-ES 4100-3000 | 10 | 30 | — | 100 | 10 | 12,720 |
| CRN-ES 4120-3600 | 12 | 36 | — | 100 | 12 | 15,840 |

# Milling Conditions for CRN-ES（4 Flutes）

Side Milling

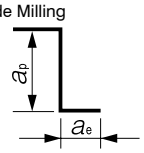
◆3D flute length type

| WORK MATERIAL | | COPPER C1100 | | | |
|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4030-0900** | **3** | 10,000 | 600 | 4.5 | 0.3 |
| **4040-1200** | **4** | 8,000 | 650 | 6 | 0.4 |
| **4050-1500** | **5** | 6,500 | 750 | 7.5 | 0.5 |
| **4060-1800** | **6** | 5,500 | 750 | 9 | 0.6 |
| **4080-2400** | **8** | 4,200 | 700 | 12 | 0.8 |
| **4100-3000** | **10** | 3,500 | 700 | 15 | 1 |
| **4120-3600** | **12** | 2,800 | 700 | 18 | 1.2 |

◆4D flute length type

| WORK MATERIAL | | COPPER C1100 | | | |
|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4030-1200** | **3** | 5,000 | 300 | 7.5 | 0.15 |
| **4040-1600** | **4** | 4,000 | 325 | 10 | 0.2 |
| **4060-2400** | **6** | 3,500 | 400 | 15 | 0.3 |

Side Milling




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

| Length of Cut / Milling | 3D Flute Length Type | 4D Flute Length Type |
|---|---|---|
| Side Milling | $a_p$ 1.5D<br>$a_e$ 0.1D | $a_p$ 2.5D<br>$a_e$ 0.05D |

Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・Adjust the milling amount and feed rate in accordance with required precision.
・Recommend water soluble or oil coolant.
・Recommended for Pure Copper. Not suitable for Tungsten Copper.

Size $\phi$3～$\phi$10

# DCES4000

MG DIA 30° Sharp Corner Shank Dia 0/-0.005

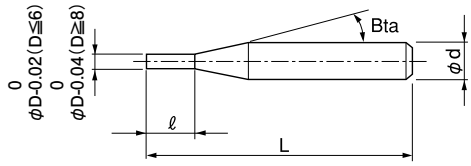
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |



## Features

**Diamond coated 4 flute square end mills for Graphite Electrodes.**
**New diamond coating with a highly adhesive base layer offers excellent wear resistance and longer tool life.**
**Refer to page 176 for 2 flute DCES.**




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

Total 11 models

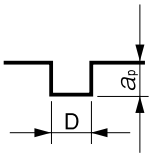
Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **DCES 4030-0900** | 3 | 9 | 16° | 50 | 6 | 20,000 |
| **DCES 4030-1200** | | 12 | | 50 | 6 | 26,000 |
| **DCES 4040-1200** | 4 | 12 | 16° | 50 | 6 | 21,000 |
| **DCES 4040-1600** | | 16 | | 60 | 6 | 27,000 |
| **DCES 4060-1800** | 6 | 18 | — | 60 | 6 | 22,000 |
| **DCES 4060-1800L** | | 18 | | 100 | 6 | 30,000 |
| **DCES 4060-2400** | | 24 | | 60 | 6 | 28,000 |
| **DCES 4080-2400** | 8 | 24 | — | 80 | 8 | 35,000 |
| **DCES 4080-3200** | | 32 | | 80 | 8 | 41,000 |
| **DCES 4100-3000** | 10 | 30 | — | 90 | 10 | 48,000 |
| **DCES 4100-4000** | | 40 | | 90 | 10 | 54,000 |

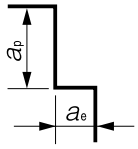
## Milling Conditions for DCES（4 Flutes）

| WORK MATERIAL | | | GRAPHITE | | | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Slotting |
| | | | | | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | $a_p$ Axial Depth (mm) |
| **4030-0900** | **3** | 9 | 25,000 | 3,000 | 6 | 0.15 | 0.75 |
| **4030-1200** | **3** | 12 | 25,000 | 3,000 | 6 | 0.15 | 0.75 |
| **4040-1200** | **4** | 12 | 19,000 | 2,350 | 9 | 0.2 | 1 |
| **4040-1600** | **4** | 16 | 19,000 | 2,350 | 9 | 0.2 | 1 |
| **4060-1800** | **6** | 18 | 13,000 | 1,800 | 12 | 0.48 | 1.5 |
| **4060-1800L** | **6** | 18 | 13,000 | 1,800 | 12 | 0.48 | 1.5 |
| **4060-2400** | **6** | 24 | 13,000 | 1,800 | 12 | 0.48 | 1.5 |
| **4080-2400** | **8** | 24 | 9,500 | 1,400 | 16 | 0.64 | 2 |
| **4080-3200** | **8** | 32 | 9,500 | 1,400 | 16 | 0.64 | 2 |
| **4100-3000** | **10** | 30 | 7,500 | 1,200 | 20 | 0.8 | 2.5 |
| **4100-4000** | **10** | 40 | 7,500 | 1,200 | 20 | 0.8 | 2.5 |

Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

**Size φ2～φ20**

# CGE

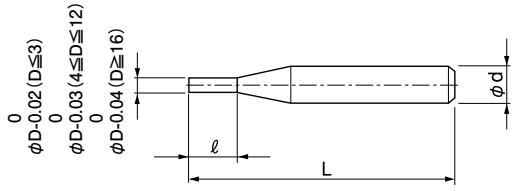
MG | 45° | Sharp Corner | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | |

## Features

**Designed for Graphite.**
**Specific carbide grade offers wear and abrasion resistance.**
**High helix angle reduces chipping of the work material.**




Total 10 models

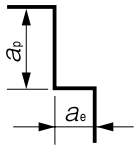
Unit (mm)

| Model Number | Outside Diameter φD | Length of Cut ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| **CGE 4020** | 2 | 15 | 60 | 3 | 16,800 |
| **CGE 4030** | 3 | 30 | 80 | 3 | 16,800 |
| **CGE 4040** | 4 | 30 | 90 | 4 | 17,700 |
| **CGE 4050** | 5 | 35 | 100 | 6 | 18,900 |
| **CGE 4060** | 6 | 40 | 150 | 6 | 19,320 |
| **CGE 4080** | 8 | 40 | 150 | 8 | 24,200 |
| **CGE 4100** | 10 | 45 | 180 | 10 | 30,580 |
| **CGE 4120** | 12 | 55 | 200 | 12 | 36,850 |
| **CGE 4160** | 16 | 70 | 200 | 16 | 56,430 |
| **CGE 4200** | 20 | 70 | 200 | 20 | 87,230 |

## Milling Conditions for CGE

| WORK MATERIAL | | GRAPHITE | | | |
|---|---|---|---|---|---|
| | | Side Milling | | | |
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4020** | **2** | 15,900 | 300 | 1 | 0.1 |
| **4030** | **3** | 15,900 | 500 | 1.5 | 0.15 |
| **4040** | **4** | 15,900 | 650 | 2 | 0.2 |
| **4050** | **5** | 12,700 | 750 | 2.5 | 0.25 |
| **4060** | **6** | 10,600 | 850 | 3 | 0.3 |
| **4080** | **8** | 8,000 | 950 | 4 | 0.4 |
| **4100** | **10** | 6,400 | 1,000 | 5 | 0.5 |
| **4120** | **12** | 5,310 | 1,000 | 6 | 0.6 |
| **4160** | **16** | 3,980 | 1,000 | 8 | 0.8 |
| **4200** | **20** | 3,180 | 1,000 | 10 | 1 |

Milling Amount for side milling (mm)
$a_p$=0.5D
$a_e$=0.05D
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)




Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

**Size φ1～φ12**

# HMS

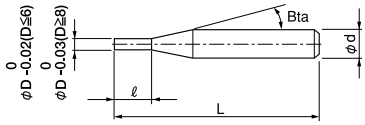
Super MG | HARD MAX | 45° | Flatland | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ ～65HRC | | | | | | | | | | |

## Features

**Offering outstanding tool life by selecting appropriate 3, 4 or 6 flutes on each tool diameter.**
**Highly efficient milling on hard materials up to 65HRC with HARDMAX COAT.**




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

Total 27 models

Unit（mm）

| Model Number | Outside Diameter φD | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Number of Flutes | Price ¥ |
|---|---|---|---|---|---|---|---|
| **HMS 3010-0250** | 1 | 2.5 | 16° | 45 | 4 | 3 | 7,500 |
| **HMS 3010-0350** | | 3.5 | | 45 | 4 | | 10,800 |
| **HMS 3015-0400** | 1.5 | 4 | 16° | 45 | 4 | 3 | 7,500 |
| **HMS 3015-0600** | | 6 | | 45 | 4 | | 10,800 |
| **HMS 3020-0400** | 2 | 4 | 16° | 45 | 4 | 3 | 6,700 |
| **HMS 3020-0700** | | 7 | | 45 | 4 | | 10,000 |
| **HMS 3030-0600** | 3 | 6 | 16° | 50 | 6 | 3 | 9,240 |
| **HMS 3030-1000** | | 10 | | 60 | 6 | | 9,800 |
| **HMS 3030-1500** | | 15 | | 60 | 6 | | 10,920 |
| **HMS 4040-0800** | 4 | 8 | 16° | 50 | 6 | 4 | 9,870 |
| **HMS 4040-1200** | | 12 | | 60 | 6 | | 10,470 |
| **HMS 4040-2000** | | 20 | | 70 | 6 | | 11,450 |
| **HMS 4050-1000** | 5 | 10 | 16° | 50 | 6 | 4 | 10,500 |
| **HMS 4050-1500** | | 15 | | 60 | 6 | | 11,100 |
| **HMS 4050-2500** | | 25 | | 70 | 6 | | 12,180 |
| **HMS 6060-1300** | 6 | 13 | — | 50 | 6 | 6 | 11,340 |
| **HMS 6060-1800** | | 18 | | 60 | 6 | | 12,100 |
| **HMS 6060-2600** | | 26 | | 70 | 6 | | 13,230 |
| **HMS 6080-1900** | 8 | 19 | — | 60 | 8 | 6 | 14,630 |
| **HMS 6080-2400** | | 24 | | 70 | 8 | | 15,000 |
| **HMS 6080-3600** | | 36 | | 90 | 8 | | 17,160 |
| **HMS 6100-2200** | 10 | 22 | — | 70 | 10 | 6 | 18,360 |
| **HMS 6100-3000** | | 30 | | 80 | 10 | | 20,000 |
| **HMS 6100-4600** | | 46 | | 100 | 10 | | 22,990 |
| **HMS 6120-2600** | 12 | 26 | — | 75 | 12 | 6 | 24,750 |
| **HMS 6120-3600** | | 36 | | 100 | 12 | | 25,400 |
| **HMS 6120-5600** | | 56 | | 120 | 12 | | 28,600 |

# Milling Conditions for HMS

◆Short length of cut

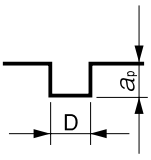
| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | | | | | HARDENED STEELS (50～60HRC) | | | | | HARDENED STEELS (60～65HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Number of Flutes | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| **3010-0250** | 3 | 1 | 9,500 | 140 | 0.05 | 1 | 0.05 | 6,400 | 95 | 0.05 | 1 | 0.05 | 6,400 | 90 | 0.05 | 1 | 0.05 |
| **3015-0400** | | 1.5 | 6,400 | 100 | 0.075 | 1.5 | 0.075 | 4,200 | 60 | 0.075 | 1.5 | 0.075 | 4,200 | 60 | 0.075 | 1.5 | 0.075 |
| **3020-0400** | | 2 | 4,700 | 80 | 0.1 | 2 | 0.1 | 3,200 | 75 | 0.1 | 2 | 0.1 | 3,200 | 70 | 0.1 | 2 | 0.1 |
| **3030-0600** | | 3 | 3,200 | 85 | 0.15 | 3 | 0.15 | 2,100 | 80 | 0.15 | 3 | 0.15 | 2,100 | 80 | 0.15 | 3 | 0.15 |
| **4040-0800** | 4 | 4 | 2,400 | 90 | 0.2 | 4 | 0.2 | 1,600 | 85 | 0.2 | 4 | 0.2 | 1,600 | 80 | 0.2 | 4 | 0.2 |
| **4050-1000** | | 5 | 1,900 | 90 | 0.25 | 5 | 0.25 | 1,300 | 85 | 0.25 | 5 | 0.25 | 1,300 | 80 | 0.25 | 5 | 0.25 |
| **6060-1300** | 6 | 6 | 1,600 | 170 | 0.3 | 6 | 0.3 | 1,100 | 120 | 0.3 | 6 | 0.3 | 1,100 | 110 | 0.3 | 6 | 0.3 |
| **6080-1900** | | 8 | 1,200 | 170 | 0.4 | 8 | 0.4 | 800 | 120 | 0.4 | 8 | 0.4 | 800 | 110 | 0.4 | 8 | 0.4 |
| **6100-2200** | | 10 | 950 | 170 | 0.5 | 15 | 0.5 | 640 | 100 | 0.5 | 15 | 0.5 | 640 | 80 | 0.5 | 15 | 0.5 |
| **6120-2600** | | 12 | 800 | 170 | 0.5 | 18 | 0.5 | 530 | 90 | 0.5 | 18 | 0.5 | 530 | 70 | 0.5 | 18 | 0.5 |
| Milling Amount (mm) | | Slotting | $a_p \leqq 0.05D$ (max 0.5 mm) | | | | | | | | | | | | | | |
| | | Side Milling | $D \leqq \phi 8$ $a_p = 1D$<br>$D \geqq \phi 10$ $a_p = 1.5D$<br>$a_e \leqq 0.05D$ (max 0.5 mm) | | | | | | | | | | | | | | |

◆High speed milling for short length of cut

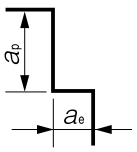
| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | | | | HARDENED STEELS (50～60HRC) | | | | HARDENED STEELS (60～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Number of Flutes | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | |
| | | | | | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_e$ (mm) |
| **3010-0250** | 3 | 1 | 22,500 | 630 | 1.5 | 0.03 | 20,000 | 540 | 1.5 | 0.02 | 15,000 | 450 | 0.5 | 0.01 |
| **3015-0400** | | 1.5 | 18,000 | 720 | 2.25 | 0.045 | 16,000 | 630 | 2.25 | 0.03 | 11,500 | 540 | 0.75 | 0.015 |
| **3020-0400** | | 2 | 14,300 | 850 | 3 | 0.06 | 13,000 | 750 | 3 | 0.04 | 8,500 | 630 | 1 | 0.02 |
| **3030-0600** | | 3 | 13,100 | 1,120 | 4.5 | 0.09 | 11,200 | 950 | 4.5 | 0.06 | 6,700 | 760 | 1.5 | 0.03 |
| **4040-0800** | 4 | 4 | 11,300 | 1,300 | 6 | 0.12 | 9,900 | 1,170 | 6 | 0.08 | 2,850 | 630 | 8 | 0.08 |
| **4050-1000** | | 5 | 10,100 | 1,530 | 7.5 | 0.15 | 8,900 | 1,350 | 7.5 | 0.1 | 2,400 | 700 | 10 | 0.1 |
| **6060-1300** | 6 | 6 | 8,900 | 1,950 | 9 | 0.18 | 8,000 | 1,800 | 9 | 0.12 | 2,150 | 830 | 12 | 0.12 |
| **6080-1900** | | 8 | 7,700 | 2,350 | 12 | 0.24 | 6,900 | 2,200 | 12 | 0.16 | 2,100 | 900 | 16 | 0.16 |
| **6100-2200** | | 10 | 6,700 | 3,100 | 15 | 0.3 | 6,000 | 2,700 | 15 | 0.2 | 2,000 | 1,000 | 20 | 0.2 |
| **6120-2600** | | 12 | 5,800 | 3,000 | 18 | 0.36 | 5,300 | 2,500 | 18 | 0.24 | 1,950 | 1,070 | 24 | 0.24 |
| Milling Amount (mm) | Side Milling | | $a_p = 1.5D$<br>$a_e = 0.03D$ (max 0.5 mm) | | | | $a_p = 1.5D$ $a_e = 0.02D$ | | | | $D \leqq \phi 3$ $a_p = 0.5D$ $a_e = 0.01D$<br>$D \geqq \phi 4$ $a_p = 2D$ $a_e = 0.02D$ | | | |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Slotting




Side Milling



## Milling Conditions for HMS

◆Medium length of cut

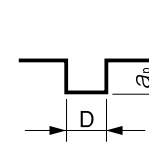
| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | | | | | HARDENED STEELS (50～60HRC) | | | | | HARDENED STEELS (60～65HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Number of Flutes | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Slotting | Side Milling | |
| | | | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_p$ (mm) | $a_e$ (mm) |
| **3030-1000** | **3** | 3 | 3,200 | 43～85 | 0.09 | 6 | 0.09 | 2,100 | 40～80 | 0.09 | 6 | 0.09 | 2,100 | 40～80 | 0.09 | 6 | 0.09 |
| **4040-1200** | **4** | 4 | 2,400 | 45～90 | 0.12 | 8 | 0.12 | 1,600 | 43～85 | 0.12 | 8 | 0.12 | 1,600 | 40～80 | 0.12 | 8 | 0.12 |
| **4050-1500** | | 5 | 1,900 | 45～90 | 0.15 | 10 | 0.15 | 1,300 | 43～85 | 0.15 | 10 | 0.15 | 1,300 | 40～80 | 0.15 | 10 | 0.15 |
| **6060-1800** | **6** | 6 | 1,600 | 85～170 | 0.18 | 12 | 0.18 | 1,100 | 60～120 | 0.18 | 12 | 0.18 | 1,100 | 55～110 | 0.18 | 12 | 0.18 |
| **6080-2400** | | 8 | 1,200 | 85～170 | 0.24 | 16 | 0.24 | 800 | 60～120 | 0.24 | 16 | 0.24 | 800 | 55～110 | 0.24 | 16 | 0.24 |
| **6100-3000** | | 10 | 950 | 85～170 | 0.3 | 25 | 0.3 | 640 | 50～100 | 0.3 | 25 | 0.3 | 640 | 40～80 | 0.3 | 25 | 0.3 |
| **6120-3600** | | 12 | 800 | 85～170 | 0.3 | 30 | 0.3 | 530 | 45～90 | 0.3 | 30 | 0.3 | 530 | 35～70 | 0.3 | 30 | 0.3 |
| Milling Amount (mm) | | Slotting | $a_p \leqq 0.03D$ (max 0.3 mm) | | | | | | | | | | | | | | |
| | | Side Milling | D≦φ8 $a_p=2D$<br>D≧φ10 $a_p=2.5D$<br>$a_e \leqq 0.03D$ (max 0.3 mm) | | | | | | | | | | | | | | |

◆Long length of cut

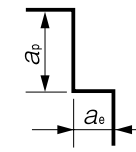
| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | | | | HARDENED STEELS (50～60HRC) | | | | HARDENED STEELS (60～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Number of Flutes | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | |
| | | | | | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_e$ (mm) | | | $a_p$ (mm) | $a_e$ (mm) |
| **3010-0350** | **3** | 1 | 9,500 | 140～210 | 3 | 0.02 | 6,400 | 95～143 | 3 | 0.02 | 6,400 | 95～133 | 3 | 0.02 |
| **3015-0600** | | 1.5 | 6,300 | 100～150 | 4.5 | 0.03 | 4,200 | 80～120 | 4.5 | 0.03 | 4,200 | 80～112 | 4.5 | 0.03 |
| **3020-0700** | | 2 | 4,700 | 80～120 | 6 | 0.04 | 3,200 | 75～113 | 6 | 0.04 | 3,200 | 75～113 | 6 | 0.04 |
| **3030-1500** | | 3 | 3,200 | 85～128 | 9 | 0.06 | 2,100 | 80～120 | 9 | 0.06 | 2,100 | 80～120 | 9 | 0.06 |
| **4040-2000** | **4** | 4 | 2,400 | 90～135 | 12 | 0.08 | 1,600 | 85～128 | 12 | 0.08 | 1,600 | 83～125 | 12 | 0.08 |
| **4050-2500** | | 5 | 1,900 | 90～135 | 15 | 0.1 | 1,300 | 85～128 | 15 | 0.1 | 1,300 | 83～125 | 15 | 0.1 |
| **6060-2600** | **6** | 6 | 1,600 | 170～255 | 18 | 0.12 | 1,100 | 120～180 | 18 | 0.12 | 1,100 | 112～168 | 18 | 0.12 |
| **6080-3600** | | 8 | 1,200 | 170～255 | 24 | 0.16 | 800 | 120～180 | 24 | 0.16 | 800 | 110～166 | 24 | 0.16 |
| **6100-4600** | | 10 | 950 | 170～255 | 30 | 0.2 | 640 | 100～150 | 30 | 0.2 | 640 | 88～132 | 30 | 0.2 |
| **6120-5600** | | 12 | 800 | 170～255 | 36 | 0.24 | 530 | 90～135 | 36 | 0.24 | 530 | 76～114 | 36 | 0.24 |
| Milling Amount (mm) | | Side Milling | $a_p=3D$<br>$a_e \leqq 0.02D$ | | | | | | | | | | | |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Slotting




Side Milling




Note:
・Recommend down cut processing.
・Reduce cutting amount, feed rate, and apply zero-cut in accordance with required surface quality.
・Recommend air blow or oil mist.

Size φ0.1～φ6

# HLS2000

Super MG | HARD MAX | 30° | Flatland | Shank Dia 0/-0.005

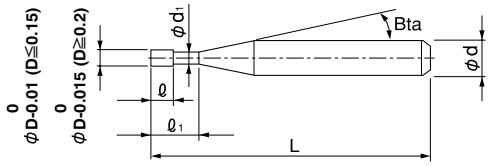
Additional 5 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

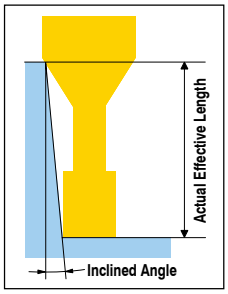
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | |

## Features

**HARDMAX coating and optimized tool design control tool chipping. Longer tool life with deep rib milling on hard materials.**
**High Accuracy: Diameter Tolerance: 0/-0.01 (D≦0.15), 0/-0.015 (D≧0.2)**
**Refer to page 276 for 4 flute HLS.**




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




Total 189 models

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30' | 1° | 1° 30' | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLS 2001-003 | 0.1 | 0.3 | 0.1 | 0.088 | 11° | 45 | 4 | 11,160 | 0.33 | 0.36 | 0.38 | 0.40 | 0.45 |
| HLS 2001-005 | | 0.5 | | | | 45 | 4 | 12,240 | 0.54 | 0.58 | 0.61 | 0.64 | 0.69 |
| ※ HLS 2001-0075 | | 0.75 | | | | 45 | 4 | 13,560 | 0.80 | 0.85 | 0.90 | 0.95 | 1.07 |
| ※ HLS 2001-010 | | 1 | | | | 45 | 4 | 15,240 | 1.07 | 1.12 | 1.18 | 1.25 | 1.41 |
| HLS 20015-005 | 0.15 | 0.5 | 0.15 | 0.128 | 11° | 45 | 4 | 11,400 | 0.58 | 0.61 | 0.63 | 0.66 | 0.71 |
| HLS 20015-0075 | | 0.75 | | | | 45 | 4 | 12,600 | 0.84 | 0.88 | 0.91 | 0.94 | 1.02 |
| HLS 20015-010 | | 1 | | | | 45 | 4 | 12,600 | 1.10 | 1.14 | 1.18 | 1.23 | 1.32 |
| HLS 2002-005 | 0.2 | 0.5 | 0.3 | 0.18 | 16° | 45 | 4 | 7,320 | 0.65 | 0.70 | 0.74 | 0.78 | 0.85 |
| HLS 2002-010 | | 1 | | | | 45 | 4 | 7,920 | 1.18 | 1.25 | 1.31 | 1.36 | 1.45 |
| HLS 2002-015 | | 1.5 | | | | 45 | 4 | 9,600 | 1.67 | 1.76 | 1.84 | 1.90 | 2.01 |
| ※ HLS 2002-020 | | 2 | | | | 45 | 4 | 10,800 | 2.23 | 2.33 | 2.41 | 2.49 | 2.68 |
| ※ HLS 2002-030 | | 3 | | | | 45 | 4 | 11,160 | 3.27 | 3.39 | 3.51 | 3.63 | 3.91 |

※Additional model

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 2003-010 | 0.3 | 1 | 0.4 | 0.28 | 16° | 45 | 4 | 6,480 | 1.22 | 1.30 | 1.37 | 1.43 | 1.55 |
| HLS 2003-015 | | 1.5 | | | | 45 | 4 | 6,480 | 1.71 | 1.82 | 1.91 | 1.98 | 2.12 |
| HLS 2003-020 | | 2 | | | | 45 | 4 | 7,920 | 2.24 | 2.36 | 2.46 | 2.55 | 2.70 |
| HLS 2003-025 | | 2.5 | | | | 45 | 4 | 8,280 | 2.77 | 2.91 | 3.02 | 3.11 | 3.27 |
| HLS 2003-030 | | 3 | | | | 45 | 4 | 8,280 | 3.30 | 3.45 | 3.56 | 3.66 | 3.83 |
| HLS 2003-040 | | 4 | | | | 45 | 4 | 9,480 | 4.35 | 4.51 | 4.64 | 4.75 | 4.94 |
| HLS 2003-060 | | 6 | | | | 45 | 4 | 10,560 | 6.43 | 6.63 | 6.78 | 6.91 | 7.12 |
| HLS 2003-090 | | 9 | | | | 45 | 4 | 11,160 | 9.53 | 9.76 | 9.94 | 10.09 | 10.32 |
| HLS 2004-015 | 0.4 | 1.5 | 0.6 | 0.38 | 16° | 45 | 4 | 4,680 | 1.77 | 1.91 | 2.03 | 2.13 | 2.31 |
| HLS 2004-020 | | 2 | | | | 45 | 4 | 4,680 | 2.31 | 2.47 | 2.60 | 2.71 | 2.91 |
| HLS 2004-025 | | 2.5 | | | | 45 | 4 | 4,680 | 2.85 | 3.02 | 3.16 | 3.28 | 3.49 |
| HLS 2004-030 | | 3 | | | | 45 | 4 | 4,680 | 3.38 | 3.57 | 3.72 | 3.85 | 4.07 |
| HLS 2004-035 | | 3.5 | | | | 45 | 4 | 4,680 | 3.91 | 4.11 | 4.27 | 4.41 | 4.64 |
| HLS 2004-040 | | 4 | | | | 45 | 4 | 4,680 | 4.44 | 4.65 | 4.82 | 4.96 | 5.21 |
| HLS 2004-050 | | 5 | | | | 45 | 4 | 4,680 | 5.49 | 5.73 | 5.91 | 6.06 | 6.33 |
| HLS 2004-080 | | 8 | | | | 45 | 4 | 10,200 | 8.63 | 8.91 | 9.13 | 9.31 | 9.62 |
| HLS 2004-120 | | 12 | | | | 45 | 4 | 11,160 | 12.77 | 13.10 | 13.36 | 13.57 | 13.91 |
| HLS 2005-015 | 0.5 | 1.5 | 0.7 | 0.48 | 16° | 45 | 4 | 3,360 | 1.83 | 1.99 | 2.13 | 2.25 | 2.48 |
| HLS 2005-020 | | 2 | | | | 45 | 4 | 3,360 | 2.37 | 2.56 | 2.71 | 2.85 | 3.09 |
| HLS 2005-025 | | 2.5 | | | | 45 | 4 | 3,360 | 2.92 | 3.12 | 3.29 | 3.43 | 3.69 |
| HLS 2005-030 | | 3 | | | | 45 | 4 | 3,360 | 3.45 | 3.68 | 3.85 | 4.01 | 4.28 |
| HLS 2005-040 | | 4 | | | | 45 | 4 | 3,360 | 4.52 | 4.77 | 4.97 | 5.14 | 5.44 |
| HLS 2005-050 | | 5 | | | | 45 | 4 | 3,360 | 5.58 | 5.86 | 6.08 | 6.26 | 6.58 |
| HLS 2005-060 | | 6 | | | | 45 | 4 | 3,360 | 6.64 | 6.94 | 7.17 | 7.37 | 7.71 |
| HLS 2005-080 | | 8 | | | | 45 | 4 | 5,640 | 8.74 | 9.07 | 9.33 | 9.56 | 9.93 |
| HLS 2005-100 | | 10 | | | | 50 | 4 | 5,640 | 10.82 | 11.19 | 11.48 | 11.72 | 12.12 |
| HLS 2005-150 | | 15 | | | | 50 | 4 | 7,200 | 16.00 | 16.44 | 16.78 | 17.05 | 17.50 |
| HLS 2006-020 | 0.6 | 2 | 0.9 | 0.58 | 16° | 45 | 4 | 3,600 | 2.39 | 2.62 | 2.80 | 2.96 | 3.24 |
| HLS 2006-030 | | 3 | | | | 45 | 4 | 3,600 | 3.49 | 3.75 | 3.96 | 4.14 | 4.32 |
| HLS 2006-040 | | 4 | | | | 45 | 4 | 3,600 | 4.57 | 4.86 | 5.09 | 5.29 | 5.69 |
| HLS 2006-050 | | 5 | | | | 45 | 4 | 3,600 | 5.64 | 5.96 | 6.21 | 6.43 | 6.92 |
| HLS 2006-060 | | 6 | | | | 45 | 4 | 3,600 | 6.70 | 7.05 | 7.32 | 7.57 | 8.14 |
| HLS 2006-070 | | 7 | | | | 45 | 4 | 4,560 | 7.76 | 8.13 | 8.42 | 8.71 | 9.36 |
| HLS 2006-080 | | 8 | | | | 45 | 4 | 5,880 | 8.81 | 9.20 | 9.52 | 9.85 | 10.59 |
| HLS 2006-100 | | 10 | | | | 45 | 4 | 6,720 | 10.91 | 11.34 | 11.72 | 12.13 | 13.04 |
| HLS 2006-120 | | 12 | | | | 50 | 4 | 7,560 | 13.00 | 13.47 | 13.92 | 14.40 | 15.48 |
| HLS 2006-180 | | 18 | | | | 50 | 4 | 9,120 | 19.23 | 19.85 | 20.52 | 21.24 | 22.82 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 2007-020 | 0.7 | 2 | 1 | 0.68 | 16° | 45 | 4 | 4,080 | 2.39 | 2.62 | 2.80 | 2.96 | 3.24 |
| HLS 2007-040 | | 4 | | | | 45 | 4 | 4,080 | 4.57 | 4.86 | 5.09 | 5.29 | 5.69 |
| HLS 2007-060 | | 6 | | | | 45 | 4 | 4,080 | 6.70 | 7.05 | 7.32 | 7.57 | 8.14 |
| HLS 2007-080 | | 8 | | | | 45 | 4 | 6,600 | 8.81 | 9.20 | 9.52 | 9.85 | 10.59 |
| HLS 2007-100 | | 10 | | | | 50 | 4 | 7,520 | 10.91 | 11.34 | 11.72 | 12.13 | 13.04 |
| HLS 2008-030 | 0.8 | 3 | 1.2 | 0.78 | 16° | 45 | 4 | 3,960 | 3.49 | 3.75 | 3.96 | 4.14 | 4.32 |
| HLS 2008-040 | | 4 | | | | 45 | 4 | 3,960 | 4.57 | 4.86 | 5.09 | 5.29 | 5.69 |
| HLS 2008-050 | | 5 | | | | 45 | 4 | 3,960 | 5.64 | 5.96 | 6.21 | 6.43 | 6.92 |
| HLS 2008-060 | | 6 | | | | 45 | 4 | 3,960 | 6.70 | 7.05 | 7.32 | 7.57 | 8.14 |
| HLS 2008-080 | | 8 | | | | 45 | 4 | 3,960 | 8.81 | 9.20 | 9.52 | 9.85 | 10.59 |
| HLS 2008-100 | | 10 | | | | 50 | 4 | 5,880 | 10.91 | 11.34 | 11.72 | 12.13 | 13.04 |
| HLS 2008-120 | | 12 | | | | 50 | 4 | 6,600 | 13.00 | 13.47 | 13.92 | 14.40 | 15.48 |
| HLS 2008-160 | | 16 | | | | 50 | 4 | 7,560 | 17.16 | 17.73 | 18.32 | 18.96 | 20.38 |
| HLS 2008-240 | | 24 | | | | 60 | 4 | 9,240 | 25.42 | 26.24 | 27.13 | 28.07 | 30.17 |
| HLS 2009-040 | 0.9 | 4 | 1.3 | 0.88 | 16° | 45 | 4 | 4,560 | 4.57 | 4.86 | 5.09 | 5.29 | 5.69 |
| HLS 2009-060 | | 6 | | | | 45 | 4 | 4,560 | 6.70 | 7.05 | 7.32 | 7.57 | 8.14 |
| HLS 2009-080 | | 8 | | | | 45 | 4 | 4,560 | 8.81 | 9.20 | 9.52 | 9.85 | 10.59 |
| HLS 2009-100 | | 10 | | | | 45 | 4 | 4,560 | 10.91 | 11.34 | 11.72 | 12.13 | 13.04 |
| HLS 2009-150 | | 15 | | | | 50 | 4 | 6,790 | 16.12 | 16.66 | 17.22 | 17.82 | 19.15 |
| HLS 2010-030 | 1 | 3 | 1.5 | 0.95 | 16° | 45 | 4 | 3,600 | 3.62 | 3.85 | 4.04 | 4.21 | 4.54 |
| HLS 2010-040 | | 4 | | | | 45 | 4 | 3,600 | 4.69 | 4.95 | 5.16 | 5.36 | 5.76 |
| HLS 2010-050 | | 5 | | | | 45 | 4 | 3,600 | 5.75 | 6.04 | 6.27 | 6.49 | 6.98 |
| HLS 2010-060 | | 6 | | | | 45 | 4 | 3,600 | 6.80 | 7.12 | 7.38 | 7.63 | 8.21 |
| HLS 2010-070 | | 7 | | | | 45 | 4 | 3,600 | 7.85 | 8.19 | 8.48 | 8.77 | 9.43 |
| HLS 2010-080 | | 8 | | | | 45 | 4 | 3,600 | 8.90 | 9.26 | 9.58 | 9.91 | 10.65 |
| HLS 2010-090 | | 9 | | | | 45 | 4 | 3,600 | 9.95 | 10.33 | 10.68 | 11.05 | 11.88 |
| HLS 2010-100 | | 10 | | | | 45 | 4 | 3,600 | 10.99 | 11.39 | 11.78 | 12.19 | 13.10 |
| HLS 2010-120 | | 12 | | | | 45 | 4 | 3,600 | 13.07 | 13.52 | 13.98 | 14.47 | 15.55 |
| HLS 2010-140 | | 14 | | | | 45 | 4 | 3,600 | 15.15 | 15.65 | 16.18 | 16.74 | 18.00 |
| HLS 2010-160 | | 16 | | | | 50 | 4 | 5,880 | 17.22 | 17.78 | 18.38 | 19.02 | 20.44 |
| ※ HLS 2010-180 | | 18 | | | | 55 | 4 | 5,880 | 19.29 | 19.92 | 20.59 | 21.30 | 22.90 |
| HLS 2010-200 | | 20 | | | | 55 | 4 | 5,880 | 21.35 | 22.04 | 22.78 | 23.57 | 25.34 |
| HLS 2010-250 | | 25 | | | | 70 | 4 | 6,720 | 26.51 | 27.37 | 28.29 | 29.27 | No Interference |
| HLS 2010-300 | | 30 | | | | 70 | 4 | 7,560 | 31.66 | 32.69 | 33.79 | 34.96 | No Interference |

※Additional model

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Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 2012-040 | 1.2 | 4 | 1.8 | 1.14 | 16° | 45 | 4 | 3,840 | 4.13 | 4.27 | 4.41 | 4.57 | 4.91 |
| HLS 2012-060 | | 6 | | | | 45 | 4 | 3,840 | 6.19 | 6.40 | 6.61 | 6.84 | 7.36 |
| HLS 2012-080 | | 8 | | | | 45 | 4 | 3,840 | 8.26 | 8.52 | 8.81 | 9.12 | 9.80 |
| HLS 2012-100 | | 10 | | | | 45 | 4 | 3,840 | 10.32 | 10.65 | 11.01 | 11.40 | 12.25 |
| HLS 2012-120 | | 12 | | | | 45 | 4 | 3,840 | 12.38 | 12.78 | 13.21 | 13.67 | 14.70 |
| HLS 2012-160 | | 16 | | | | 50 | 4 | 6,000 | 16.51 | 17.04 | 17.62 | 18.23 | 19.59 |
| HLS 2012-200 | | 20 | | | | 60 | 4 | 6,000 | 20.63 | 21.30 | 22.02 | 22.78 | 24.49 |
| HLS 2014-060 | 1.4 | 6 | 2.1 | 1.34 | 16° | 45 | 4 | 3,960 | 6.19 | 6.40 | 6.61 | 6.84 | 7.36 |
| HLS 2014-080 | | 8 | | | | 45 | 4 | 3,960 | 8.26 | 8.52 | 8.81 | 9.12 | 9.80 |
| HLS 2014-100 | | 10 | | | | 45 | 4 | 3,960 | 10.32 | 10.65 | 11.01 | 11.40 | 12.25 |
| HLS 2014-120 | | 12 | | | | 45 | 4 | 3,960 | 12.38 | 12.78 | 13.21 | 13.67 | 14.70 |
| HLS 2014-140 | | 14 | | | | 45 | 4 | 3,960 | 14.44 | 14.91 | 15.42 | 15.95 | 17.15 |
| HLS 2014-160 | | 16 | | | | 50 | 4 | 4,560 | 16.51 | 17.04 | 17.62 | 18.23 | 19.59 |
| HLS 2014-220 | | 22 | | | | 55 | 4 | 6,120 | 22.69 | 23.43 | 24.22 | 25.06 | No Interference |
| HLS 2015-040 | 1.5 | 4 | 2.3 | 1.44 | 16° | 45 | 4 | 3,840 | 4.13 | 4.27 | 4.41 | 4.57 | 4.91 |
| HLS 2015-060 | | 6 | | | | 45 | 4 | 3,840 | 6.19 | 6.40 | 6.61 | 6.84 | 7.36 |
| HLS 2015-080 | | 8 | | | | 45 | 4 | 3,840 | 8.26 | 8.52 | 8.81 | 9.12 | 9.80 |
| HLS 2015-100 | | 10 | | | | 45 | 4 | 3,840 | 10.32 | 10.65 | 11.01 | 11.40 | 12.25 |
| HLS 2015-120 | | 12 | | | | 45 | 4 | 3,840 | 12.38 | 12.78 | 13.21 | 13.67 | 14.70 |
| HLS 2015-140 | | 14 | | | | 50 | 4 | 3,960 | 14.44 | 14.91 | 15.42 | 15.95 | 17.15 |
| HLS 2015-160 | | 16 | | | | 50 | 4 | 3,960 | 16.51 | 17.04 | 17.62 | 18.23 | 19.59 |
| HLS 2015-180 | | 18 | | | | 55 | 4 | 3,960 | 18.57 | 19.17 | 19.82 | 20.51 | 22.04 |
| HLS 2015-200 | | 20 | | | | 55 | 4 | 3,960 | 20.63 | 21.30 | 22.02 | 22.78 | No Interference |
| HLS 2015-250 | | 25 | | | | 70 | 4 | 5,880 | 25.79 | 26.63 | 27.52 | 28.48 | No Interference |
| HLS 2015-300 | | 30 | | | | 70 | 4 | 5,880 | 30.95 | 31.95 | 33.02 | 34.17 | No Interference |
| HLS 2015-350 | | 35 | | | | 70 | 4 | 6,600 | 36.10 | 37.27 | 38.53 | No Interference | No Interference |
| HLS 2015-400 | | 40 | | | | 80 | 4 | 7,440 | 41.26 | 42.60 | 44.03 | No Interference | No Interference |
| HLS 2015-450 | | 45 | | | | 80 | 4 | 7,440 | 46.42 | 47.92 | No Interference | No Interference | No Interference |
| HLS 2016-060 | 1.6 | 6 | 2.4 | 1.51 | 16° | 45 | 4 | 3,960 | 6.23 | 6.43 | 6.65 | 6.88 | 7.40 |
| HLS 2016-080 | | 8 | | | | 45 | 4 | 3,960 | 8.29 | 8.56 | 8.85 | 9.16 | 9.85 |
| HLS 2016-100 | | 10 | | | | 45 | 4 | 3,960 | 10.35 | 10.69 | 11.05 | 11.43 | 12.29 |
| HLS 2016-120 | | 12 | | | | 45 | 4 | 3,960 | 12.42 | 12.82 | 13.25 | 13.71 | 14.74 |
| HLS 2016-140 | | 14 | | | | 50 | 4 | 3,960 | 14.48 | 14.95 | 15.45 | 15.99 | 17.19 |
| HLS 2016-160 | | 16 | | | | 50 | 4 | 3,960 | 16.54 | 17.08 | 17.65 | 18.27 | 19.63 |
| HLS 2016-180 | | 18 | | | | 55 | 4 | 3,960 | 18.60 | 19.21 | 19.85 | 20.54 | 22.08 |
| HLS 2016-200 | | 20 | | | | 55 | 4 | 3,960 | 20.67 | 21.34 | 22.05 | 22.82 | No Interference |
| HLS 2016-260 | | 26 | | | | 60 | 4 | 6,120 | 26.85 | 27.73 | 28.66 | 29.65 | No Interference |

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Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 2018-060 | 1.8 | 6 | 2.7 | 1.71 | 16° | 45 | 4 | 3,960 | 6.23 | 6.43 | 6.65 | 6.88 | 7.40 |
| HLS 2018-080 | | 8 | | | | 45 | 4 | 3,960 | 8.29 | 8.56 | 8.85 | 9.16 | 9.85 |
| HLS 2018-100 | | 10 | | | | 45 | 4 | 3,960 | 10.35 | 10.69 | 11.05 | 11.43 | 12.29 |
| HLS 2018-120 | | 12 | | | | 45 | 4 | 3,960 | 12.42 | 12.82 | 13.25 | 13.71 | 14.74 |
| HLS 2018-140 | | 14 | | | | 50 | 4 | 3,960 | 14.48 | 14.95 | 15.45 | 15.99 | 17.19 |
| HLS 2018-160 | | 16 | | | | 50 | 4 | 3,960 | 16.54 | 17.08 | 17.65 | 18.27 | 19.63 |
| HLS 2018-180 | | 18 | | | | 55 | 4 | 3,960 | 18.60 | 19.21 | 19.85 | 20.54 | No Interference |
| HLS 2018-200 | | 20 | | | | 55 | 4 | 3,960 | 20.67 | 21.34 | 22.05 | 22.82 | No Interference |
| HLS 2018-250 | | 25 | | | | 60 | 4 | 5,520 | 25.82 | 26.66 | 27.56 | 28.52 | No Interference |
| HLS 2020-060 | 2 | 6 | 3 | 1.91 | 16° | 45 | 4 | 3,840 | 6.23 | 6.43 | 6.65 | 6.88 | 7.40 |
| HLS 2020-080 | | 8 | | | | 45 | 4 | 3,840 | 8.29 | 8.56 | 8.85 | 9.16 | 9.85 |
| HLS 2020-100 | | 10 | | | | 45 | 4 | 3,840 | 10.35 | 10.69 | 11.05 | 11.44 | 12.29 |
| HLS 2020-120 | | 12 | | | | 45 | 4 | 3,840 | 12.42 | 12.82 | 13.25 | 13.71 | 14.74 |
| HLS 2020-140 | | 14 | | | | 50 | 4 | 3,840 | 14.48 | 14.95 | 15.45 | 15.99 | 17.19 |
| HLS 2020-160 | | 16 | | | | 50 | 4 | 3,840 | 16.54 | 17.08 | 17.65 | 18.27 | No Interference |
| HLS 2020-180 | | 18 | | | | 55 | 4 | 3,840 | 18.61 | 19.21 | 19.86 | 20.55 | No Interference |
| HLS 2020-200 | | 20 | | | | 55 | 4 | 3,840 | 20.67 | 21.34 | 22.05 | 22.82 | No Interference |
| HLS 2020-250 | | 25 | | | | 60 | 4 | 3,840 | 25.83 | 26.66 | 27.56 | 28.52 | No Interference |
| HLS 2020-300 | | 30 | | | | 70 | 4 | 4,680 | 30.98 | 31.99 | 33.06 | No Interference | No Interference |
| HLS 2020-350 | | 35 | | | | 80 | 4 | 5,640 | 36.14 | 37.31 | 38.56 | No Interference | No Interference |
| HLS 2020-400 | | 40 | | | | 90 | 4 | 7,080 | 41.30 | 42.64 | No Interference | No Interference | No Interference |
| HLS 2020-500 | | 50 | | | | 100 | 4 | 8,520 | 51.61 | 53.28 | No Interference | No Interference | No Interference |
| HLS 2020-600 | | 60 | | | | 110 | 4 | 10,200 | 61.92 | No Interference | No Interference | No Interference | No Interference |
| HLS 2025-080 | 2.5 | 8 | 3.7 | 2.41 | 16° | 45 | 4 | 3,960 | 8.29 | 8.56 | 8.85 | 9.16 | 9.85 |
| HLS 2025-100 | | 10 | | | | 45 | 4 | 3,960 | 10.35 | 10.69 | 11.05 | 11.44 | 12.29 |
| HLS 2025-120 | | 12 | | | | 45 | 4 | 3,960 | 12.42 | 12.82 | 13.25 | 13.71 | No Interference |
| HLS 2025-140 | | 14 | | | | 50 | 4 | 3,960 | 14.48 | 14.95 | 15.45 | 15.99 | No Interference |
| HLS 2025-160 | | 16 | | | | 50 | 4 | 3,960 | 16.54 | 17.08 | 17.65 | 18.27 | No Interference |
| HLS 2025-180 | | 18 | | | | 55 | 4 | 3,960 | 18.61 | 19.21 | 19.86 | 20.55 | No Interference |
| HLS 2025-200 | | 20 | | | | 55 | 4 | 3,960 | 20.67 | 21.34 | 22.06 | No Interference | No Interference |
| HLS 2025-250 | | 25 | | | | 60 | 4 | 4,320 | 25.83 | 26.66 | 27.56 | No Interference | No Interference |
| HLS 2025-300 | | 30 | | | | 70 | 4 | 4,320 | 30.98 | 31.99 | No Interference | No Interference | No Interference |
| HLS 2025-400 | | 40 | | | | 90 | 4 | 6,000 | 41.30 | 42.64 | No Interference | No Interference | No Interference |
| HLS 2025-500 | | 50 | | | | 100 | 4 | 7,440 | 51.61 | No Interference | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 2030-080 | 3 | 8 | 4.5 | 2.92 | 16° | 45 | 6 | 5,160 | 8.29 | 8.56 | 8.85 | 9.16 | 9.84 |
| HLS 2030-100 | | 10 | | | | 45 | 6 | 5,160 | 10.35 | 10.69 | 11.05 | 11.43 | 12.29 |
| HLS 2030-120 | | 12 | | | | 50 | 6 | 5,160 | 12.41 | 12.82 | 13.25 | 13.71 | 14.74 |
| HLS 2030-140 | | 14 | | | | 50 | 6 | 5,160 | 14.48 | 14.95 | 15.45 | 15.99 | 17.18 |
| HLS 2030-160 | | 16 | | | | 60 | 6 | 5,160 | 16.54 | 17.08 | 17.65 | 18.26 | 19.63 |
| HLS 2030-180 | | 18 | | | | 60 | 6 | 5,160 | 18.60 | 19.21 | 19.85 | 20.54 | 22.08 |
| HLS 2030-200 | | 20 | | | | 60 | 6 | 5,160 | 20.66 | 21.34 | 22.05 | 22.82 | 24.53 |
| HLS 2030-250 | | 25 | | | | 70 | 6 | 5,160 | 25.82 | 26.66 | 27.56 | 28.51 | No Interference |
| HLS 2030-300 | | 30 | | | | 80 | 6 | 6,120 | 30.98 | 31.98 | 33.06 | 34.21 | No Interference |
| HLS 2030-350 | | 35 | | | | 80 | 6 | 6,360 | 36.14 | 37.31 | 38.56 | 39.90 | No Interference |
| HLS 2030-400 | | 40 | | | | 90 | 6 | 6,360 | 41.29 | 42.63 | 44.06 | No Interference | No Interference |
| HLS 2030-500 | | 50 | | | | 100 | 6 | 8,880 | 51.61 | 53.28 | 55.07 | No Interference | No Interference |
| HLS 2040-120 | 4 | 12 | 6 | 3.82 | 16° | 50 | 6 | 5,880 | 12.59 | 13.00 | 13.44 | 13.91 | 14.95 |
| HLS 2040-160 | | 16 | | | | 60 | 6 | 5,880 | 16.72 | 17.26 | 17.84 | 18.46 | No Interference |
| HLS 2040-200 | | 20 | | | | 60 | 6 | 5,880 | 20.84 | 21.52 | 22.24 | 23.02 | No Interference |
| HLS 2040-250 | | 25 | | | | 70 | 6 | 5,880 | 26.00 | 26.85 | 27.75 | 28.71 | No Interference |
| HLS 2040-300 | | 30 | | | | 70 | 6 | 5,880 | 31.16 | 32.17 | 33.25 | No Interference | No Interference |
| HLS 2040-350 | | 35 | | | | 80 | 6 | 5,880 | 36.32 | 37.49 | 38.75 | No Interference | No Interference |
| HLS 2040-400 | | 40 | | | | 90 | 6 | 7,440 | 41.47 | 42.82 | No Interference | No Interference | No Interference |
| HLS 2040-450 | | 45 | | | | 90 | 6 | 9,000 | 46.63 | 48.14 | No Interference | No Interference | No Interference |
| HLS 2040-500 | | 50 | | | | 100 | 6 | 11,040 | 51.79 | 53.47 | No Interference | No Interference | No Interference |
| HLS 2040-600 | | 60 | | | | 110 | 6 | 13,680 | 62.10 | No Interference | No Interference | No Interference | No Interference |
| HLS 2050-160 | 5 | 16 | 7.5 | 4.82 | 16° | 60 | 6 | 7,440 | 16.72 | 17.26 | 17.84 | No Interference | No Interference |
| HLS 2050-200 | | 20 | | | | 60 | 6 | 7,440 | 20.84 | 21.52 | No Interference | No Interference | No Interference |
| HLS 2050-250 | | 25 | | | | 60 | 6 | 7,440 | 26.00 | 26.85 | No Interference | No Interference | No Interference |
| HLS 2050-300 | | 30 | | | | 80 | 6 | 7,440 | 31.16 | No Interference | No Interference | No Interference | No Interference |
| HLS 2050-350 | | 35 | | | | 80 | 6 | 7,440 | 36.32 | No Interference | No Interference | No Interference | No Interference |
| HLS 2050-400 | | 40 | | | | 80 | 6 | 7,440 | 41.47 | No Interference | No Interference | No Interference | No Interference |
| HLS 2050-500 | | 50 | | | | 110 | 6 | 11,760 | 51.79 | No Interference | No Interference | No Interference | No Interference |
| HLS 2050-600 | | 60 | | | | 120 | 6 | 14,400 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 2060-200 | 6 | 20 | 9 | 5.82 | — | 80 | 6 | 7,680 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 2060-300 | | 30 | | | | 80 | 6 | 7,920 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 2060-400 | | 40 | | | | 100 | 6 | 9,240 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 2060-500 | | 50 | | | | 120 | 6 | 11,760 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 2060-600 | | 60 | | | | 120 | 6 | 15,000 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD(30～45HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2001 | 0.1 | 0.3 | 30,000 | 30 | 0.003～0.005 | 0.035 | 30,000 | 15 | 0.002～0.005 | 0.035 | 30,000 | 16 | 0.001～0.004 | 0.035 |
| | | 0.5 | 28,000 | 28 | 0.002～0.005 | 0.03 | 28,000 | 14 | 0.002～0.004 | 0.03 | 28,000 | 14 | 0.001～0.003 | 0.03 |
| | | 0.75 | 26,000 | 26 | 0.002～0.003 | 0.01 | 26,000 | 13 | 0.001～0.002 | 0.01 | 26,000 | 13 | 0.001～0.002 | 0.01 |
| | | 1 | 24,000 | 24 | 0.002～0.003 | 0.005 | 24,000 | 12 | 0.001～0.002 | 0.005 | 24,000 | 12 | 0.001～0.002 | 0.005 |
| 20015 | 0.15 | 0.5 | 30,000 | 90 | 0.004～0.007 | 0.07 | 30,000 | 80 | 0.003～0.006 | 0.07 | 30,000 | 70 | 0.003～0.005 | 0.07 |
| | | 0.75 | 28,700 | 90 | 0.003～0.007 | 0.032 | 28,700 | 80 | 0.002～0.006 | 0.032 | 28,700 | 70 | 0.002～0.005 | 0.032 |
| | | 1 | 27,300 | 80 | 0.002～0.006 | 0.015 | 27,300 | 70 | 0.001～0.005 | 0.015 | 27,300 | 60 | 0.001～0.004 | 0.015 |
| 2002 | 0.2 | 0.5 | 56,000 | 340 | 0.005～0.009 | 0.13 | 56,000 | 310 | 0.005～0.008 | 0.13 | 56,000 | 270 | 0.004～0.006 | 0.13 |
| | | 1 | 50,900 | 290 | 0.003～0.007 | 0.035 | 50,900 | 260 | 0.003～0.006 | 0.035 | 50,900 | 230 | 0.002～0.004 | 0.035 |
| | | 1.5 | 48,200 | 250 | 0.003～0.004 | 0.012 | 48,200 | 230 | 0.002～0.003 | 0.012 | 48,200 | 200 | 0.001～0.002 | 0.012 |
| | | 2 | 43,500 | 190 | 0.001～0.002 | 0.003 | 43,500 | 170 | 0.001～0.002 | 0.003 | 43,500 | 150 | 0.001～0.002 | 0.003 |
| | | 3 | 41,300 | 160 | 0.001～0.001 | 0.002 | 41,300 | 145 | 0.001～0.001 | 0.002 | 41,300 | 130 | 0.001～0.001 | 0.002 |
| 2003 | 0.3 | 1 | 60,000 | 560 | 0.009～0.015 | 0.101 | 60,000 | 500 | 0.008～0.013 | 0.101 | 60,000 | 440 | 0.006～0.01 | 0.101 |
| | | 1.5 | 50,800 | 460 | 0.008～0.013 | 0.05 | 50,800 | 410 | 0.007～0.011 | 0.05 | 50,800 | 360 | 0.005～0.009 | 0.05 |
| | | 2 | 41,500 | 350 | 0.006～0.01 | 0.023 | 41,500 | 320 | 0.005～0.009 | 0.023 | 41,500 | 280 | 0.004～0.007 | 0.023 |
| | | 2.5 | 36,700 | 300 | 0.004～0.005 | 0.012 | 36,700 | 270 | 0.004～0.006 | 0.012 | 36,700 | 240 | 0.003～0.005 | 0.012 |
| | | 3 | 31,900 | 240 | 0.002～0.004 | 0.008 | 31,900 | 220 | 0.002～0.003 | 0.008 | 31,900 | 190 | 0.001～0.002 | 0.008 |
| | | 4 | 26,200 | 170 | 0.001～0.002 | 0.003 | 26,200 | 160 | 0.001～0.002 | 0.003 | 26,200 | 140 | 0.001～0.001 | 0.003 |
| | | 6 | 20,400 | 100 | 0.001～0.001 | — | 20,400 | 90 | 0.001～0.001 | — | 20,400 | 80 | 0.001～0.001 | — |
| | | 9 | 15,700 | 30 | 0.001～0.001 | — | 15,700 | 30 | 0.001～0.001 | — | 15,700 | 30 | 0.001～0.001 | — |
| 2004 | 0.4 | 1.5 | 52,700 | 660 | 0.011～0.016 | 0.095 | 57,700 | 640 | 0.009～0.015 | 0.095 | 48,100 | 470 | 0.007～0.012 | 0.095 |
| | | 2 | 50,000 | 610 | 0.009～0.014 | 0.052 | 53,000 | 580 | 0.008～0.013 | 0.052 | 44,600 | 430 | 0.006～0.01 | 0.052 |
| | | 2.5 | 47,300 | 560 | 0.007～0.012 | 0.026 | 48,300 | 520 | 0.007～0.011 | 0.026 | 41,100 | 390 | 0.005～0.008 | 0.026 |
| | | 3 | 44,500 | 510 | 0.005～0.009 | 0.018 | 43,600 | 450 | 0.005～0.008 | 0.018 | 37,500 | 340 | 0.004～0.006 | 0.018 |
| | | 3.5 | 42,800 | 480 | 0.005～0.008 | 0.01 | 40,800 | 410 | 0.004～0.009 | 0.01 | 35,300 | 310 | 0.004～0.005 | 0.01 |
| | | 4 | 41,000 | 440 | 0.004～0.006 | 0.008 | 38,000 | 360 | 0.003～0.005 | 0.008 | 33,100 | 280 | 0.003～0.004 | 0.008 |
| | | 5 | 38,500 | 380 | 0.003～0.004 | 0.004 | 34,200 | 300 | 0.002～0.004 | 0.004 | 30,100 | 240 | 0.002～0.003 | 0.004 |
| | | 8 | 33,700 | 260 | 0.001～0.002 | 0.001 | 27,300 | 190 | 0.001～0.002 | 0.001 | 24,600 | 150 | 0.001～0.002 | 0.001 |
| | | 12 | 30,000 | 140 | 0.001～0.001 | — | 22,500 | 100 | 0.001～0.001 | — | 20,700 | 80 | 0.001～0.001 | — |
| 2005 | 0.5 | 1.5 | 63,100 | 1,020 | 0.019～0.029 | 0.139 | 61,000 | 870 | 0.017～0.027 | 0.139 | 46,500 | 610 | 0.013～0.02 | 0.139 |
| | | 2 | 56,800 | 900 | 0.015～0.025 | 0.098 | 54,000 | 760 | 0.014～0.023 | 0.098 | 40,600 | 510 | 0.011～0.018 | 0.098 |
| | | 2.5 | 50,500 | 780 | 0.011～0.021 | 0.057 | 47,000 | 650 | 0.011～0.019 | 0.057 | 34,700 | 410 | 0.009～0.016 | 0.057 |
| | | 3 | 44,200 | 660 | 0.007～0.016 | 0.037 | 39,900 | 530 | 0.008～0.015 | 0.037 | 32,200 | 370 | 0.007～0.011 | 0.037 |
| | | 4 | 40,600 | 580 | 0.008～0.013 | 0.016 | 36,100 | 460 | 0.007～0.012 | 0.016 | 29,700 | 330 | 0.006～0.009 | 0.016 |
| | | 5 | 37,000 | 500 | 0.006～0.01 | 0.008 | 32,300 | 390 | 0.006～0.009 | 0.008 | 27,200 | 290 | 0.005～0.007 | 0.008 |
| | | 6 | 33,400 | 420 | 0.004～0.007 | 0.005 | 28,500 | 320 | 0.004～0.006 | 0.005 | 24,700 | 250 | 0.003～0.005 | 0.005 |
| | | 8 | 29,100 | 320 | 0.002～0.003 | 0.002 | 24,100 | 240 | 0.002～0.003 | 0.002 | 21,600 | 190 | 0.001～0.003 | 0.002 |
| | | 10 | 26,100 | 250 | 0.001～0.002 | 0.001 | 21,200 | 180 | 0.001～0.002 | 0.001 | 19,600 | 150 | 0.001～0.002 | 0.001 |
| | | 15 | 21,500 | 120 | 0.001～0.001 | — | 16,700 | 80 | 0.001～0.001 | — | 16,300 | 70 | 0.001～0.001 | — |
| 2006 | 0.6 | 2 | 63,600 | 1,240 | 0.023～0.038 | 0.18 | 53,300 | 930 | 0.02 ～0.034 | 0.18 | 39,100 | 600 | 0.016～0.026 | 0.18 |
| | | 3 | 52,500 | 990 | 0.018～0.03 | 0.075 | 44,000 | 740 | 0.016～0.026 | 0.075 | 33,500 | 500 | 0.013～0.02 | 0.075 |
| | | 4 | 41,300 | 740 | 0.012～0.021 | 0.03 | 34,700 | 550 | 0.011～0.018 | 0.03 | 27,900 | 390 | 0.009～0.014 | 0.03 |
| | | 5 | 36,700 | 630 | 0.01 ～0.017 | 0.017 | 30,900 | 470 | 0.009～0.014 | 0.017 | 25,500 | 340 | 0.007～0.011 | 0.017 |
| | | 6 | 32,100 | 520 | 0.007～0.012 | 0.01 | 27,000 | 390 | 0.006～0.01 | 0.01 | 23,000 | 290 | 0.005～0.008 | 0.01 |
| | | 7 | 29,500 | 460 | 0.006～0.01 | 0.005 | 24,800 | 350 | 0.005～0.008 | 0.005 | 21,500 | 260 | 0.004～0.006 | 0.005 |
| | | 8 | 26,800 | 390 | 0.004～0.007 | 0.004 | 22,600 | 300 | 0.004～0.006 | 0.004 | 20,000 | 230 | 0.003～0.005 | 0.004 |
| | | 10 | 23,400 | 300 | 0.002～0.004 | 0.002 | 19,700 | 230 | 0.002～0.004 | 0.002 | 17,900 | 180 | 0.002～0.003 | 0.002 |
| | | 12 | 20,900 | 240 | 0.002～0.003 | 0.001 | 17,600 | 180 | 0.002～0.002 | 0.001 | 16,400 | 150 | 0.001～0.002 | 0.001 |
| | | 18 | 16,200 | 100 | 0.001～0.001 | — | 13,700 | 80 | 0.001～0.001 | — | 13,500 | 70 | 0.001～0.001 | — |

# Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2001 | 0.1 | 0.3 | — | — | — ～ — | 0.035 | — | — | — ～ — | 0.035 |
| | | 0.5 | — | — | — ～ — | 0.03 | — | — | — ～ — | 0.03 |
| | | 0.75 | — | — | — ～ — | — | — | — | — ～ — | — |
| | | 1 | — | — | — ～ — | — | — | — | — ～ — | — |
| 20015 | 0.15 | 0.5 | 30,000 | 50 | 0.003～0.004 | 0.07 | — | — | — ～ — | 0.07 |
| | | 0.75 | 28,700 | 50 | 0.002～0.004 | 0.032 | — | — | — ～ — | 0.032 |
| | | 1 | 27,300 | 40 | 0.001～0.003 | 0.015 | — | — | — ～ — | 0.015 |
| 2002 | 0.2 | 0.5 | 44,800 | 180 | 0.003～0.004 | 0.13 | 15,000 | 10 | 0.001～0.002 | 0.13 |
| | | 1 | 40,800 | 160 | 0.001～0.002 | 0.035 | — | — | — ～ — | 0.035 |
| | | 1.5 | 38,500 | 140 | 0.001～0.001 | 0.012 | — | — | — ～ — | 0.012 |
| | | 2 | 34,500 | 100 | 0.001～0.001 | 0.003 | — | — | — ～ — | — |
| | | 3 | 32,600 | 80 | 0.001～0.001 | 0.002 | — | — | — ～ — | — |
| 2003 | 0.3 | 1 | 52,100 | 330 | 0.004～0.007 | 0.101 | 14,600 | 14 | 0.003～0.004 | 0.101 |
| | | 1.5 | 42,700 | 260 | 0.004～0.006 | 0.05 | 14,600 | 13 | 0.003～0.004 | 0.05 |
| | | 2 | 33,200 | 190 | 0.003～0.005 | 0.023 | 14,600 | 12 | 0.002～0.003 | 0.023 |
| | | 2.5 | 29,400 | 160 | 0.002～0.004 | 0.012 | 14,600 | 11 | 0.001～0.002 | 0.012 |
| | | 3 | 25,500 | 130 | 0.001～0.002 | 0.008 | 14,600 | 10 | 0.001～0.001 | 0.008 |
| | | 4 | 20,900 | 100 | 0.001～0.001 | 0.003 | 14,600 | 9 | 0.001～0.001 | 0.003 |
| | | 6 | 16,300 | 60 | 0.001～0.001 | — | — | — | — ～ — | — |
| | | 9 | 12,500 | 20 | 0.001～0.001 | — | — | — | — ～ — | — |
| 2004 | 0.4 | 1.5 | 38,500 | 320 | 0.004～0.008 | 0.095 | 14,300 | 17 | 0.003～0.004 | 0.095 |
| | | 2 | 35,700 | 290 | 0.004～0.007 | 0.052 | 14,300 | 17 | 0.003～0.004 | 0.052 |
| | | 2.5 | 32,900 | 260 | 0.004～0.006 | 0.026 | 14,300 | 17 | 0.003～0.004 | 0.026 |
| | | 3 | 30,000 | 230 | 0.003～0.005 | 0.018 | 14,300 | 16 | 0.002～0.003 | 0.018 |
| | | 3.5 | 28,300 | 210 | 0.003～0.004 | 0.01 | 14,300 | 16 | 0.002～0.003 | 0.01 |
| | | 4 | 26,500 | 190 | 0.002～0.003 | 0.008 | 14,300 | 15 | 0.001～0.002 | 0.008 |
| | | 5 | 24,100 | 160 | 0.001～0.002 | 0.004 | 14,300 | 14 | 0.001～0.001 | 0.004 |
| | | 8 | 19,700 | 100 | 0.001～0.001 | 0.001 | 14,300 | 11 | 0.001～0.001 | 0.001 |
| | | 12 | 16,500 | 60 | 0.001～0.001 | — | — | — | — ～ — | — |
| 2005 | 0.5 | 1.5 | 37,300 | 410 | 0.009～0.015 | 0.139 | 14,000 | 20 | 0.004～0.008 | 0.139 |
| | | 2 | 32,500 | 350 | 0.008～0.013 | 0.098 | 14,000 | 20 | 0.004～0.007 | 0.098 |
| | | 2.5 | 27,700 | 290 | 0.007～0.011 | 0.057 | 14,000 | 20 | 0.004～0.006 | 0.057 |
| | | 3 | 25,700 | 260 | 0.005～0.009 | 0.037 | 14,000 | 19 | 0.004～0.005 | 0.037 |
| | | 4 | 23,700 | 230 | 0.004～0.007 | 0.016 | 14,000 | 18 | 0.003～0.004 | 0.016 |
| | | 5 | 21,700 | 200 | 0.003～0.005 | 0.008 | 14,000 | 17 | 0.002～0.003 | 0.008 |
| | | 6 | 19,700 | 170 | 0.002～0.003 | 0.005 | 14,000 | 16 | 0.001～0.002 | 0.005 |
| | | 8 | 17,300 | 130 | 0.001～0.002 | 0.002 | 14,000 | 14 | 0.001～0.001 | 0.002 |
| | | 10 | 15,600 | 100 | 0.001～0.001 | 0.001 | 14,000 | 12 | 0.001～0.001 | 0.001 |
| | | 15 | 13,000 | 50 | 0.001～0.001 | — | — | — | — ～ — | — |
| 2006 | 0.6 | 2 | 31,300 | 410 | 0.011～0.019 | 0.18 | 12,000 | 23 | 0.006～0.01 | 0.18 |
| | | 3 | 26,800 | 340 | 0.009～0.015 | 0.075 | 12,000 | 22 | 0.005～0.008 | 0.075 |
| | | 4 | 22,300 | 270 | 0.006～0.01 | 0.03 | 12,000 | 21 | 0.003～0.005 | 0.03 |
| | | 5 | 20,400 | 240 | 0.005～0.008 | 0.017 | 12,000 | 20 | 0.003～0.004 | 0.017 |
| | | 6 | 18,400 | 200 | 0.003～0.006 | 0.01 | 12,000 | 19 | 0.002～0.003 | 0.01 |
| | | 7 | 17,200 | 180 | 0.003～0.005 | 0.005 | 12,000 | 18 | 0.002～0.003 | 0.005 |
| | | 8 | 16,000 | 160 | 0.002～0.003 | 0.004 | 12,000 | 17 | 0.001～0.002 | 0.004 |
| | | 10 | 14,300 | 130 | 0.001～0.002 | 0.002 | 12,000 | 15 | 0.001～0.001 | 0.002 |
| | | 12 | 13,100 | 100 | 0.001～0.001 | 0.001 | 12,000 | 13 | 0.001～0.001 | 0.001 |
| | | 18 | 10,800 | 50 | 0.001～0.001 | — | — | — | — ～ — | — |

## Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD(30～45HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **2007** | **0.7** | 2 | 59,800 | 1,380 | 0.03 ～0.05 | 0.165 | 50,200 | 1,040 | 0.027～0.045 | 0.165 | 36,100 | 660 | 0.021～0.035 | 0.165 |
| | | 4 | 38,900 | 840 | 0.017～0.029 | 0.047 | 32,700 | 630 | 0.015～0.026 | 0.047 | 25,800 | 440 | 0.012～0.02 | 0.047 |
| | | 6 | 30,200 | 600 | 0.01 ～0.017 | 0.014 | 25,400 | 450 | 0.009～0.015 | 0.014 | 21,200 | 330 | 0.007～0.012 | 0.014 |
| | | 8 | 25,300 | 460 | 0.006～0.01 | 0.006 | 21,300 | 350 | 0.005～0.009 | 0.006 | 18,400 | 260 | 0.004～0.007 | 0.006 |
| | | 10 | 22,000 | 360 | 0.004～0.006 | 0.004 | 18,500 | 270 | 0.003～0.005 | 0.004 | 16,500 | 220 | 0.003～0.005 | 0.004 |
| **2008** | **0.8** | 3 | 41,200 | 1,050 | 0.033～0.053 | 0.15 | 34,500 | 790 | 0.029～0.049 | 0.15 | 26,200 | 530 | 0.023～0.038 | 0.15 |
| | | 4 | 37,100 | 930 | 0.027～0.044 | 0.08 | 31,100 | 700 | 0.024～0.04 | 0.08 | 24,100 | 480 | 0.019～0.031 | 0.08 |
| | | 5 | 33,000 | 810 | 0.021～0.035 | 0.052 | 27,700 | 610 | 0.019～0.031 | 0.052 | 22,000 | 430 | 0.015～0.024 | 0.052 |
| | | 6 | 28,800 | 680 | 0.015～0.025 | 0.024 | 24,200 | 510 | 0.013～0.022 | 0.024 | 19,800 | 370 | 0.01 ～0.017 | 0.024 |
| | | 8 | 24,100 | 520 | 0.009～0.015 | 0.01 | 20,300 | 390 | 0.008～0.013 | 0.01 | 17,200 | 300 | 0.006～0.01 | 0.01 |
| | | 10 | 21,000 | 420 | 0.006～0.009 | 0.005 | 17,700 | 320 | 0.005～0.008 | 0.005 | 15,500 | 240 | 0.004～0.007 | 0.005 |
| | | 12 | 18,700 | 340 | 0.004～0.006 | 0.003 | 15,800 | 260 | 0.003～0.006 | 0.003 | 14,100 | 200 | 0.003～0.004 | 0.003 |
| | | 16 | 15,600 | 230 | 0.002～0.003 | 0.001 | 13,200 | 180 | 0.002～0.003 | 0.001 | 12,300 | 150 | 0.002～0.002 | 0.001 |
| | | 24 | 12,100 | 100 | 0.001～0.002 | — | 10,300 | 80 | 0.001～0.002 | — | 10,100 | 70 | 0.001～0.001 | — |
| **2009** | **0.9** | 4 | 35,600 | 1,100 | 0.033～0.054 | 0.128 | 29,500 | 820 | 0.029～0.049 | 0.128 | 22,500 | 550 | 0.023～0.038 | 0.128 |
| | | 6 | 27,600 | 790 | 0.019～0.032 | 0.038 | 23,000 | 590 | 0.017～0.029 | 0.038 | 18,500 | 420 | 0.013～0.022 | 0.038 |
| | | 8 | 23,000 | 600 | 0.012～0.02 | 0.016 | 19,300 | 450 | 0.011～0.018 | 0.016 | 16,100 | 330 | 0.008～0.014 | 0.016 |
| | | 10 | 20,000 | 470 | 0.008～0.013 | 0.008 | 16,800 | 360 | 0.007～0.012 | 0.008 | 14,500 | 270 | 0.005～0.009 | 0.008 |
| | | 15 | 15,500 | 270 | 0.003～0.006 | 0.002 | 13,100 | 200 | 0.003～0.005 | 0.002 | 11,900 | 160 | 0.002～0.004 | 0.002 |
| **2010** | **1** | 3 | 37,900 | 1,340 | 0.048～0.067 | 0.263 | 31,500 | 990 | 0.043～0.072 | 0.263 | 23,400 | 650 | 0.034～0.057 | 0.263 |
| | | 4 | 34,100 | 1,170 | 0.04 ～0.067 | 0.195 | 28,400 | 870 | 0.036～0.06 | 0.195 | 21,500 | 580 | 0.028～0.047 | 0.195 |
| | | 5 | 30,300 | 1,000 | 0.032～0.053 | 0.127 | 25,300 | 750 | 0.029～0.048 | 0.127 | 19,600 | 510 | 0.022～0.037 | 0.127 |
| | | 6 | 26,500 | 850 | 0.023～0.039 | 0.058 | 22,100 | 630 | 0.021～0.035 | 0.058 | 17,600 | 440 | 0.016～0.027 | 0.058 |
| | | 7 | 24,300 | 760 | 0.019～0.032 | 0.041 | 20,400 | 560 | 0.017～0.029 | 0.041 | 16,500 | 400 | 0.013～0.022 | 0.041 |
| | | 8 | 22,100 | 660 | 0.014～0.024 | 0.024 | 18,600 | 490 | 0.013～0.022 | 0.024 | 15,300 | 360 | 0.01 ～0.017 | 0.024 |
| | | 9 | 20,700 | 600 | 0.012～0.02 | 0.019 | 17,400 | 450 | 0.011～0.018 | 0.019 | 14,600 | 330 | 0.009～0.014 | 0.019 |
| | | 10 | 19,200 | 530 | 0.01 ～0.016 | 0.013 | 16,200 | 400 | 0.009～0.014 | 0.013 | 13,800 | 300 | 0.007～0.011 | 0.013 |
| | | 12 | 17,200 | 440 | 0.007～0.011 | 0.007 | 14,500 | 330 | 0.006～0.01 | 0.007 | 12,600 | 250 | 0.005～0.008 | 0.007 |
| | | 14 | 15,600 | 360 | 0.005～0.008 | 0.005 | 13,200 | 270 | 0.004～0.007 | 0.005 | 11,700 | 210 | 0.003～0.006 | 0.005 |
| | | 16 | 14,300 | 300 | 0.004～0.006 | 0.003 | 12,100 | 230 | 0.003～0.006 | 0.003 | 11,000 | 180 | 0.003～0.005 | 0.003 |
| | | 18 | 13,400 | 250 | 0.003～0.005 | 0.002 | 11,350 | 190 | 0.002～0.004 | 0.002 | 10,400 | 150 | 0.002～0.004 | 0.002 |
| | | 20 | 12,500 | 200 | 0.002～0.004 | 0.002 | 10,600 | 160 | 0.002～0.003 | 0.002 | 9,800 | 130 | 0.002～0.003 | 0.002 |
| | | 25 | 10,800 | 120 | 0.002～0.003 | 0.001 | 9,200 | 100 | 0.001～0.002 | 0.001 | 8,800 | 80 | 0.001～0.002 | 0.001 |
| | | 30 | 9,700 | 80 | 0.001～0.002 | — | 8,200 | 60 | 0.001～0.002 | — | 8,100 | 50 | 0.001～0.002 | — |
| **2012** | **1.2** | 4 | 28,900 | 1,180 | 0.05 ～0.085 | 0.23 | 24,100 | 870 | 0.047～0.077 | 0.23 | 18,300 | 580 | 0.036～0.059 | 0.23 |
| | | 6 | 24,800 | 970 | 0.037～0.062 | 0.12 | 20,700 | 720 | 0.034～0.056 | 0.12 | 16,100 | 490 | 0.026～0.043 | 0.12 |
| | | 8 | 20,700 | 760 | 0.024～0.039 | 0.051 | 17,300 | 570 | 0.021～0.035 | 0.051 | 13,900 | 400 | 0.016～0.027 | 0.051 |
| | | 10 | 18,000 | 620 | 0.016～0.026 | 0.026 | 15,100 | 470 | 0.014～0.023 | 0.026 | 12,400 | 340 | 0.011～0.018 | 0.026 |
| | | 12 | 16,100 | 520 | 0.011～0.018 | 0.015 | 13,500 | 390 | 0.01 ～0.016 | 0.015 | 11,400 | 290 | 0.008～0.013 | 0.015 |
| | | 16 | 13,400 | 380 | 0.006～0.01 | 0.006 | 11,300 | 290 | 0.005～0.009 | 0.006 | 9,800 | 220 | 0.004～0.007 | 0.006 |
| | | 20 | 11,700 | 280 | 0.004～0.007 | 0.003 | 9,900 | 210 | 0.004～0.006 | 0.003 | 8,800 | 170 | 0.003～0.005 | 0.003 |
| **2014** | **1.4** | 6 | 23,300 | 1,070 | 0.052～0.086 | 0.222 | 19,400 | 800 | 0.047～0.078 | 0.222 | 14,800 | 540 | 0.036～0.061 | 0.222 |
| | | 8 | 19,500 | 850 | 0.035～0.059 | 0.094 | 16,300 | 640 | 0.032～0.053 | 0.094 | 12,900 | 440 | 0.025～0.041 | 0.094 |
| | | 10 | 16,900 | 710 | 0.025～0.041 | 0.048 | 14,200 | 530 | 0.022～0.037 | 0.048 | 11,500 | 380 | 0.017～0.029 | 0.048 |
| | | 12 | 15,100 | 600 | 0.018～0.03 | 0.028 | 12,700 | 450 | 0.016～0.027 | 0.028 | 10,500 | 330 | 0.013～0.021 | 0.028 |
| | | 14 | 13,700 | 510 | 0.013～0.022 | 0.018 | 11,500 | 390 | 0.012～0.02 | 0.018 | 9,700 | 290 | 0.009～0.016 | 0.018 |
| | | 16 | 12,600 | 450 | 0.01 ～0.017 | 0.012 | 10,600 | 340 | 0.009～0.015 | 0.012 | 9,100 | 250 | 0.007～0.012 | 0.012 |
| | | 22 | 10,300 | 300 | 0.006～0.009 | 0.004 | 8,700 | 230 | 0.005～0.008 | 0.004 | 7,800 | 180 | 0.004～0.006 | 0.004 |

# Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2007 | 0.7 | 2 | 28,800 | 430 | 0.015～0.025 | 0.165 | 10,000 | 24 | 0.01 ～0.015 | 0.165 |
| | | 4 | 20,600 | 290 | 0.009～0.014 | 0.047 | 10,000 | 22 | 0.006～0.009 | 0.047 |
| | | 6 | 16,900 | 230 | 0.005～0.008 | 0.014 | 10,000 | 20 | 0.003～0.005 | 0.014 |
| | | 8 | 14,700 | 190 | 0.003～0.005 | 0.006 | 10,000 | 18 | 0.002～0.003 | 0.006 |
| | | 10 | 13,200 | 160 | 0.002～0.003 | 0.004 | 10,000 | 13 | 0.001～0.002 | 0.004 |
| 2008 | 0.8 | 3 | 21,000 | 370 | 0.016～0.027 | 0.15 | 8,000 | 21 | 0.012～0.016 | 0.15 |
| | | 4 | 19,300 | 330 | 0.013～0.022 | 0.08 | 8,000 | 20 | 0.01 ～0.013 | 0.08 |
| | | 5 | 17,600 | 290 | 0.01 ～0.017 | 0.052 | 8,000 | 19 | 0.008～0.01 | 0.052 |
| | | 6 | 15,800 | 250 | 0.007～0.012 | 0.024 | 8,000 | 18 | 0.005～0.007 | 0.024 |
| | | 8 | 13,800 | 200 | 0.004～0.007 | 0.01 | 8,000 | 16 | 0.003～0.004 | 0.01 |
| | | 10 | 12,400 | 170 | 0.003～0.005 | 0.005 | 8,000 | 14 | 0.002～0.003 | 0.005 |
| | | 12 | 11,300 | 140 | 0.002～0.003 | 0.003 | 8,000 | 12 | 0.001～0.002 | 0.003 |
| | | 16 | 9,800 | 100 | 0.001～0.002 | 0.001 | — | — | — ～ — | 0.001 |
| | | 24 | 8,100 | 50 | 0.001～0.001 | — | — | — | — ～ — | — |
| 2009 | 0.9 | 4 | 18,000 | 380 | 0.016～0.027 | 0.128 | 7,200 | 20 | 0.01 ～0.014 | 0.128 |
| | | 6 | 14,800 | 290 | 0.01 ～0.016 | 0.038 | 7,200 | 18 | 0.007～0.009 | 0.038 |
| | | 8 | 12,900 | 230 | 0.006～0.01 | 0.016 | 7,200 | 16 | 0.004～0.006 | 0.016 |
| | | 10 | 11,600 | 190 | 0.004～0.006 | 0.008 | 7,200 | 14 | 0.002～0.003 | 0.008 |
| | | 15 | 9,500 | 120 | 0.002～0.003 | 0.002 | — | — | — ～ — | 0.002 |
| 2010 | 1 | 3 | 18,700 | 440 | 0.024～0.039 | 0.263 | 6,500 | 15 | 0.011～0.016 | 0.263 |
| | | 4 | 17,200 | 400 | 0.02 ～0.033 | 0.195 | 6,500 | 15 | 0.01 ～0.015 | 0.195 |
| | | 5 | 15,700 | 360 | 0.016～0.027 | 0.127 | 6,500 | 15 | 0.009～0.014 | 0.127 |
| | | 6 | 14,100 | 310 | 0.012～0.02 | 0.058 | 6,500 | 14 | 0.007～0.012 | 0.058 |
| | | 7 | 13,200 | 280 | 0.01 ～0.016 | 0.041 | 6,500 | 14 | 0.006～0.009 | 0.041 |
| | | 8 | 12,300 | 250 | 0.007～0.012 | 0.024 | 6,500 | 13 | 0.004～0.006 | 0.024 |
| | | 9 | 11,700 | 230 | 0.006～0.01 | 0.019 | 6,500 | 13 | 0.004～0.005 | 0.019 |
| | | 10 | 11,000 | 210 | 0.005～0.008 | 0.013 | 6,500 | 12 | 0.003～0.004 | 0.013 |
| | | 12 | 10,100 | 170 | 0.003～0.006 | 0.007 | 6,500 | 11 | 0.002～0.003 | 0.007 |
| | | 14 | 9,400 | 150 | 0.002～0.004 | 0.005 | 6,500 | 10 | 0.001～0.002 | 0.005 |
| | | 16 | 8,800 | 130 | 0.002～0.003 | 0.003 | — | — | — ～ — | 0.003 |
| | | 18 | 8,350 | 110 | 0.001～0.002 | 0.002 | — | — | — ～ — | 0.002 |
| | | 20 | 7,900 | 90 | 0.001～0.002 | 0.002 | — | — | — ～ — | 0.002 |
| | | 25 | 7,100 | 60 | 0.001～0.001 | 0.001 | — | — | — ～ — | 0.001 |
| | | 30 | 6,500 | 40 | 0.001～0.001 | — | — | — | — ～ — | — |
| 2012 | 1.2 | 4 | 14,500 | 400 | 0.026～0.042 | 0.23 | 9,600 | 34 | 0.015～0.026 | 0.23 |
| | | 6 | 12,800 | 340 | 0.019～0.031 | 0.12 | 9,600 | 22 | 0.011～0.019 | 0.12 |
| | | 8 | 11,100 | 280 | 0.012～0.02 | 0.051 | 9,600 | 10 | 0.007～0.012 | 0.051 |
| | | 10 | 9,900 | 230 | 0.008～0.013 | 0.026 | — | — | — ～ — | 0.026 |
| | | 12 | 9,100 | 200 | 0.005～0.009 | 0.015 | — | — | — ～ — | 0.015 |
| | | 16 | 7,900 | 150 | 0.003～0.005 | 0.006 | — | — | — ～ — | 0.006 |
| | | 20 | 7,000 | 120 | 0.002～0.003 | 0.003 | — | — | — ～ — | 0.003 |
| 2014 | 1.4 | 6 | 11,900 | 370 | 0.026～0.043 | 0.222 | 9,600 | 44 | 0.015～0.026 | 0.222 |
| | | 8 | 10,300 | 310 | 0.018～0.029 | 0.094 | 9,600 | 18 | 0.01 ～0.017 | 0.094 |
| | | 10 | 9,200 | 260 | 0.012～0.021 | 0.048 | — | — | — ～ — | 0.048 |
| | | 12 | 8,400 | 230 | 0.009～0.015 | 0.028 | — | — | — ～ — | 0.028 |
| | | 14 | 7,800 | 200 | 0.007～0.011 | 0.018 | — | — | — ～ — | 0.018 |
| | | 16 | 7,300 | 180 | 0.005～0.009 | 0.012 | — | — | — ～ — | 0.012 |
| | | 22 | 6,200 | 120 | 0.003～0.005 | 0.004 | — | — | — ～ — | 0.004 |

## Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD(30～45HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2015 | 1.5 | 4 | 26,600 | 1,340 | 0.073～0.12 | 0.462 | 22,100 | 1,000 | 0.065～0.109 | 0.462 | 16,300 | 640 | 0.051～0.084 | 0.462 |
| | | 6 | 22,800 | 1,120 | 0.057～0.094 | 0.293 | 19,000 | 840 | 0.051～0.085 | 0.293 | 14,400 | 550 | 0.04 ～0.066 | 0.293 |
| | | 8 | 19,000 | 900 | 0.041～0.068 | 0.124 | 15,900 | 670 | 0.037～0.061 | 0.124 | 12,500 | 460 | 0.029～0.048 | 0.124 |
| | | 10 | 16,600 | 750 | 0.03 ～0.05 | 0.063 | 13,800 | 560 | 0.027～0.045 | 0.063 | 11,200 | 390 | 0.021～0.035 | 0.063 |
| | | 12 | 14,800 | 630 | 0.023～0.038 | 0.037 | 12,400 | 470 | 0.02 ～0.034 | 0.037 | 10,200 | 340 | 0.016～0.026 | 0.037 |
| | | 14 | 13,400 | 550 | 0.017～0.029 | 0.023 | 11,200 | 410 | 0.016～0.026 | 0.023 | 9,500 | 300 | 0.012～0.02 | 0.023 |
| | | 16 | 12,300 | 480 | 0.013～0.022 | 0.015 | 10,300 | 360 | 0.012～0.02 | 0.015 | 8,900 | 270 | 0.009～0.016 | 0.015 |
| | | 18 | 11,500 | 420 | 0.011～0.018 | 0.011 | 9,600 | 310 | 0.01 ～0.016 | 0.011 | 8,400 | 240 | 0.007～0.012 | 0.011 |
| | | 20 | 10,700 | 370 | 0.009～0.014 | 0.008 | 9,000 | 280 | 0.008～0.013 | 0.008 | 7,900 | 220 | 0.006～0.01 | 0.008 |
| | | 25 | 9,300 | 270 | 0.005～0.009 | 0.004 | 7,800 | 200 | 0.005～0.008 | 0.004 | 7,100 | 160 | 0.004～0.006 | 0.004 |
| | | 30 | 8,300 | 200 | 0.004～0.007 | 0.002 | 7,000 | 150 | 0.004～0.006 | 0.002 | 6,500 | 120 | 0.003～0.005 | 0.002 |
| | | 35 | 7,600 | 140 | 0.003～0.004 | 0.001 | 6,400 | 110 | 0.003～0.004 | 0.001 | 6,000 | 90 | 0.002～0.003 | 0.001 |
| | | 40 | 7,000 | 90 | 0.002～0.003 | 0.001 | 5,800 | 70 | 0.002～0.003 | 0.001 | 5,600 | 60 | 0.002～0.002 | 0.001 |
| | | 45 | 6,500 | 60 | 0.002～0.003 | 0.001 | 5,400 | 50 | 0.002～0.002 | 0.001 | 5,300 | 40 | 0.001～0.002 | 0.001 |
| 2016 | 1.6 | 6 | 22,200 | 1,170 | 0.065～0.108 | 0.379 | 18,500 | 870 | 0.058～0.097 | 0.379 | 13,800 | 570 | 0.045～0.076 | 0.379 |
| | | 8 | 18,500 | 940 | 0.047～0.079 | 0.16 | 15,500 | 700 | 0.042～0.071 | 0.16 | 12,000 | 480 | 0.033～0.055 | 0.16 |
| | | 10 | 16,100 | 780 | 0.035～0.058 | 0.082 | 13,500 | 580 | 0.032～0.053 | 0.082 | 10,800 | 410 | 0.025～0.041 | 0.082 |
| | | 12 | 14,400 | 670 | 0.027～0.044 | 0.047 | 12,000 | 500 | 0.024～0.04 | 0.047 | 9,800 | 360 | 0.019～0.031 | 0.047 |
| | | 14 | 13,000 | 580 | 0.02 ～0.034 | 0.03 | 10,900 | 430 | 0.018～0.031 | 0.03 | 9,100 | 320 | 0.014～0.024 | 0.03 |
| | | 16 | 12,000 | 510 | 0.016～0.027 | 0.02 | 10,000 | 380 | 0.014～0.024 | 0.02 | 8,500 | 280 | 0.011～0.019 | 0.02 |
| | | 18 | 11,100 | 450 | 0.013～0.022 | 0.014 | 9,300 | 340 | 0.012～0.019 | 0.014 | 8,000 | 260 | 0.009～0.015 | 0.014 |
| | | 20 | 10,400 | 400 | 0.011～0.018 | 0.01 | 8,700 | 300 | 0.01 ～0.016 | 0.01 | 7,600 | 230 | 0.007～0.012 | 0.01 |
| | | 26 | 8,800 | 280 | 0.007～0.011 | 0.005 | 7,400 | 210 | 0.006～0.01 | 0.005 | 6,700 | 170 | 0.005～0.008 | 0.005 |
| 2018 | 1.8 | 6 | 21,000 | 1,270 | 0.061～0.102 | 0.608 | 17,800 | 950 | 0.055～0.092 | 0.608 | 12,800 | 600 | 0.043～0.071 | 0.608 |
| | | 8 | 17,700 | 1,020 | 0.05 ～0.083 | 0.256 | 14,900 | 760 | 0.045～0.075 | 0.256 | 11,100 | 500 | 0.035～0.058 | 0.256 |
| | | 10 | 15,400 | 860 | 0.041～0.068 | 0.131 | 12,900 | 640 | 0.037～0.061 | 0.131 | 9,900 | 430 | 0.029～0.048 | 0.131 |
| | | 12 | 13,800 | 740 | 0.033～0.055 | 0.076 | 11,500 | 550 | 0.03 ～0.05 | 0.076 | 9,100 | 380 | 0.023～0.039 | 0.076 |
| | | 14 | 12,500 | 640 | 0.027～0.045 | 0.048 | 10,500 | 480 | 0.024～0.041 | 0.048 | 8,400 | 340 | 0.019～0.032 | 0.048 |
| | | 16 | 11,500 | 570 | 0.022～0.037 | 0.032 | 9,600 | 420 | 0.02 ～0.033 | 0.032 | 7,800 | 300 | 0.016～0.026 | 0.032 |
| | | 18 | 10,700 | 500 | 0.018～0.03 | 0.023 | 8,900 | 380 | 0.016～0.027 | 0.023 | 7,400 | 280 | 0.013～0.021 | 0.023 |
| | | 20 | 10,000 | 450 | 0.015～0.025 | 0.016 | 8,400 | 340 | 0.013～0.022 | 0.016 | 7,000 | 250 | 0.01 ～0.017 | 0.016 |
| | | 25 | 8,700 | 350 | 0.009～0.015 | 0.008 | 7,300 | 260 | 0.008～0.014 | 0.008 | 6,300 | 200 | 0.006～0.011 | 0.008 |
| 2020 | 2 | 6 | 20,300 | 1,350 | 0.064～0.107 | 0.926 | 17,400 | 1,030 | 0.058～0.097 | 0.926 | 12,500 | 650 | 0.045～0.075 | 0.926 |
| | | 8 | 17,000 | 1,090 | 0.054～0.089 | 0.391 | 14,500 | 830 | 0.048～0.081 | 0.391 | 10,800 | 540 | 0.038～0.063 | 0.391 |
| | | 10 | 14,800 | 920 | 0.045～0.075 | 0.2 | 12,600 | 700 | 0.04 ～0.067 | 0.2 | 9,700 | 470 | 0.031～0.052 | 0.2 |
| | | 12 | 13,200 | 790 | 0.037～0.062 | 0.116 | 11,200 | 600 | 0.034～0.056 | 0.116 | 8,900 | 420 | 0.026～0.044 | 0.116 |
| | | 14 | 12,000 | 700 | 0.031～0.052 | 0.073 | 10,200 | 530 | 0.028～0.047 | 0.073 | 8,200 | 370 | 0.022～0.036 | 0.073 |
| | | 16 | 11,100 | 620 | 0.026～0.044 | 0.049 | 9,400 | 470 | 0.024～0.039 | 0.049 | 7,700 | 340 | 0.018～0.03 | 0.049 |
| | | 18 | 10,300 | 550 | 0.022～0.036 | 0.034 | 8,700 | 420 | 0.02 ～0.033 | 0.034 | 7,200 | 310 | 0.015～0.026 | 0.034 |
| | | 20 | 9,600 | 500 | 0.018～0.031 | 0.025 | 8,100 | 380 | 0.016～0.027 | 0.025 | 6,900 | 280 | 0.013～0.021 | 0.025 |
| | | 25 | 8,400 | 390 | 0.012～0.02 | 0.013 | 7,100 | 290 | 0.011～0.018 | 0.013 | 6,200 | 230 | 0.008～0.014 | 0.013 |
| | | 30 | 7,500 | 310 | 0.008～0.013 | 0.007 | 6,300 | 230 | 0.007～0.012 | 0.007 | 5,600 | 180 | 0.005～0.009 | 0.007 |
| | | 35 | 6,800 | 250 | 0.005～0.008 | 0.005 | 5,700 | 190 | 0.005～0.008 | 0.005 | 5,200 | 150 | 0.004～0.006 | 0.005 |
| | | 40 | 6,300 | 200 | 0.003～0.006 | 0.003 | 5,200 | 150 | 0.003～0.005 | 0.003 | 4,900 | 120 | 0.002～0.004 | 0.003 |
| | | 50 | 5,400 | 110 | 0.003～0.004 | 0.002 | 4,500 | 90 | 0.002～0.002 | 0.002 | 4,400 | 70 | 0.002～0.002 | 0.002 |
| | | 60 | 4,900 | 50 | 0.002～0.003 | 0.002 | 4,000 | 40 | 0.002～0.002 | 0.002 | 4,000 | 30 | 0.002～0.002 | 0.002 |

# Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2015 | 1.5 | 4 | 13,000 | 440 | 0.036～0.06 | 0.462 | 9,600 | 95 | 0.02 ～0.036 | 0.462 |
| | | 6 | 11,500 | 380 | 0.028～0.047 | 0.293 | 9,600 | 60 | 0.016～0.028 | 0.293 |
| | | 8 | 10,000 | 320 | 0.02 ～0.034 | 0.124 | 9,600 | 25 | 0.012～0.02 | 0.124 |
| | | 10 | 8,900 | 270 | 0.015～0.025 | 0.063 | 9,600 | 13 | 0.009～0.015 | 0.063 |
| | | 12 | 8,200 | 240 | 0.011～0.019 | 0.037 | — | — | — ～ — | 0.037 |
| | | 14 | 7,600 | 210 | 0.009～0.014 | 0.023 | — | — | — ～ — | 0.023 |
| | | 16 | 7,100 | 190 | 0.007～0.011 | 0.015 | — | — | — ～ — | 0.015 |
| | | 18 | 6,700 | 170 | 0.005～0.009 | 0.011 | — | — | — ～ — | 0.011 |
| | | 20 | 6,300 | 150 | 0.004～0.007 | 0.008 | — | — | — ～ — | 0.008 |
| | | 25 | 5,700 | 110 | 0.003～0.005 | 0.004 | — | — | — ～ — | 0.004 |
| | | 30 | 5,200 | 90 | 0.002～0.003 | 0.002 | — | — | — ～ — | 0.002 |
| | | 35 | 4,800 | 60 | 0.002～0.002 | 0.001 | — | — | — ～ — | 0.001 |
| | | 40 | 4,500 | 40 | 0.001～0.002 | 0.001 | — | — | — ～ — | 0.001 |
| | | 45 | 4,300 | 30 | 0.001～0.001 | 0.001 | — | — | — ～ — | 0.001 |
| 2016 | 1.6 | 6 | 11,100 | 400 | 0.032～0.054 | 0.379 | 9,600 | 73 | 0.019～0.032 | 0.379 |
| | | 8 | 9,600 | 330 | 0.024～0.039 | 0.16 | 9,600 | 31 | 0.014～0.023 | 0.16 |
| | | 10 | 8,600 | 280 | 0.018～0.029 | 0.082 | 9,600 | 15 | 0.01 ～0.017 | 0.082 |
| | | 12 | 7,900 | 250 | 0.013～0.022 | 0.047 | — | — | — ～ — | 0.047 |
| | | 14 | 7,300 | 220 | 0.01 ～0.017 | 0.03 | — | — | — ～ — | 0.03 |
| | | 16 | 6,800 | 200 | 0.008～0.013 | 0.02 | — | — | — ～ — | 0.02 |
| | | 18 | 6,400 | 180 | 0.006～0.011 | 0.014 | — | — | — ～ — | 0.014 |
| | | 20 | 6,100 | 160 | 0.005～0.009 | 0.01 | — | — | — ～ — | 0.01 |
| | | 26 | 5,300 | 120 | 0.003～0.005 | 0.005 | — | — | — ～ — | 0.005 |
| 2018 | 1.8 | 6 | 10,200 | 410 | 0.031～0.051 | 0.608 | 9,600 | 137 | 0.018～0.031 | 0.608 |
| | | 8 | 8,900 | 350 | 0.025～0.042 | 0.256 | 9,600 | 58 | 0.015～0.025 | 0.256 |
| | | 10 | 7,900 | 300 | 0.02 ～0.034 | 0.131 | 9,600 | 29 | 0.012～0.02 | 0.131 |
| | | 12 | 7,200 | 260 | 0.017～0.028 | 0.076 | 9,600 | 17 | 0.01 ～0.017 | 0.076 |
| | | 14 | 6,700 | 230 | 0.014～0.023 | 0.048 | 9,600 | 10 | 0.008～0.014 | 0.048 |
| | | 16 | 6,300 | 210 | 0.011～0.019 | 0.032 | — | — | — ～ — | 0.032 |
| | | 18 | 5,900 | 190 | 0.009～0.015 | 0.023 | — | — | — ～ — | 0.023 |
| | | 20 | 5,600 | 170 | 0.007～0.012 | 0.016 | — | — | — ～ — | 0.016 |
| | | 25 | 5,000 | 140 | 0.005～0.008 | 0.008 | — | — | — ～ — | 0.008 |
| 2020 | 2 | 6 | 10,000 | 450 | 0.032～0.054 | 0.926 | 9,600 | 211 | 0.019～0.032 | 0.926 |
| | | 8 | 8,700 | 380 | 0.027～0.045 | 0.391 | 9,600 | 89 | 0.016～0.027 | 0.391 |
| | | 10 | 7,800 | 330 | 0.022～0.037 | 0.2 | 9,600 | 45 | 0.013～0.022 | 0.2 |
| | | 12 | 7,100 | 290 | 0.019～0.031 | 0.116 | 9,600 | 28 | 0.011～0.019 | 0.116 |
| | | 14 | 6,600 | 260 | 0.016～0.026 | 0.073 | 9,600 | 16 | 0.009～0.016 | 0.073 |
| | | 16 | 6,100 | 230 | 0.013～0.022 | 0.049 | 9,600 | 11 | 0.007～0.013 | 0.049 |
| | | 18 | 5,800 | 210 | 0.011～0.018 | 0.034 | — | — | — ～ — | 0.034 |
| | | 20 | 5,500 | 190 | 0.009～0.015 | 0.025 | — | — | — ～ — | 0.025 |
| | | 25 | 4,900 | 160 | 0.006～0.01 | 0.013 | — | — | — ～ — | 0.013 |
| | | 30 | 4,500 | 130 | 0.004～0.006 | 0.007 | — | — | — ～ — | 0.007 |
| | | 35 | 4,200 | 100 | 0.003～0.004 | 0.005 | — | — | — ～ — | 0.005 |
| | | 40 | 3,900 | 80 | 0.002～0.003 | 0.003 | — | — | — ～ — | 0.003 |
| | | 50 | 3,500 | 50 | 0.001～0.001 | 0.002 | — | — | — ～ — | 0.002 |
| | | 60 | 3,200 | 30 | 0.001～0.001 | 0.002 | — | — | — ～ — | 0.002 |

## Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD(30～45HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2025 | 2.5 | 8 | 15,000 | 1,340 | 0.077～0.129 | 0.954 | 12,800 | 1,020 | 0.069～0.116 | 0.954 | 9,600 | 670 | 0.054～0.09 | 0.954 |
| | | 10 | 13,100 | 1,140 | 0.068～0.113 | 0.488 | 11,100 | 860 | 0.061～0.102 | 0.488 | 8,600 | 590 | 0.048～0.079 | 0.488 |
| | | 12 | 11,800 | 1,000 | 0.06 ～0.099 | 0.283 | 10,000 | 750 | 0.054～0.089 | 0.283 | 7,900 | 520 | 0.042～0.07 | 0.283 |
| | | 14 | 10,700 | 880 | 0.052～0.087 | 0.178 | 9,100 | 660 | 0.047～0.078 | 0.178 | 7,300 | 470 | 0.036～0.061 | 0.178 |
| | | 16 | 9,900 | 790 | 0.045～0.075 | 0.119 | 8,400 | 590 | 0.04 ～0.067 | 0.119 | 6,800 | 430 | 0.031～0.052 | 0.119 |
| | | 18 | 9,200 | 710 | 0.039～0.064 | 0.084 | 7,800 | 540 | 0.035～0.058 | 0.084 | 6,500 | 390 | 0.027～0.045 | 0.084 |
| | | 20 | 8,700 | 650 | 0.033～0.055 | 0.061 | 7,300 | 490 | 0.03 ～0.05 | 0.061 | 6,100 | 360 | 0.023～0.039 | 0.061 |
| | | 25 | 7,600 | 520 | 0.022～0.036 | 0.031 | 6,400 | 390 | 0.019～0.032 | 0.031 | 5,500 | 300 | 0.015～0.025 | 0.031 |
| | | 30 | 6,800 | 430 | 0.014～0.023 | 0.018 | 5,700 | 320 | 0.012～0.02 | 0.018 | 5,000 | 250 | 0.01 ～0.016 | 0.018 |
| | | 40 | 5,700 | 290 | 0.005～0.008 | 0.008 | 4,800 | 220 | 0.004～0.007 | 0.008 | 4,400 | 170 | 0.003～0.006 | 0.008 |
| | | 50 | 5,000 | 190 | 0.003～0.004 | 0.004 | 4,200 | 140 | 0.002～0.004 | 0.004 | 3,900 | 120 | 0.002～0.003 | 0.004 |
| 2030 | 3 | 8 | 13,200 | 1,470 | 0.103～0.172 | 1.978 | 10,900 | 1,080 | 0.093～0.155 | 1.978 | 8,000 | 700 | 0.072～0.12 | 1.978 |
| | | 10 | 11,600 | 1,270 | 0.092～0.153 | 1.013 | 9,600 | 930 | 0.083～0.138 | 1.013 | 7,200 | 620 | 0.064～0.107 | 1.013 |
| | | 12 | 10,500 | 1,110 | 0.081～0.136 | 0.586 | 8,700 | 830 | 0.073～0.122 | 0.586 | 6,700 | 560 | 0.057～0.095 | 0.586 |
| | | 14 | 9,600 | 1,000 | 0.072～0.12 | 0.369 | 8,000 | 740 | 0.065～0.108 | 0.369 | 6,200 | 510 | 0.051～0.084 | 0.369 |
| | | 16 | 8,900 | 900 | 0.064～0.107 | 0.247 | 7,400 | 670 | 0.058～0.096 | 0.247 | 5,900 | 470 | 0.045～0.075 | 0.247 |
| | | 18 | 8,300 | 820 | 0.057～0.094 | 0.174 | 7,000 | 610 | 0.051～0.085 | 0.174 | 5,600 | 430 | 0.04 ～0.066 | 0.174 |
| | | 20 | 7,800 | 750 | 0.05 ～0.083 | 0.127 | 6,600 | 560 | 0.045～0.075 | 0.127 | 5,300 | 400 | 0.035～0.058 | 0.127 |
| | | 25 | 6,900 | 620 | 0.036～0.06 | 0.065 | 5,800 | 460 | 0.032～0.054 | 0.065 | 4,800 | 340 | 0.025～0.042 | 0.065 |
| | | 30 | 6,200 | 520 | 0.026～0.043 | 0.038 | 5,200 | 390 | 0.023～0.039 | 0.038 | 4,500 | 290 | 0.018～0.03 | 0.038 |
| | | 35 | 5,700 | 440 | 0.018～0.031 | 0.024 | 4,800 | 330 | 0.016～0.027 | 0.024 | 4,200 | 250 | 0.013～0.021 | 0.024 |
| | | 40 | 5,300 | 370 | 0.013～0.021 | 0.016 | 4,500 | 280 | 0.012～0.019 | 0.016 | 3,900 | 220 | 0.009～0.015 | 0.016 |
| | | 50 | 4,700 | 270 | 0.006～0.01 | 0.008 | 3,900 | 200 | 0.005～0.009 | 0.008 | 3,600 | 160 | 0.004～0.007 | 0.008 |
| 2040 | 4 | 12 | 8,500 | 1,280 | 0.112～0.187 | 1.852 | 7,100 | 950 | 0.101～0.168 | 1.852 | 5,100 | 600 | 0.078～0.131 | 1.852 |
| | | 16 | 7,200 | 1,050 | 0.093～0.155 | 0.781 | 6,000 | 770 | 0.084～0.139 | 0.781 | 4,400 | 510 | 0.065～0.108 | 0.781 |
| | | 20 | 6,300 | 880 | 0.077～0.128 | 0.4 | 5,200 | 650 | 0.069～0.115 | 0.4 | 4,000 | 440 | 0.054～0.09 | 0.4 |
| | | 25 | 5,600 | 750 | 0.061～0.101 | 0.205 | 4,600 | 540 | 0.055～0.091 | 0.205 | 3,600 | 380 | 0.042～0.071 | 0.205 |
| | | 30 | 5,000 | 630 | 0.048～0.08 | 0.119 | 4,100 | 460 | 0.043～0.072 | 0.119 | 3,300 | 330 | 0.033～0.056 | 0.119 |
| | | 35 | 4,600 | 540 | 0.038～0.063 | 0.075 | 3,800 | 400 | 0.034～0.057 | 0.075 | 3,100 | 290 | 0.026～0.044 | 0.075 |
| | | 40 | 4,200 | 470 | 0.03 ～0.049 | 0.05 | 3,500 | 350 | 0.027～0.044 | 0.05 | 2,900 | 250 | 0.021～0.035 | 0.05 |
| | | 45 | 3,900 | 410 | 0.023～0.039 | 0.035 | 3,300 | 300 | 0.021～0.035 | 0.035 | 2,700 | 230 | 0.016～0.027 | 0.035 |
| | | 50 | 3,700 | 360 | 0.018～0.031 | 0.026 | 3,100 | 270 | 0.016～0.027 | 0.026 | 2,600 | 200 | 0.013～0.021 | 0.026 |
| | | 60 | 3,300 | 280 | 0.011～0.019 | 0.015 | 2,800 | 210 | 0.01 ～0.017 | 0.015 | 2,400 | 160 | 0.008～0.013 | 0.015 |
| 2050 | 5 | 16 | 6,000 | 1,140 | 0.127～0.212 | 1.907 | 5,100 | 860 | 0.114～0.191 | 1.907 | 3,500 | 520 | 0.089～0.148 | 1.907 |
| | | 20 | 5,300 | 980 | 0.121～0.202 | 0.977 | 4,400 | 730 | 0.109～0.182 | 0.977 | 3,100 | 440 | 0.085～0.142 | 0.977 |
| | | 25 | 4,600 | 820 | 0.109～0.182 | 0.5 | 3,800 | 600 | 0.099～0.164 | 0.5 | 2,800 | 390 | 0.077～0.128 | 0.5 |
| | | 30 | 4,200 | 710 | 0.094～0.157 | 0.289 | 3,400 | 510 | 0.085～0.141 | 0.289 | 2,500 | 340 | 0.066～0.11 | 0.289 |
| | | 35 | 3,800 | 620 | 0.077～0.128 | 0.182 | 3,100 | 450 | 0.069～0.115 | 0.182 | 2,300 | 300 | 0.054～0.09 | 0.182 |
| | | 40 | 3,500 | 540 | 0.06 ～0.099 | 0.122 | 2,800 | 390 | 0.054～0.089 | 0.122 | 2,200 | 270 | 0.042～0.07 | 0.122 |
| | | 50 | 3,100 | 430 | 0.031～0.052 | 0.063 | 2,400 | 300 | 0.028～0.047 | 0.063 | 1,900 | 210 | 0.022～0.036 | 0.063 |
| | | 60 | 2,800 | 350 | 0.02 ～0.035 | 0.035 | 2,100 | 240 | 0.02 ～0.033 | 0.035 | 1,800 | 170 | 0.019～0.031 | 0.035 |
| 2060 | 6 | 20 | 4,200 | 960 | 0.126～0.211 | 2.025 | 3,800 | 780 | 0.114～0.19 | 2.025 | 2,600 | 470 | 0.088～0.147 | 2.025 |
| | | 30 | 3,400 | 730 | 0.109～0.182 | 0.6 | 2,800 | 540 | 0.099～0.164 | 0.6 | 2,000 | 340 | 0.077～0.128 | 0.6 |
| | | 40 | 3,000 | 600 | 0.083～0.138 | 0.253 | 2,300 | 410 | 0.074～0.124 | 0.253 | 1,700 | 260 | 0.058～0.096 | 0.253 |
| | | 50 | 2,600 | 480 | 0.054～0.09 | 0.13 | 1,900 | 310 | 0.049～0.081 | 0.13 | 1,500 | 220 | 0.038～0.063 | 0.13 |
| | | 60 | 2,400 | 410 | 0.031～0.052 | 0.075 | 1,700 | 260 | 0.028～0.047 | 0.075 | 1,300 | 170 | 0.022～0.036 | 0.075 |

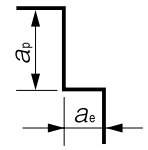
# Milling Conditions for HLS（2 Flutes）

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2025 | 2.5 | 8 | 7,700 | 460 | 0.039～0.064 | 0.954 | 9,600 | 227 | 0.023～0.038 | 0.954 |
| | | 10 | 6,900 | 400 | 0.034～0.057 | 0.488 | 9,600 | 116 | 0.02 ～0.034 | 0.488 |
| | | 12 | 6,300 | 360 | 0.03 ～0.05 | 0.283 | 9,600 | 67 | 0.018～0.03 | 0.283 |
| | | 14 | 5,800 | 320 | 0.026～0.043 | 0.178 | 9,600 | 42 | 0.015～0.026 | 0.178 |
| | | 16 | 5,500 | 290 | 0.022～0.037 | 0.119 | 9,600 | 28 | 0.013～0.022 | 0.119 |
| | | 18 | 5,200 | 270 | 0.019～0.032 | 0.084 | 9,600 | 20 | 0.011～0.019 | 0.084 |
| | | 20 | 4,900 | 250 | 0.017～0.028 | 0.061 | 9,600 | 14 | 0.01 ～0.017 | 0.061 |
| | | 25 | 4,400 | 210 | 0.011～0.018 | 0.031 | — | — | — ～ — | 0.031 |
| | | 30 | 4,000 | 170 | 0.007～0.011 | 0.018 | — | — | — ～ — | 0.018 |
| | | 40 | 3,500 | 120 | 0.002～0.004 | 0.008 | — | — | — ～ — | 0.008 |
| | | 50 | 3,100 | 80 | 0.002～0.002 | 0.004 | — | — | — ～ — | 0.004 |
| 2030 | 3 | 8 | 6,400 | 480 | 0.052～0.086 | 1.978 | 8,000 | 435 | 0.031～0.052 | 1.978 |
| | | 10 | 5,800 | 430 | 0.046～0.076 | 1.013 | 8,000 | 222 | 0.027～0.046 | 1.013 |
| | | 12 | 5,300 | 380 | 0.041～0.068 | 0.586 | 8,000 | 128 | 0.024～0.041 | 0.586 |
| | | 14 | 5,000 | 350 | 0.036～0.06 | 0.369 | 8,000 | 81 | 0.021～0.036 | 0.369 |
| | | 16 | 4,700 | 320 | 0.032～0.053 | 0.247 | 8,000 | 54 | 0.019～0.032 | 0.247 |
| | | 18 | 4,500 | 300 | 0.028～0.047 | 0.174 | 8,000 | 38 | 0.016～0.028 | 0.174 |
| | | 20 | 4,300 | 280 | 0.025～0.042 | 0.127 | 8,000 | 27 | 0.015～0.025 | 0.127 |
| | | 25 | 3,900 | 230 | 0.018～0.03 | 0.065 | 8,000 | 14 | 0.01 ～0.018 | 0.065 |
| | | 30 | 3,600 | 200 | 0.013～0.022 | 0.038 | 8,000 | 10 | 0.007～0.013 | 0.038 |
| | | 35 | 3,300 | 170 | 0.009～0.015 | 0.024 | — | — | — ～ — | 0.024 |
| | | 40 | 3,100 | 150 | 0.006～0.011 | 0.016 | — | — | — ～ — | 0.016 |
| | | 50 | 2,800 | 110 | 0.003～0.005 | 0.008 | — | — | — ～ — | 0.008 |
| 2040 | 4 | 12 | 4,100 | 410 | 0.056～0.093 | 1.852 | 6,000 | 388 | 0.033～0.056 | 1.852 |
| | | 16 | 3,600 | 350 | 0.046～0.077 | 0.781 | 6,000 | 164 | 0.027～0.046 | 0.781 |
| | | 20 | 3,200 | 300 | 0.038～0.064 | 0.4 | 6,000 | 84 | 0.022～0.038 | 0.4 |
| | | 25 | 2,900 | 260 | 0.03 ～0.051 | 0.205 | 6,000 | 43 | 0.018～0.031 | 0.205 |
| | | 30 | 2,600 | 230 | 0.024～0.04 | 0.119 | 6,000 | 24 | 0.014～0.024 | 0.119 |
| | | 35 | 2,500 | 200 | 0.019～0.031 | 0.075 | 6,000 | 15 | 0.011～0.019 | 0.075 |
| | | 40 | 2,300 | 180 | 0.015～0.025 | 0.05 | 6,000 | 10 | 0.009～0.015 | 0.05 |
| | | 45 | 2,200 | 160 | 0.012～0.019 | 0.035 | — | — | — ～ — | 0.035 |
| | | 50 | 2,100 | 140 | 0.009～0.015 | 0.026 | — | — | — ～ — | 0.026 |
| | | 60 | 1,900 | 110 | 0.006～0.009 | 0.015 | — | — | — ～ — | 0.015 |
| 2050 | 5 | 16 | 2,800 | 360 | 0.064～0.106 | 1.907 | 4,800 | 457 | 0.038～0.064 | 1.907 |
| | | 20 | 2,500 | 310 | 0.061～0.101 | 0.977 | 4,800 | 234 | 0.036～0.061 | 0.977 |
| | | 25 | 2,200 | 270 | 0.055～0.091 | 0.5 | 4,800 | 120 | 0.033～0.055 | 0.5 |
| | | 30 | 2,000 | 230 | 0.047～0.078 | 0.289 | 4,800 | 69 | 0.028～0.047 | 0.289 |
| | | 35 | 1,900 | 210 | 0.038～0.064 | 0.182 | 4,800 | 43 | 0.022～0.038 | 0.182 |
| | | 40 | 1,700 | 180 | 0.03 ～0.05 | 0.122 | 4,800 | 29 | 0.018～0.03 | 0.122 |
| | | 50 | 1,500 | 150 | 0.016～0.026 | 0.063 | 4,800 | 15 | 0.009～0.016 | 0.063 |
| | | 60 | 1,400 | 120 | 0.007～0.011 | 0.035 | 4,800 | 10 | 0.004～0.007 | 0.035 |
| 2060 | 6 | 20 | 2,100 | 330 | 0.063～0.105 | 2.025 | 4,000 | 607 | 0.037～0.063 | 2.025 |
| | | 30 | 1,600 | 240 | 0.055～0.091 | 0.6 | 4,000 | 180 | 0.033～0.055 | 0.6 |
| | | 40 | 1,300 | 170 | 0.041～0.069 | 0.253 | 4,000 | 75 | 0.024～0.041 | 0.253 |
| | | 50 | 1,200 | 160 | 0.027～0.045 | 0.13 | 4,000 | 38 | 0.016～0.027 | 0.13 |
| | | 60 | 1,000 | 120 | 0.016～0.026 | 0.075 | 4,000 | 22 | 0.009～0.016 | 0.075 |

Side Milling

$a_p$ : Axial Depth (mm)

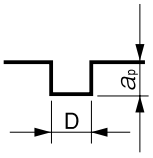
$a_e$ : Radial Depth (mm)




Slotting

$a_p$ : Axial Depth (mm)

D : Outside Diameter (mm)




Note:

・Recommend using a non-contact measuring device to avoid damaging the precision tip point.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

## Size φ0.1～φ6

# C-CER

Super MG | UT COAT | 30° | Flatland | Shank Dia 0/-0.005

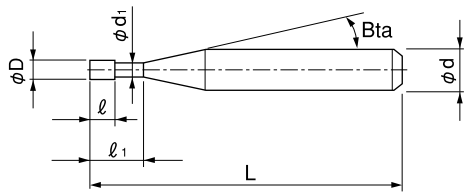
Additional 10 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

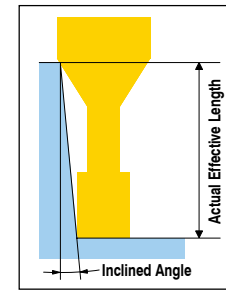
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**Recommend deep rib milling using an under cut design.**




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




Total 148 models

Unit (mm)

| | Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30' | 1° | 1° 30' | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ※ | C-CER 2001-0.3 | 0.1 | 0.3 | 0.1 | 0.088 | 11° | 45 | 4 | 11,160 | 0.32 | 0.35 | 0.38 | 0.40 | 0.47 |
| ※ | C-CER 2001-0.5 | | 0.5 | | | | 45 | 4 | 12,240 | 0.54 | 0.58 | 0.61 | 0.65 | 0.75 |
| ※ | C-CER 2001-0.75 | | 0.75 | | | | 45 | 4 | 13,560 | 0.80 | 0.85 | 0.91 | 0.97 | 1.11 |
| ※ | C-CER 2001-1 | | 1 | | | | 45 | 4 | 15,240 | 1.07 | 1.13 | 1.20 | 1.28 | 1.47 |
| ※ | C-CER 20015-0.5 | 0.15 | 0.5 | 0.15 | 0.128 | 11° | 45 | 4 | 11,400 | 0.57 | 0.61 | 0.65 | 0.69 | 0.79 |
| ※ | C-CER 20015-0.75 | | 0.75 | | | | 45 | 4 | 12,600 | 0.84 | 0.88 | 0.94 | 1.00 | 1.15 |
| ※ | C-CER 20015-1 | | 1 | | | | 45 | 4 | 12,600 | 1.10 | 1.16 | 1.23 | 1.31 | 1.51 |
| | C-CER 2002-0.5 | 0.2 | 0.5 | 0.3 | 0.18 | 16° | 45 | 4 | 8,640 | 0.65 | 0.70 | 0.74 | 0.78 | 0.85 |
| | C-CER 2002-1 | | 1 | | | | 45 | 4 | 9,360 | 1.18 | 1.25 | 1.31 | 1.36 | 1.45 |
| | C-CER 2002-1.5 | | 1.5 | | | | 45 | 4 | 11,280 | 1.67 | 1.76 | 1.84 | 1.90 | 2.01 |
| ※ | C-CER 2002-2 | | 2 | | | | 45 | 4 | 12,480 | 2.20 | 2.30 | 2.39 | 2.48 | 2.69 |
| ※ | C-CER 2002-3 | | 3 | | | | 45 | 4 | 12,840 | 3.25 | 3.37 | 3.50 | 3.63 | 3.93 |
| | C-CER 2003-1 | 0.3 | 1 | 0.4 | 0.28 | 16° | 45 | 4 | 7,560 | 1.22 | 1.30 | 1.37 | 1.43 | 1.55 |
| ※ | C-CER 2003-1.5 | | 1.5 | | | | 45 | 4 | 7,560 | 1.71 | 1.82 | 1.90 | 1.98 | 2.15 |
| | C-CER 2003-2 | | 2 | | | | 45 | 4 | 9,360 | 2.24 | 2.36 | 2.46 | 2.55 | 2.70 |
| | C-CER 2003-3 | | 3 | | | | 45 | 4 | 9,720 | 3.30 | 3.45 | 3.56 | 3.66 | 3.83 |

※Additional model

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| C-CER 2004-2 | 0.4 | 2 | 0.6 | 0.38 | 16° | 45 | 4 | 6,700 | 2.31 | 2.47 | 2.60 | 2.71 | 2.91 |
| C-CER 2004-3 | | 3 | | | | 45 | 4 | 5,520 | 3.38 | 3.57 | 3.72 | 3.85 | 4.07 |
| C-CER 2004-4 | | 4 | | | | 45 | 4 | 5,520 | 4.44 | 4.65 | 4.82 | 4.96 | 5.21 |
| C-CER 2004-5 | | 5 | | | | 45 | 4 | 5,520 | 5.49 | 5.73 | 5.91 | 6.06 | 6.33 |
| C-CER 2005-2 | 0.5 | 2 | 0.7 | 0.48 | 16° | 45 | 4 | 3,960 | 2.37 | 2.56 | 2.71 | 2.85 | 3.09 |
| C-CER 2005-4 | | 4 | | | | 45 | 4 | 3,960 | 4.52 | 4.77 | 4.97 | 5.14 | 5.44 |
| C-CER 2005-6 | | 6 | | | | 45 | 4 | 3,960 | 6.64 | 6.94 | 7.17 | 7.37 | 7.71 |
| C-CER 2005-8 | | 8 | | | | 45 | 4 | 6,600 | 8.74 | 9.07 | 9.33 | 9.56 | 9.93 |
| C-CER 2006-2 | 0.6 | 2 | 0.9 | 0.58 | 16° | 45 | 4 | 4,200 | 2.35 | 2.59 | 2.78 | 2.94 | 3.23 |
| C-CER 2006-4 | | 4 | | | | 45 | 4 | 4,200 | 4.54 | 4.84 | 5.08 | 5.28 | 5.68 |
| C-CER 2006-6 | | 6 | | | | 45 | 4 | 4,200 | 6.68 | 7.03 | 7.30 | 7.56 | 8.13 |
| C-CER 2006-8 | | 8 | | | | 45 | 4 | 6,840 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| C-CER 2006-10 | | 10 | | | | 45 | 4 | 7,920 | 10.90 | 11.33 | 11.71 | 12.11 | 13.02 |
| C-CER 2007-2 | 0.7 | 2 | 1 | 0.68 | 16° | 45 | 4 | 4,800 | 2.35 | 2.59 | 2.78 | 2.94 | 3.23 |
| C-CER 2007-3 | | 3 | | | | 45 | 4 | 4,800 | 3.46 | 3.73 | 3.94 | 4.13 | 4.46 |
| C-CER 2007-4 | | 4 | | | | 45 | 4 | 4,800 | 4.54 | 4.84 | 5.08 | 5.28 | 5.68 |
| C-CER 2007-6 | | 6 | | | | 45 | 4 | 4,800 | 6.68 | 7.03 | 7.30 | 7.56 | 8.13 |
| C-CER 2007-8 | | 8 | | | | 45 | 4 | 7,000 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| C-CER 2007-10 | | 10 | | | | 50 | 4 | 8,000 | 10.90 | 11.33 | 11.71 | 12.11 | 13.02 |
| C-CER 2008-4 | 0.8 | 4 | 1.2 | 0.78 | 16° | 45 | 4 | 4,680 | 4.54 | 4.84 | 5.08 | 5.28 | 5.68 |
| C-CER 2008-6 | | 6 | | | | 45 | 4 | 4,680 | 6.68 | 7.03 | 7.30 | 7.56 | 8.13 |
| C-CER 2008-8 | | 8 | | | | 45 | 4 | 4,680 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| C-CER 2008-10 | | 10 | | | | 50 | 4 | 6,840 | 10.90 | 11.33 | 11.71 | 12.11 | 13.02 |
| C-CER 2008-12 | | 12 | | | | 50 | 4 | 7,800 | 12.99 | 13.45 | 13.91 | 14.39 | 15.47 |
| C-CER 2009-4 | 0.9 | 4 | 1.3 | 0.88 | 16° | 45 | 4 | 5,000 | 4.54 | 4.84 | 5.08 | 5.28 | 5.68 |
| C-CER 2009-6 | | 6 | | | | 45 | 4 | 5,400 | 6.68 | 7.03 | 7.30 | 7.56 | 8.13 |
| C-CER 2009-8 | | 8 | | | | 45 | 4 | 5,400 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| C-CER 2009-10 | | 10 | | | | 45 | 4 | 5,400 | 10.90 | 11.33 | 11.71 | 12.11 | 13.02 |
| C-CER 2009-15 | | 15 | | | | 50 | 4 | 8,000 | 16.11 | 16.65 | 17.21 | 17.81 | 19.14 |
| C-CER 2010-4 | 1 | 4 | 1.5 | 0.95 | 16° | 45 | 4 | 4,200 | 4.66 | 4.93 | 5.15 | 5.34 | 5.74 |
| C-CER 2010-6 | | 6 | | | | 45 | 4 | 4,200 | 6.78 | 7.10 | 7.36 | 7.62 | 8.19 |
| C-CER 2010-8 | | 8 | | | | 45 | 4 | 4,200 | 8.88 | 9.25 | 9.56 | 9.90 | 10.64 |
| C-CER 2010-10 | | 10 | | | | 45 | 4 | 4,200 | 10.97 | 11.38 | 11.76 | 12.17 | 13.09 |
| C-CER 2010-12 | | 12 | | | | 45 | 4 | 4,200 | 13.06 | 13.51 | 13.97 | 14.45 | 15.53 |
| C-CER 2010-16 | | 16 | | | | 50 | 4 | 6,840 | 17.20 | 17.77 | 18.37 | 19.01 | 20.43 |
| C-CER 2010-20 | | 20 | | | | 55 | 4 | 6,840 | 21.34 | 22.03 | 22.77 | 23.56 | 25.32 |
| C-CER 2012-6 | 1.2 | 6 | 1.8 | 1.14 | 11° | 45 | 4 | 4,440 | 6.29 | 6.61 | 6.95 | 7.34 | 8.25 |
| C-CER 2012-8 | | 8 | | | | 45 | 4 | 4,440 | 8.39 | 8.80 | 9.26 | 9.78 | 10.99 |
| C-CER 2012-10 | | 10 | | | | 45 | 4 | 4,440 | 10.48 | 11.00 | 11.58 | 12.21 | 13.72 |
| C-CER 2012-12 | | 12 | | | | 45 | 4 | 4,440 | 12.58 | 13.20 | 13.89 | 14.65 | 16.46 |
| C-CER 2012-16 | | 16 | | | | 50 | 4 | 7,080 | 16.76 | 17.59 | 18.51 | 19.53 | 21.94 |
| C-CER 2014-6 | 1.4 | 6 | 2.1 | 1.34 | 11° | 45 | 4 | 4,560 | 6.29 | 6.61 | 6.95 | 7.34 | 8.25 |
| C-CER 2014-8 | | 8 | | | | 45 | 4 | 4,560 | 8.39 | 8.80 | 9.26 | 9.78 | 10.99 |
| C-CER 2014-10 | | 10 | | | | 45 | 4 | 4,560 | 10.48 | 11.00 | 11.58 | 12.21 | 13.72 |
| C-CER 2014-12 | | 12 | | | | 45 | 4 | 4,560 | 12.58 | 13.20 | 13.89 | 14.65 | 16.46 |
| C-CER 2014-14 | | 14 | | | | 45 | 4 | 4,560 | 14.67 | 15.40 | 16.20 | 17.09 | 19.20 |
| C-CER 2014-16 | | 16 | | | | 50 | 4 | 5,280 | 16.76 | 17.59 | 18.51 | 19.53 | 21.94 |
| C-CER 2014-22 | | 22 | | | | 55 | 4 | 7,080 | 23.05 | 24.19 | 25.44 | 26.84 | No Interference |

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Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| C-CER 2015-6 | 1.5 | 6 | 2.3 | 1.44 | 11° | 45 | 4 | 4,440 | 6.29 | 6.61 | 6.95 | 7.34 | 8.25 |
| C-CER 2015-8 | | 8 | | | | 45 | 4 | 4,440 | 8.39 | 8.80 | 9.26 | 9.78 | 10.99 |
| C-CER 2015-10 | | 10 | | | | 45 | 4 | 4,440 | 10.48 | 11.00 | 11.58 | 12.21 | 13.72 |
| C-CER 2015-12 | | 12 | | | | 45 | 4 | 4,440 | 12.58 | 13.20 | 13.89 | 14.65 | 16.46 |
| C-CER 2015-14 | | 14 | | | | 50 | 4 | 4,560 | 14.67 | 15.40 | 16.20 | 17.09 | 19.20 |
| C-CER 2015-16 | | 16 | | | | 50 | 4 | 4,560 | 16.76 | 17.59 | 18.51 | 19.53 | 21.94 |
| C-CER 2015-18 | | 18 | | | | 55 | 4 | 4,560 | 18.86 | 19.79 | 20.82 | 21.97 | No Interference |
| C-CER 2015-20 | | 20 | | | | 55 | 4 | 4,560 | 20.95 | 21.99 | 23.13 | 24.40 | No Interference |
| C-CER 2016-6 | 1.6 | 6 | 2.4 | 1.51 | 11° | 45 | 4 | 4,560 | 6.35 | 6.66 | 7.01 | 7.40 | 8.32 |
| C-CER 2016-8 | | 8 | | | | 45 | 4 | 4,560 | 8.44 | 8.86 | 9.32 | 9.84 | 11.06 |
| C-CER 2016-10 | | 10 | | | | 45 | 4 | 4,560 | 10.54 | 11.06 | 11.64 | 12.28 | 13.79 |
| C-CER 2016-12 | | 12 | | | | 45 | 4 | 4,560 | 12.63 | 13.26 | 13.95 | 14.71 | 16.53 |
| C-CER 2016-14 | | 14 | | | | 50 | 4 | 4,560 | 14.72 | 15.45 | 16.26 | 17.15 | 19.27 |
| C-CER 2016-16 | | 16 | | | | 50 | 4 | 4,560 | 16.82 | 17.65 | 18.57 | 19.59 | 22.01 |
| C-CER 2016-18 | | 18 | | | | 55 | 4 | 4,560 | 18.91 | 19.85 | 20.88 | 22.03 | No Interference |
| C-CER 2016-20 | | 20 | | | | 55 | 4 | 4,560 | 21.01 | 22.05 | 23.19 | 24.47 | No Interference |
| C-CER 2016-26 | | 26 | | | | 60 | 4 | 7,200 | 27.29 | 28.64 | 30.13 | 31.78 | No Interference |
| C-CER 2018-6 | 1.8 | 6 | 2.7 | 1.71 | 11° | 45 | 4 | 4,560 | 6.35 | 6.66 | 7.01 | 7.40 | 8.32 |
| C-CER 2018-8 | | 8 | | | | 45 | 4 | 4,560 | 8.44 | 8.86 | 9.32 | 9.84 | 11.06 |
| C-CER 2018-10 | | 10 | | | | 45 | 4 | 4,560 | 10.54 | 11.06 | 11.64 | 12.28 | 13.79 |
| C-CER 2018-12 | | 12 | | | | 45 | 4 | 4,560 | 12.63 | 13.26 | 13.95 | 14.71 | 16.53 |
| C-CER 2018-14 | | 14 | | | | 50 | 4 | 4,560 | 14.72 | 15.45 | 16.26 | 17.15 | 19.27 |
| C-CER 2018-16 | | 16 | | | | 50 | 4 | 4,560 | 16.82 | 17.65 | 18.57 | 19.59 | No Interference |
| C-CER 2018-18 | | 18 | | | | 55 | 4 | 4,560 | 18.91 | 19.85 | 20.88 | 22.03 | No Interference |
| C-CER 2018-20 | | 20 | | | | 55 | 4 | 4,560 | 21.01 | 22.05 | 23.19 | 24.47 | No Interference |
| C-CER 2018-25 | | 25 | | | | 60 | 4 | 6,240 | 26.24 | 27.54 | 28.97 | 30.56 | No Interference |
| C-CER 2020-6 | 2 | 6 | 3 | 1.91 | 11° | 45 | 4 | 4,440 | 6.35 | 6.66 | 7.01 | 7.40 | 8.32 |
| C-CER 2020-8 | | 8 | | | | 45 | 4 | 4,440 | 8.44 | 8.86 | 9.32 | 9.84 | 11.06 |
| C-CER 2020-10 | | 10 | | | | 45 | 4 | 4,440 | 10.54 | 11.06 | 11.64 | 12.28 | 13.79 |
| C-CER 2020-12 | | 12 | | | | 45 | 4 | 4,440 | 12.63 | 13.26 | 13.95 | 14.71 | 16.53 |
| C-CER 2020-14 | | 14 | | | | 50 | 4 | 4,440 | 14.72 | 15.45 | 16.26 | 17.15 | 19.27 |
| C-CER 2020-16 | | 16 | | | | 50 | 4 | 4,440 | 16.82 | 17.65 | 18.57 | 19.59 | No Interference |
| C-CER 2020-18 | | 18 | | | | 55 | 4 | 4,440 | 18.91 | 19.85 | 20.88 | 22.03 | No Interference |
| C-CER 2020-20 | | 20 | | | | 55 | 4 | 4,440 | 21.01 | 22.05 | 23.19 | 24.47 | No Interference |
| C-CER 2020-25 | | 25 | | | | 60 | 4 | 4,440 | 26.24 | 27.54 | 28.97 | No Interference | No Interference |
| C-CER 2020-30 | | 30 | | | | 70 | 4 | 5,520 | 31.48 | 33.03 | 34.75 | No Interference | No Interference |
| C-CER 2025-8 | 2.5 | 8 | 3.7 | 2.41 | 11° | 45 | 4 | 4,680 | 8.44 | 8.86 | 9.32 | 9.84 | 11.06 |
| C-CER 2025-10 | | 10 | | | | 45 | 4 | 4,680 | 10.54 | 11.06 | 11.64 | 12.28 | 13.79 |
| C-CER 2025-12 | | 12 | | | | 45 | 4 | 4,680 | 12.63 | 13.26 | 13.95 | 14.71 | No Interference |
| C-CER 2025-14 | | 14 | | | | 50 | 4 | 4,680 | 14.72 | 15.45 | 16.26 | 17.15 | No Interference |
| C-CER 2025-16 | | 16 | | | | 50 | 4 | 4,680 | 16.82 | 17.65 | 18.57 | 19.59 | No Interference |
| C-CER 2025-18 | | 18 | | | | 55 | 4 | 4,680 | 18.91 | 19.85 | 20.88 | No Interference | No Interference |
| C-CER 2025-20 | | 20 | | | | 55 | 4 | 4,680 | 21.01 | 22.05 | 23.19 | No Interference | No Interference |
| C-CER 2025-25 | | 25 | | | | 60 | 4 | 5,040 | 26.24 | 27.54 | 28.97 | No Interference | No Interference |
| C-CER 2025-30 | | 30 | | | | 70 | 4 | 5,040 | 31.48 | 33.03 | No Interference | No Interference | No Interference |





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Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| C-CER 2030-8 | 3 | 8 | 4.5 | 2.92 | 11° | 45 | 6 | 6,000 | 8.44 | 8.86 | 9.32 | 9.83 | 11.05 |
| C-CER 2030-10 | | 10 | | | | 45 | 6 | 6,000 | 10.53 | 11.05 | 11.63 | 12.27 | 13.79 |
| C-CER 2030-12 | | 12 | | | | 50 | 6 | 6,000 | 12.62 | 13.25 | 13.94 | 14.71 | 16.53 |
| C-CER 2030-14 | | 14 | | | | 50 | 6 | 6,000 | 14.72 | 15.45 | 16.25 | 17.15 | 19.26 |
| C-CER 2030-16 | | 16 | | | | 60 | 6 | 6,000 | 16.81 | 17.65 | 18.56 | 19.58 | 22.00 |
| C-CER 2030-18 | | 18 | | | | 60 | 6 | 6,000 | 18.91 | 19.84 | 20.88 | 22.02 | 24.74 |
| C-CER 2030-20 | | 20 | | | | 60 | 6 | 6,000 | 21.00 | 22.04 | 23.19 | 24.46 | 27.48 |
| C-CER 2030-25 | | 25 | | | | 70 | 6 | 6,000 | 26.24 | 27.53 | 28.97 | 30.55 | No Interference |
| C-CER 2030-30 | | 30 | | | | 80 | 6 | 7,200 | 31.47 | 33.03 | 34.74 | 36.65 | No Interference |
| C-CER 2030-35 | | 35 | | | | 80 | 6 | 7,440 | 36.71 | 38.52 | 40.52 | 42.74 | No Interference |
| C-CER 2030-40 | | 40 | | | | 90 | 6 | 7,440 | 41.94 | 44.01 | 46.30 | No Interference | No Interference |
| C-CER 2035-12 | 3.5 | 12 | 5 | 3.37 | 11° | 50 | 6 | 8,400 | 12.76 | 13.39 | 14.09 | 14.86 | 16.70 |
| C-CER 2035-15 | | 15 | | | | 60 | 6 | 8,400 | 15.90 | 16.69 | 17.56 | 18.52 | 20.81 |
| C-CER 2035-16 | | 16 | | | | 60 | 6 | 8,400 | 16.95 | 17.79 | 18.71 | 19.74 | 22.18 |
| C-CER 2035-20 | | 20 | | | | 60 | 6 | 8,400 | 21.14 | 22.18 | 23.34 | 24.62 | No Interference |
| C-CER 2035-25 | | 25 | | | | 70 | 6 | 8,400 | 26.37 | 27.67 | 29.11 | 30.71 | No Interference |
| C-CER 2035-30 | | 30 | | | | 70 | 6 | 8,400 | 31.61 | 33.17 | 34.89 | No Interference | No Interference |
| C-CER 2035-35 | | 35 | | | | 80 | 6 | 8,400 | 36.84 | 38.66 | 40.67 | No Interference | No Interference |
| C-CER 2040-12 | 4 | 12 | 6 | 3.82 | 11° | 50 | 6 | 6,960 | 12.89 | 13.53 | 14.24 | 15.02 | 16.88 |
| C-CER 2040-16 | | 16 | | | | 60 | 6 | 6,960 | 17.08 | 17.93 | 18.86 | 19.90 | No Interference |
| C-CER 2040-20 | | 20 | | | | 60 | 6 | 6,960 | 21.27 | 22.32 | 23.48 | 24.77 | No Interference |
| C-CER 2040-25 | | 25 | | | | 70 | 6 | 6,960 | 26.51 | 27.82 | 29.26 | No Interference | No Interference |
| C-CER 2040-30 | | 30 | | | | 70 | 6 | 6,960 | 31.74 | 33.31 | 35.04 | No Interference | No Interference |
| C-CER 2040-35 | | 35 | | | | 80 | 6 | 6,960 | 36.98 | 38.80 | No Interference | No Interference | No Interference |
| C-CER 2040-40 | | 40 | | | | 90 | 6 | 8,760 | 42.21 | 44.30 | No Interference | No Interference | No Interference |
| C-CER 2040-45 | | 45 | | | | 90 | 6 | 10,440 | 47.45 | 49.79 | No Interference | No Interference | No Interference |
| C-CER 2040-50 | | 50 | | | | 100 | 6 | 12,960 | 52.68 | 55.28 | No Interference | No Interference | No Interference |
| C-CER 2050-16 | 5 | 16 | 7.5 | 4.82 | 11° | 60 | 6 | 8,760 | 17.08 | 17.93 | 18.86 | No Interference | No Interference |
| C-CER 2050-20 | | 20 | | | | 60 | 6 | 8,760 | 21.27 | 22.32 | No Interference | No Interference | No Interference |
| C-CER 2050-25 | | 25 | | | | 60 | 6 | 8,760 | 26.51 | 27.82 | No Interference | No Interference | No Interference |
| C-CER 2050-30 | | 30 | | | | 80 | 6 | 8,760 | 31.74 | No Interference | No Interference | No Interference | No Interference |
| C-CER 2050-35 | | 35 | | | | 80 | 6 | 8,760 | 36.98 | No Interference | No Interference | No Interference | No Interference |
| C-CER 2050-40 | | 40 | | | | 80 | 6 | 8,760 | 42.21 | No Interference | No Interference | No Interference | No Interference |
| C-CER 2050-50 | | 50 | | | | 110 | 6 | 13,800 | 52.68 | No Interference | No Interference | No Interference | No Interference |
| C-CER 2060-20 | 6 | 20 | 9 | 5.82 | — | 80 | 6 | 9,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| C-CER 2060-30 | | 30 | | | | 80 | 6 | 9,240 | No Interference | No Interference | No Interference | No Interference | No Interference |
| C-CER 2060-40 | | 40 | | | | 100 | 6 | 10,920 | No Interference | No Interference | No Interference | No Interference | No Interference |
| C-CER 2060-50 | | 50 | | | | 120 | 6 | 13,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| C-CER 2060-60 | | 60 | | | | 120 | 6 | 16,440 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for C-CER

| WORK MATERIAL | | | COPPER OFC / TPC | | | CARBON STEELS S45C / S50C (~225HB) | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | HARDENED STEELS SKD / SKT (45~50HRC) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2001** | **0.1** | 0.3 | 30,000 | 30 | 0.003~0.006 | 30,000 | 30 | 0.003~0.005 | 30,000 | 15 | 0.002~0.005 | 30,000 | 16 | 0.001~0.004 | — | — | — |
| | | 0.5 | 28,000 | 28 | 0.002~0.006 | 28,000 | 28 | 0.002~0.005 | 28,000 | 14 | 0.002~0.004 | 28,000 | 14 | 0.001~0.003 | — | — | — |
| | | 0.75 | 25,500 | 26 | 0.002~0.005 | 25,500 | 26 | 0.002~0.004 | 25,500 | 13 | 0.002~0.003 | 25,500 | 12 | 0.001~0.002 | — | — | — |
| | | 1 | 23,000 | 5 | 0.002~0.004 | 23,000 | 5 | 0.001~0.002 | 23,000 | 5 | 0.001~0.002 | 23,000 | 5 | 0.001 | — | — | — |
| **20015** | **0.15** | 0.5 | 30,000 | 90 | 0.004~0.008 | 30,000 | 90 | 0.004~0.007 | 30,000 | 80 | 0.003~0.006 | 30,000 | 70 | 0.003~0.005 | 30,000 | 50 | 0.003~0.004 |
| | | 0.75 | 28,700 | 90 | 0.003~0.008 | 28,700 | 90 | 0.003~0.007 | 28,700 | 80 | 0.002~0.006 | 28,700 | 70 | 0.002~0.005 | 28,700 | 50 | 0.002~0.004 |
| | | 1 | 27,300 | 80 | 0.002~0.006 | 27,300 | 80 | 0.002~0.006 | 27,300 | 70 | 0.001~0.005 | 27,300 | 60 | 0.001~0.004 | 27,300 | 40 | 0.001~0.003 |
| **2002** | **0.2** | 0.5 | 43,000 | 130 | 0.005~0.011 | 43,000 | 130 | 0.005~0.009 | 41,000 | 110 | 0.004~0.008 | 39,000 | 90 | 0.003~0.006 | 39,000 | 40 | 0.002~0.004 |
| | | 1 | 34,000 | 100 | 0.005~0.01 | 34,000 | 100 | 0.005~0.008 | 32,000 | 80 | 0.004~0.007 | 30,000 | 70 | 0.003~0.006 | 30,000 | 30 | 0.002~0.004 |
| | | 1.5 | 27,000 | 80 | 0.002~0.005 | 27,000 | 80 | 0.002~0.004 | 24,000 | 60 | 0.002~0.003 | 23,000 | 50 | 0.001~0.003 | 23,000 | 20 | 0.001~0.002 |
| | | 2 | 21,900 | 20 | 0.002~0.004 | 21,900 | 20 | 0.001~0.002 | 21,900 | 15 | 0.001~0.002 | 21,900 | 10 | 0.001~0.002 | 21,900 | 10 | 0.001 |
| | | 3 | 16,500 | 10 | 0.001~0.003 | 16,500 | 10 | 0.001~0.002 | 16,500 | 8 | 0.001~0.002 | 16,500 | 5 | 0.001~0.002 | 16,500 | 5 | 0.001 |
| **2003** | **0.3** | 1 | 49,000 | 520 | 0.007~0.016 | 49,000 | 440 | 0.007~0.013 | 49,000 | 390 | 0.007~0.011 | 49,000 | 350 | 0.005~0.009 | 38,000 | 230 | 0.003~0.006 |
| | | 1.5 | 43,000 | 425 | 0.005~0.012 | 43,000 | 360 | 0.005~0.01 | 43,000 | 320 | 0.005~0.008 | 43,000 | 285 | 0.004~0.007 | 37,500 | 210 | 0.002~0.004 |
| | | 2 | 37,000 | 330 | 0.003~0.007 | 37,000 | 280 | 0.003~0.006 | 37,000 | 250 | 0.003~0.005 | 37,000 | 220 | 0.002~0.004 | 37,000 | 190 | 0.001~0.003 |
| | | 3 | 31,000 | 280 | 0.002~0.004 | 31,000 | 240 | 0.002~0.003 | 31,000 | 210 | 0.001~0.003 | 31,000 | 190 | 0.001~0.002 | 31,000 | 160 | 0.001~0.002 |
| **2004** | **0.4** | 2 | 47,000 | 720 | 0.01 ~0.02 | 47,000 | 600 | 0.01 ~0.017 | 47,000 | 560 | 0.009~0.015 | 42,000 | 410 | 0.007~0.012 | 30,000 | 250 | 0.005~0.008 |
| | | 3 | 47,000 | 630 | 0.005~0.01 | 47,000 | 530 | 0.005~0.008 | 47,000 | 470 | 0.004~0.007 | 40,000 | 350 | 0.003~0.006 | 30,000 | 220 | 0.002~0.004 |
| | | 4 | 39,000 | 520 | 0.002~0.005 | 39,000 | 440 | 0.002~0.004 | 37,000 | 370 | 0.002~0.004 | 31,000 | 270 | 0.002~0.003 | 30,000 | 220 | 0.001~0.002 |
| | | 5 | 38,000 | 440 | 0.002~0.005 | 38,000 | 370 | 0.002~0.004 | 32,000 | 280 | 0.002~0.003 | 29,000 | 220 | 0.001~0.003 | 28,000 | 180 | 0.001~0.002 |
| **2005** | **0.5** | 2 | 47,000 | 900 | 0.014~0.028 | 47,000 | 750 | 0.014~0.023 | 43,000 | 610 | 0.012~0.021 | 38,000 | 460 | 0.009~0.016 | 25,000 | 260 | 0.004~0.007 |
| | | 4 | 43,000 | 750 | 0.008~0.017 | 43,000 | 630 | 0.008~0.014 | 40,000 | 520 | 0.007~0.013 | 28,000 | 320 | 0.006~0.01 | 24,000 | 230 | 0.002~0.004 |
| | | 6 | 31,000 | 460 | 0.004~0.008 | 31,000 | 390 | 0.004~0.007 | 26,000 | 290 | 0.003~0.006 | 24,000 | 230 | 0.002~0.004 | 23,000 | 190 | 0.002~0.003 |
| | | 8 | 25,000 | 360 | 0.002~0.004 | 25,000 | 300 | 0.002~0.003 | 21,000 | 220 | 0.001~0.003 | 19,000 | 180 | 0.001~0.002 | 18,000 | 140 | 0.001~0.002 |
| **2006** | **0.6** | 2 | 46,000 | 1,050 | 0.018~0.036 | 46,000 | 880 | 0.018~0.03 | 40,000 | 670 | 0.016~0.027 | 32,000 | 470 | 0.012~0.021 | 21,000 | 270 | 0.009~0.015 |
| | | 4 | 41,000 | 790 | 0.01 ~0.02 | 41,000 | 660 | 0.01 ~0.017 | 34,000 | 520 | 0.009~0.016 | 27,000 | 360 | 0.007~0.012 | 20,000 | 230 | 0.005~0.008 |
| | | 6 | 31,000 | 600 | 0.005~0.011 | 31,000 | 500 | 0.005~0.009 | 26,000 | 370 | 0.005~0.008 | 21,000 | 260 | 0.003~0.006 | 20,000 | 210 | 0.002~0.004 |
| | | 8 | 23,000 | 360 | 0.002~0.005 | 23,000 | 300 | 0.002~0.004 | 19,000 | 220 | 0.002~0.003 | 18,000 | 180 | 0.001~0.002 | 16,000 | 140 | 0.001~0.002 |
| | | 10 | 21,000 | 330 | 0.002~0.005 | 21,000 | 280 | 0.002~0.004 | 17,000 | 200 | 0.002~0.003 | 16,000 | 160 | 0.001~0.002 | 15,000 | 130 | 0.001~0.002 |

## Milling Conditions for C-CER

| WORK MATERIAL | | | COPPER OFC / TPC | | | CARBON STEELS S45C / S50C (~225HB) | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | HARDENED STEELS SKD / SKT (45~50HRC) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| 2007 | 0.7 | 2 | 40,000 | 1,050 | 0.026~0.053 | 40,000 | 880 | 0.026~0.044 | 34,000 | 670 | 0.023~0.039 | 27,000 | 480 | 0.018~0.03 | 18,000 | 270 | 0.013~0.022 |
| | | 3 | 40,000 | 1,050 | 0.022~0.044 | 40,000 | 880 | 0.022~0.037 | 34,000 | 670 | 0.02 ~0.033 | 27,000 | 470 | 0.015~0.026 | 18,000 | 270 | 0.011~0.018 |
| | | 4 | 35,000 | 810 | 0.012~0.024 | 35,000 | 680 | 0.012~0.02 | 29,000 | 510 | 0.01 ~0.018 | 23,000 | 350 | 0.008~0.014 | 17,000 | 230 | 0.006~0.01 |
| | | 6 | 27,000 | 620 | 0.006~0.013 | 27,000 | 520 | 0.006~0.011 | 22,000 | 380 | 0.005~0.009 | 18,000 | 270 | 0.004~0.007 | 17,000 | 220 | 0.003~0.005 |
| | | 8 | 22,000 | 460 | 0.005~0.011 | 22,000 | 390 | 0.005~0.009 | 18,000 | 290 | 0.005~0.008 | 17,000 | 240 | 0.003~0.006 | 16,000 | 190 | 0.002~0.004 |
| | | 10 | 20,000 | 360 | 0.002~0.005 | 20,000 | 300 | 0.002~0.004 | 16,000 | 220 | 0.002~0.004 | 15,000 | 180 | 0.001~0.003 | 14,000 | 140 | 0.001~0.002 |
| 2008 | 0.8 | 4 | 35,000 | 1,050 | 0.027~0.054 | 35,000 | 880 | 0.027~0.045 | 30,000 | 670 | 0.024~0.04 | 24,000 | 470 | 0.019~0.031 | 16,000 | 270 | 0.013~0.022 |
| | | 6 | 31,000 | 820 | 0.013~0.028 | 31,000 | 690 | 0.013~0.023 | 25,000 | 510 | 0.012~0.02 | 20,000 | 350 | 0.009~0.016 | 15,000 | 220 | 0.006~0.011 |
| | | 8 | 23,000 | 630 | 0.007~0.014 | 23,000 | 530 | 0.007~0.012 | 19,000 | 390 | 0.006~0.011 | 15,000 | 270 | 0.005~0.008 | 15,000 | 220 | 0.003~0.006 |
| | | 10 | 19,000 | 450 | 0.006~0.012 | 19,000 | 380 | 0.006~0.01 | 16,000 | 280 | 0.005~0.009 | 15,000 | 230 | 0.004~0.007 | 14,000 | 180 | 0.003~0.005 |
| | | 12 | 17,000 | 360 | 0.003~0.006 | 17,000 | 300 | 0.003~0.005 | 14,000 | 220 | 0.002~0.004 | 13,000 | 180 | 0.002~0.003 | 12,000 | 140 | 0.001~0.002 |
| 2009 | 0.9 | 4 | 31,000 | 1,090 | 0.028~0.058 | 31,000 | 910 | 0.028~0.048 | 26,000 | 690 | 0.026~0.043 | 21,000 | 480 | 0.02 ~0.033 | 14,000 | 270 | 0.014~0.024 |
| | | 6 | 27,000 | 840 | 0.014~0.029 | 27,000 | 700 | 0.014~0.024 | 22,000 | 510 | 0.013~0.022 | 18,000 | 360 | 0.01 ~0.017 | 13,000 | 230 | 0.007~0.012 |
| | | 8 | 21,000 | 640 | 0.008~0.016 | 21,000 | 540 | 0.008~0.013 | 17,000 | 400 | 0.007~0.012 | 14,000 | 280 | 0.005~0.009 | 13,000 | 230 | 0.004~0.006 |
| | | 10 | 17,000 | 460 | 0.006~0.013 | 17,000 | 390 | 0.006~0.011 | 14,000 | 290 | 0.006~0.01 | 13,000 | 230 | 0.004~0.007 | 12,000 | 190 | 0.003~0.005 |
| | | 15 | 11,000 | 320 | 0.003~0.006 | 11,000 | 270 | 0.003~0.005 | 13,000 | 200 | 0.003~0.005 | 12,000 | 160 | 0.002~0.003 | 11,000 | 130 | 0.001~0.002 |
| 2010 | 1 | 4 | 28,000 | 1,120 | 0.03 ~0.06 | 28,000 | 940 | 0.03 ~0.05 | 23,000 | 710 | 0.027~0.045 | 19,000 | 490 | 0.021~0.035 | 12,700 | 280 | 0.015~0.025 |
| | | 6 | 24,000 | 850 | 0.015~0.03 | 24,000 | 710 | 0.015~0.025 | 20,000 | 520 | 0.013~0.023 | 16,000 | 360 | 0.01 ~0.017 | 12,000 | 230 | 0.007~0.012 |
| | | 8 | 24,000 | 850 | 0.015~0.03 | 24,000 | 710 | 0.015~0.025 | 20,000 | 520 | 0.013~0.023 | 16,000 | 360 | 0.01 ~0.017 | 12,000 | 230 | 0.007~0.012 |
| | | 10 | 19,000 | 640 | 0.008~0.017 | 19,000 | 540 | 0.008~0.014 | 15,000 | 400 | 0.007~0.012 | 12,000 | 280 | 0.005~0.009 | 12,000 | 230 | 0.004~0.007 |
| | | 12 | 15,000 | 460 | 0.007~0.014 | 15,000 | 390 | 0.007~0.012 | 13,000 | 290 | 0.006~0.01 | 12,000 | 230 | 0.005~0.008 | 11,400 | 190 | 0.003~0.006 |
| | | 16 | 12,000 | 360 | 0.003~0.007 | 12,000 | 300 | 0.003~0.006 | 10,500 | 220 | 0.003~0.005 | 9,700 | 180 | 0.002~0.004 | 9,100 | 140 | 0.001~0.003 |
| | | 20 | 10,000 | 320 | 0.003~0.007 | 10,000 | 270 | 0.003~0.006 | 8,400 | 200 | 0.003~0.005 | 7,700 | 160 | 0.002~0.004 | 7,300 | 130 | 0.001~0.003 |
| 2012 | 1.2 | 6 | 23,000 | 1,050 | 0.036~0.072 | 23,000 | 880 | 0.036~0.06 | 20,000 | 670 | 0.032~0.054 | 16,000 | 470 | 0.025~0.042 | 10,000 | 260 | 0.018~0.03 |
| | | 8 | 20,000 | 820 | 0.018~0.036 | 20,000 | 690 | 0.018~0.03 | 16,000 | 500 | 0.016~0.027 | 13,000 | 350 | 0.012~0.021 | 10,000 | 220 | 0.009~0.015 |
| | | 10 | 15,000 | 630 | 0.01 ~0.019 | 15,000 | 530 | 0.01 ~0.016 | 13,000 | 390 | 0.009~0.015 | 10,600 | 270 | 0.007~0.011 | 10,000 | 220 | 0.005~0.008 |
| | | 12 | 15,000 | 630 | 0.01 ~0.019 | 15,000 | 530 | 0.01 ~0.016 | 13,000 | 390 | 0.009~0.015 | 10,600 | 270 | 0.007~0.011 | 10,000 | 220 | 0.005~0.008 |
| | | 16 | 11,000 | 320 | 0.004~0.008 | 11,000 | 270 | 0.004~0.007 | 9,000 | 200 | 0.003~0.006 | 9,000 | 160 | 0.003~0.005 | 8,400 | 130 | 0.002~0.003 |

## Milling Conditions for C-CER

| WORK MATERIAL | | | COPPER OFC / TPC | | | CARBON STEELS S45C / S50C (~225HB) | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | HARDENED STEELS SKD / SKT (45~50HRC) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| 2014 | 1.4 | 6 | 20,000 | 1,000 | 0.042~0.084 | 20,000 | 840 | 0.042~0.07 | 17,000 | 640 | 0.038~0.063 | 13,000 | 440 | 0.029~0.049 | 9,000 | 250 | 0.021~0.035 |
| | | 8 | 17,000 | 790 | 0.021~0.042 | 17,000 | 660 | 0.021~0.035 | 14,000 | 480 | 0.019~0.032 | 11,500 | 330 | 0.015~0.025 | 8,600 | 210 | 0.01 ~0.017 |
| | | 10 | 17,000 | 790 | 0.021~0.042 | 17,000 | 660 | 0.021~0.035 | 14,000 | 480 | 0.019~0.032 | 11,500 | 330 | 0.015~0.025 | 8,600 | 210 | 0.01 ~0.017 |
| | | 12 | 13,000 | 620 | 0.011~0.023 | 13,000 | 520 | 0.011~0.019 | 11,000 | 380 | 0.01 ~0.017 | 9,000 | 270 | 0.008~0.013 | 8,600 | 220 | 0.005~0.009 |
| | | 14 | 13,000 | 620 | 0.011~0.023 | 13,000 | 520 | 0.011~0.019 | 11,000 | 380 | 0.01 ~0.017 | 9,000 | 270 | 0.008~0.013 | 8,600 | 220 | 0.005~0.009 |
| | | 16 | 11,000 | 430 | 0.01 ~0.02 | 11,000 | 360 | 0.01 ~0.017 | 9,000 | 270 | 0.009~0.015 | 8,000 | 220 | 0.007~0.011 | 8,100 | 180 | 0.005~0.008 |
| | | 22 | 10,000 | 310 | 0.005~0.01 | 10,000 | 260 | 0.005~0.008 | 8,000 | 190 | 0.004~0.007 | 7,000 | 150 | 0.003~0.005 | 7,200 | 120 | 0.002~0.004 |
| 2015 | 1.5 | 6 | 18,000 | 1,030 | 0.045~0.09 | 18,000 | 860 | 0.045~0.075 | 15,000 | 650 | 0.04 ~0.068 | 12,000 | 460 | 0.031~0.052 | 8,400 | 260 | 0.022~0.037 |
| | | 8 | 16,000 | 810 | 0.023~0.046 | 16,000 | 680 | 0.023~0.038 | 13,000 | 500 | 0.02 ~0.034 | 10,000 | 340 | 0.016~0.026 | 8,000 | 220 | 0.011~0.019 |
| | | 10 | 16,000 | 810 | 0.023~0.046 | 16,000 | 680 | 0.023~0.038 | 13,000 | 500 | 0.02 ~0.034 | 10,000 | 340 | 0.016~0.026 | 8,000 | 220 | 0.011~0.019 |
| | | 12 | 16,000 | 810 | 0.023~0.046 | 16,000 | 680 | 0.023~0.038 | 13,000 | 500 | 0.02 ~0.034 | 10,000 | 340 | 0.016~0.026 | 8,000 | 220 | 0.011~0.019 |
| | | 14 | 12,700 | 620 | 0.012~0.025 | 12,700 | 520 | 0.012~0.021 | 10,600 | 390 | 0.011~0.018 | 8,400 | 270 | 0.008~0.014 | 8,000 | 220 | 0.006~0.01 |
| | | 16 | 10,300 | 450 | 0.01 ~0.022 | 10,300 | 380 | 0.01 ~0.018 | 8,600 | 280 | 0.009~0.016 | 8,000 | 230 | 0.007~0.012 | 7,600 | 180 | 0.005~0.009 |
| | | 18 | 10,300 | 450 | 0.01 ~0.022 | 10,300 | 380 | 0.01 ~0.018 | 8,600 | 280 | 0.009~0.016 | 8,000 | 230 | 0.007~0.012 | 7,600 | 180 | 0.005~0.009 |
| | | 20 | 9,000 | 320 | 0.005~0.011 | 9,000 | 270 | 0.005~0.009 | 7,000 | 200 | 0.004~0.008 | 7,200 | 160 | 0.003~0.006 | 6,700 | 130 | 0.002~0.004 |
| 2016 | 1.6 | 6 | 17,000 | 1,050 | 0.048~0.096 | 17,000 | 880 | 0.048~0.08 | 14,000 | 670 | 0.043~0.072 | 11,900 | 470 | 0.033~0.056 | 7,900 | 260 | 0.024~0.04 |
| | | 8 | 17,000 | 1,050 | 0.048~0.096 | 17,000 | 880 | 0.048~0.08 | 14,000 | 670 | 0.043~0.072 | 11,900 | 470 | 0.033~0.056 | 7,900 | 260 | 0.024~0.04 |
| | | 10 | 15,000 | 820 | 0.024~0.048 | 15,000 | 690 | 0.024~0.04 | 12,700 | 500 | 0.022~0.036 | 10,100 | 350 | 0.017~0.028 | 7,500 | 220 | 0.012~0.02 |
| | | 12 | 15,000 | 820 | 0.024~0.048 | 15,000 | 690 | 0.024~0.04 | 12,700 | 500 | 0.022~0.036 | 10,100 | 350 | 0.017~0.028 | 7,500 | 220 | 0.012~0.02 |
| | | 14 | 11,900 | 630 | 0.013~0.026 | 11,900 | 530 | 0.013~0.022 | 9,900 | 390 | 0.012~0.02 | 7,900 | 270 | 0.009~0.015 | 7,500 | 220 | 0.006~0.011 |
| | | 16 | 11,900 | 630 | 0.013~0.026 | 11,900 | 530 | 0.013~0.022 | 9,900 | 390 | 0.012~0.02 | 7,900 | 270 | 0.009~0.015 | 7,500 | 220 | 0.006~0.011 |
| | | 18 | 9,700 | 460 | 0.011~0.023 | 9,700 | 390 | 0.011~0.019 | 8,100 | 290 | 0.01 ~0.017 | 7,500 | 230 | 0.008~0.013 | 7,100 | 190 | 0.005~0.009 |
| | | 20 | 9,000 | 450 | 0.011~0.023 | 9,000 | 380 | 0.011~0.019 | 8,100 | 280 | 0.01 ~0.017 | 7,500 | 230 | 0.008~0.013 | 7,100 | 180 | 0.005~0.009 |
| | | 26 | 8,000 | 280 | 0.005~0.011 | 8,000 | 240 | 0.005~0.009 | 7,300 | 180 | 0.005~0.008 | 6,700 | 140 | 0.004~0.006 | 6,300 | 120 | 0.002~0.004 |
| 2018 | 1.8 | 6 | 15,000 | 1,030 | 0.051~0.102 | 15,000 | 860 | 0.051~0.085 | 13,200 | 650 | 0.045~0.076 | 10,600 | 460 | 0.035~0.059 | 7,000 | 260 | 0.025~0.042 |
| | | 8 | 15,000 | 1,030 | 0.051~0.102 | 15,000 | 860 | 0.051~0.085 | 13,200 | 650 | 0.045~0.076 | 10,600 | 460 | 0.035~0.059 | 7,000 | 260 | 0.025~0.042 |
| | | 10 | 13,700 | 810 | 0.027~0.055 | 13,700 | 680 | 0.027~0.046 | 11,400 | 500 | 0.024~0.041 | 9,000 | 340 | 0.019~0.032 | 6,700 | 220 | 0.013~0.023 |
| | | 12 | 13,700 | 810 | 0.027~0.055 | 13,700 | 680 | 0.027~0.046 | 11,400 | 500 | 0.024~0.041 | 9,000 | 340 | 0.019~0.032 | 6,700 | 220 | 0.013~0.023 |
| | | 14 | 13,700 | 810 | 0.027~0.055 | 13,700 | 680 | 0.027~0.046 | 11,400 | 500 | 0.024~0.041 | 9,000 | 340 | 0.019~0.032 | 6,700 | 220 | 0.013~0.023 |
| | | 16 | 10,600 | 620 | 0.015~0.03 | 10,600 | 520 | 0.015~0.025 | 8,800 | 380 | 0.013~0.022 | 7,000 | 270 | 0.01 ~0.017 | 6,700 | 220 | 0.007~0.012 |
| | | 18 | 10,600 | 620 | 0.015~0.03 | 10,600 | 520 | 0.015~0.025 | 8,800 | 380 | 0.013~0.022 | 7,000 | 270 | 0.01 ~0.017 | 6,700 | 220 | 0.007~0.012 |
| | | 20 | 8,600 | 450 | 0.012~0.024 | 8,600 | 380 | 0.012~0.02 | 7,200 | 280 | 0.01 ~0.018 | 6,700 | 230 | 0.008~0.014 | 6,300 | 180 | 0.006~0.01 |
| | | 25 | 7,700 | 310 | 0.006~0.012 | 7,700 | 260 | 0.006~0.01 | 6,500 | 200 | 0.005~0.009 | 6,000 | 160 | 0.004~0.007 | 5,600 | 130 | 0.003~0.005 |

## Milling Conditions for C-CER

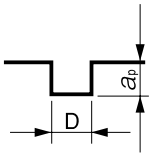
| WORK MATERIAL | | | COPPER OFC / TPC | | | CARBON STEELS S45C / S50C (~225HB) | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | HARDENED STEELS SKD / SKT (45~50HRC) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| 2020 | 2 | 6 | 14,000 | 1,080 | 0.058~0.118 | 14,000 | 900 | 0.058~0.098 | 12,000 | 680 | 0.052~0.088 | 9,600 | 480 | 0.041~0.068 | 6,400 | 270 | 0.029~0.049 |
| | | 8 | 14,000 | 1,020 | 0.052~0.106 | 14,000 | 850 | 0.052~0.088 | 12,000 | 650 | 0.047~0.079 | 9,600 | 450 | 0.037~0.061 | 6,400 | 260 | 0.026~0.044 |
| | | 10 | 14,000 | 1,020 | 0.052~0.106 | 14,000 | 850 | 0.052~0.088 | 12,000 | 650 | 0.047~0.079 | 9,600 | 450 | 0.037~0.061 | 6,400 | 260 | 0.026~0.044 |
| | | 12 | 12,300 | 790 | 0.026~0.053 | 12,300 | 660 | 0.026~0.044 | 10,400 | 500 | 0.024~0.04 | 8,100 | 340 | 0.018~0.031 | 6,000 | 220 | 0.013~0.022 |
| | | 14 | 12,300 | 790 | 0.026~0.053 | 12,300 | 660 | 0.026~0.044 | 10,400 | 500 | 0.024~0.04 | 8,100 | 340 | 0.018~0.031 | 6,000 | 220 | 0.013~0.022 |
| | | 16 | 12,300 | 790 | 0.026~0.053 | 12,300 | 660 | 0.026~0.044 | 10,400 | 500 | 0.024~0.04 | 8,100 | 340 | 0.018~0.031 | 6,000 | 220 | 0.013~0.022 |
| | | 18 | 9,500 | 610 | 0.014~0.029 | 9,500 | 510 | 0.014~0.024 | 7,900 | 380 | 0.013~0.022 | 6,300 | 270 | 0.01 ~0.017 | 6,000 | 220 | 0.007~0.012 |
| | | 20 | 9,500 | 610 | 0.014~0.029 | 9,500 | 510 | 0.014~0.024 | 7,900 | 380 | 0.013~0.022 | 6,300 | 270 | 0.01 ~0.017 | 6,000 | 220 | 0.007~0.012 |
| | | 25 | 7,700 | 430 | 0.012~0.025 | 7,700 | 360 | 0.012~0.021 | 6,400 | 270 | 0.011~0.018 | 6,000 | 220 | 0.008~0.014 | 5,700 | 180 | 0.006~0.01 |
| | | 30 | 7,000 | 310 | 0.006~0.012 | 7,000 | 260 | 0.006~0.01 | 5,800 | 190 | 0.005~0.009 | 5,400 | 150 | 0.004~0.007 | 5,000 | 120 | 0.003~0.005 |
| 2025 | 2.5 | 8 | 10,800 | 1,390 | 0.066~0.132 | 10,800 | 1,160 | 0.066~0.11 | 9,100 | 880 | 0.059~0.099 | 7,600 | 640 | 0.046~0.077 | 5,100 | 360 | 0.033~0.055 |
| | | 10 | 10,800 | 1,390 | 0.066~0.132 | 10,800 | 1,160 | 0.066~0.11 | 9,100 | 880 | 0.059~0.099 | 7,600 | 640 | 0.046~0.077 | 5,100 | 360 | 0.033~0.055 |
| | | 12 | 10,800 | 1,390 | 0.066~0.132 | 10,800 | 1,160 | 0.066~0.11 | 9,100 | 880 | 0.059~0.099 | 7,600 | 640 | 0.046~0.077 | 5,100 | 360 | 0.033~0.055 |
| | | 14 | 9,500 | 1,090 | 0.033~0.067 | 9,500 | 910 | 0.033~0.056 | 8,000 | 680 | 0.03 ~0.05 | 6,500 | 490 | 0.023~0.039 | 4,800 | 310 | 0.016~0.028 |
| | | 16 | 9,500 | 1,090 | 0.033~0.067 | 9,500 | 910 | 0.033~0.056 | 8,000 | 680 | 0.03 ~0.05 | 6,500 | 490 | 0.023~0.039 | 4,800 | 310 | 0.016~0.028 |
| | | 18 | 9,500 | 1,090 | 0.033~0.067 | 9,500 | 910 | 0.033~0.056 | 8,000 | 680 | 0.03 ~0.05 | 6,500 | 490 | 0.023~0.039 | 4,800 | 310 | 0.016~0.028 |
| | | 20 | 9,500 | 1,090 | 0.033~0.067 | 9,500 | 910 | 0.033~0.056 | 8,000 | 680 | 0.03 ~0.05 | 6,500 | 490 | 0.023~0.039 | 4,800 | 310 | 0.016~0.028 |
| | | 25 | 7,600 | 820 | 0.018~0.036 | 7,600 | 690 | 0.018~0.03 | 6,300 | 510 | 0.016~0.027 | 5,000 | 360 | 0.012~0.021 | 4,800 | 290 | 0.009~0.015 |
| | | 30 | 6,200 | 480 | 0.014~0.029 | 6,200 | 400 | 0.014~0.024 | 5,200 | 300 | 0.013~0.022 | 4,800 | 240 | 0.01 ~0.017 | 4,500 | 200 | 0.007~0.012 |
| 2030 | 3 | 8 | 8,700 | 1,580 | 0.088~0.176 | 8,700 | 1,320 | 0.088~0.147 | 7,300 | 990 | 0.079~0.132 | 5,900 | 700 | 0.055~0.092 | 4,200 | 420 | 0.044~0.073 |
| | | 10 | 8,700 | 1,500 | 0.079~0.158 | 8,700 | 1,250 | 0.079~0.132 | 7,300 | 940 | 0.071~0.119 | 5,900 | 660 | 0.055~0.092 | 4,200 | 400 | 0.039~0.066 |
| | | 12 | 8,700 | 1,500 | 0.079~0.158 | 8,700 | 1,250 | 0.079~0.132 | 7,300 | 940 | 0.071~0.119 | 5,900 | 660 | 0.055~0.092 | 4,200 | 400 | 0.039~0.066 |
| | | 14 | 8,700 | 1,500 | 0.079~0.158 | 8,700 | 1,250 | 0.079~0.132 | 7,300 | 940 | 0.071~0.119 | 5,900 | 660 | 0.055~0.092 | 4,200 | 400 | 0.039~0.066 |
| | | 16 | 7,600 | 1,160 | 0.04 ~0.08 | 7,600 | 970 | 0.04 ~0.067 | 6,300 | 720 | 0.036~0.06 | 5,000 | 500 | 0.028~0.047 | 3,900 | 340 | 0.02 ~0.033 |
| | | 18 | 7,600 | 1,160 | 0.04 ~0.08 | 7,600 | 970 | 0.04 ~0.067 | 6,300 | 720 | 0.036~0.06 | 5,000 | 500 | 0.028~0.047 | 3,900 | 340 | 0.02 ~0.033 |
| | | 20 | 7,600 | 1,160 | 0.04 ~0.08 | 7,600 | 970 | 0.04 ~0.067 | 6,300 | 720 | 0.036~0.06 | 5,000 | 500 | 0.028~0.047 | 3,900 | 340 | 0.02 ~0.033 |
| | | 25 | 6,300 | 970 | 0.022~0.043 | 6,300 | 810 | 0.022~0.036 | 5,300 | 600 | 0.019~0.033 | 4,200 | 420 | 0.015~0.025 | 3,900 | 340 | 0.011~0.018 |
| | | 30 | 6,300 | 970 | 0.022~0.043 | 6,300 | 810 | 0.022~0.036 | 5,300 | 600 | 0.019~0.033 | 4,200 | 420 | 0.015~0.025 | 3,900 | 340 | 0.011~0.018 |
| | | 35 | 5,100 | 490 | 0.017~0.035 | 5,100 | 410 | 0.017~0.029 | 4,300 | 300 | 0.016~0.026 | 4,000 | 240 | 0.012~0.02 | 3,800 | 200 | 0.008~0.014 |
| | | 40 | 4,600 | 310 | 0.007~0.014 | 4,600 | 260 | 0.007~0.012 | 3,900 | 200 | 0.006~0.01 | 3,600 | 160 | 0.005~0.008 | 3,300 | 130 | 0.003~0.006 |

## Milling Conditions for C-CER

| WORK MATERIAL | | | COPPER OFC / TPC | | | CARBON STEELS S45C / S50C (~225HB) | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | HARDENED STEELS SKD / SKT (45~50HRC) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| 2035 | 3.5 | 12 | 7,100 | 1,280 | 0.092~0.185 | 7,100 | 1,070 | 0.092~0.154 | 6,000 | 790 | 0.083~0.138 | 4,800 | 560 | 0.064~0.108 | 3,300 | 330 | 0.046~0.077 |
| | | 15 | 7,100 | 1,280 | 0.092~0.185 | 7,100 | 1,070 | 0.092~0.154 | 6,000 | 790 | 0.083~0.138 | 4,800 | 560 | 0.064~0.108 | 3,300 | 330 | 0.046~0.077 |
| | | 16 | 7,100 | 1,280 | 0.092~0.185 | 7,100 | 1,070 | 0.092~0.154 | 6,000 | 790 | 0.083~0.138 | 4,800 | 560 | 0.064~0.108 | 3,300 | 330 | 0.046~0.077 |
| | | 20 | 6,200 | 990 | 0.043~0.086 | 6,200 | 830 | 0.043~0.072 | 5,100 | 610 | 0.039~0.065 | 4,000 | 420 | 0.03 ~0.05 | 3,100 | 280 | 0.021~0.036 |
| | | 25 | 6,200 | 990 | 0.043~0.086 | 6,200 | 830 | 0.043~0.072 | 5,100 | 610 | 0.039~0.065 | 4,000 | 420 | 0.03 ~0.05 | 3,100 | 280 | 0.021~0.036 |
| | | 30 | 5,000 | 800 | 0.025~0.05 | 5,000 | 670 | 0.025~0.042 | 4,200 | 500 | 0.023~0.038 | 3,300 | 340 | 0.018~0.03 | 3,100 | 280 | 0.012~0.021 |
| | | 35 | 5,000 | 800 | 0.025~0.05 | 5,000 | 670 | 0.025~0.042 | 4,200 | 500 | 0.023~0.038 | 3,300 | 340 | 0.018~0.03 | 3,100 | 280 | 0.012~0.021 |
| 2040 | 4 | 12 | 6,000 | 1,170 | 0.1 ~0.202 | 6,000 | 980 | 0.1 ~0.168 | 5,000 | 720 | 0.09 ~0.151 | 3,900 | 500 | 0.07 ~0.117 | 2,700 | 290 | 0.05 ~0.084 |
| | | 16 | 6,000 | 1,110 | 0.09 ~0.181 | 6,000 | 930 | 0.09 ~0.151 | 5,000 | 690 | 0.081~0.136 | 3,900 | 480 | 0.063~0.105 | 2,700 | 280 | 0.045~0.075 |
| | | 20 | 6,000 | 1,110 | 0.09 ~0.181 | 6,000 | 930 | 0.09 ~0.151 | 5,000 | 690 | 0.081~0.136 | 3,900 | 480 | 0.063~0.105 | 2,700 | 280 | 0.045~0.075 |
| | | 25 | 5,200 | 860 | 0.046~0.091 | 5,200 | 720 | 0.046~0.076 | 4,200 | 520 | 0.041~0.069 | 3,300 | 350 | 0.032~0.053 | 2,500 | 230 | 0.023~0.038 |
| | | 30 | 5,200 | 860 | 0.046~0.091 | 5,200 | 720 | 0.046~0.076 | 4,200 | 520 | 0.041~0.069 | 3,300 | 350 | 0.032~0.053 | 2,500 | 230 | 0.023~0.038 |
| | | 35 | 4,200 | 660 | 0.025~0.05 | 4,200 | 550 | 0.025~0.042 | 3,500 | 400 | 0.022~0.037 | 2,700 | 270 | 0.017~0.029 | 2,500 | 220 | 0.012~0.021 |
| | | 40 | 4,200 | 660 | 0.025~0.05 | 4,200 | 550 | 0.025~0.042 | 3,500 | 400 | 0.022~0.037 | 2,700 | 270 | 0.017~0.029 | 2,500 | 220 | 0.012~0.021 |
| | | 45 | 3,400 | 430 | 0.018~0.037 | 3,400 | 360 | 0.018~0.031 | 2,800 | 270 | 0.016~0.028 | 2,500 | 210 | 0.013~0.021 | 2,300 | 160 | 0.009~0.015 |
| | | 50 | 3,400 | 380 | 0.018~0.037 | 3,400 | 320 | 0.018~0.031 | 2,800 | 240 | 0.016~0.028 | 2,500 | 190 | 0.013~0.021 | 2,300 | 140 | 0.009~0.015 |
| 2050 | 5 | 16 | 4,400 | 870 | 0.113~0.227 | 4,400 | 730 | 0.113~0.189 | 3,600 | 530 | 0.102~0.17 | 2,800 | 360 | 0.079~0.132 | 1,700 | 190 | 0.056~0.094 |
| | | 20 | 4,400 | 870 | 0.113~0.227 | 4,400 | 730 | 0.113~0.189 | 3,600 | 530 | 0.102~0.17 | 2,800 | 360 | 0.079~0.132 | 1,700 | 190 | 0.056~0.094 |
| | | 25 | 4,400 | 870 | 0.113~0.227 | 4,400 | 730 | 0.113~0.189 | 3,600 | 530 | 0.102~0.17 | 2,800 | 360 | 0.079~0.132 | 1,700 | 190 | 0.056~0.094 |
| | | 30 | 3,800 | 630 | 0.057~0.115 | 3,800 | 530 | 0.057~0.096 | 3,000 | 380 | 0.051~0.086 | 2,200 | 240 | 0.04 ~0.067 | 1,600 | 150 | 0.028~0.048 |
| | | 35 | 3,800 | 630 | 0.057~0.115 | 3,800 | 530 | 0.057~0.096 | 3,000 | 380 | 0.051~0.086 | 2,200 | 240 | 0.04 ~0.067 | 1,600 | 150 | 0.028~0.048 |
| | | 40 | 3,800 | 630 | 0.057~0.115 | 3,800 | 530 | 0.057~0.096 | 3,000 | 380 | 0.051~0.086 | 2,200 | 240 | 0.022~0.036 | 1,600 | 150 | 0.028~0.048 |
| | | 50 | 2,900 | 460 | 0.031~0.062 | 2,900 | 390 | 0.031~0.052 | 2,400 | 280 | 0.028~0.047 | 1,700 | 180 | 0.022~0.036 | 1,600 | 140 | 0.015~0.026 |
| 2060 | 6 | 20 | 3,300 | 670 | 0.113~0.227 | 3,300 | 560 | 0.113~0.189 | 2,700 | 400 | 0.102~0.17 | 2,000 | 260 | 0.079~0.132 | 1,100 | 130 | 0.056~0.094 |
| | | 30 | 3,300 | 670 | 0.113~0.227 | 3,300 | 560 | 0.113~0.189 | 2,700 | 400 | 0.102~0.17 | 2,000 | 260 | 0.079~0.132 | 1,100 | 130 | 0.056~0.094 |
| | | 40 | 2,800 | 480 | 0.057~0.115 | 2,800 | 400 | 0.057~0.096 | 2,200 | 270 | 0.051~0.086 | 1,500 | 170 | 0.04 ~0.067 | 1,000 | 100 | 0.028~0.048 |
| | | 50 | 2,100 | 330 | 0.031~0.062 | 2,100 | 280 | 0.031~0.052 | 1,600 | 200 | 0.028~0.047 | 1,100 | 120 | 0.022~0.036 | 1,000 | 90 | 0.015~0.026 |
| | | 60 | 2,100 | 330 | 0.031~0.062 | 2,100 | 280 | 0.031~0.052 | 1,600 | 200 | 0.028~0.047 | 1,100 | 120 | 0.022~0.036 | 1,000 | 90 | 0.015~0.026 |

Slotting

$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)




Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

## Size φ0.4～φ6

# DCLS

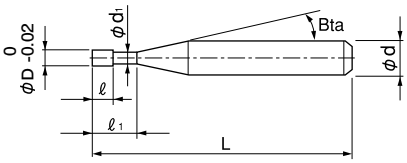
MG DIA 30° Sharp Corner Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

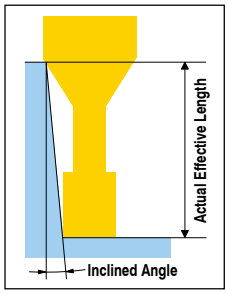
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |

## Features

**2 Flute Diamond coated Long Neck Square End Mills for milling Graphite Electrodes.**
**New diamond coating, with a highly adhesive base layer,**
**offers excellent wear resistance and long tool life.**




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




Neck diameter have been changed.
Change Date: From Production in November, 2012

Total 45 models

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30' | 1° | 1° 30' | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DCLS 2004-020 | 0.4 | 2 | 0.8 | 0.37 | 16° | 45 | 4 | 16,000 | 2.26 | 2.43 | 2.57 | 2.68 | 2.89 |
| DCLS 2004-040 | | 4 | | | | 45 | 4 | 16,000 | 4.40 | 4.63 | 4.80 | 4.97 | 5.34 |
| DCLS 2004-060 | | 6 | | | | 45 | 4 | 16,000 | 6.51 | 6.77 | 7.00 | 7.24 | 7.79 |
| DCLS 2005-020 | 0.5 | 2 | 1 | 0.47 | 16° | 45 | 4 | 16,000 | 2.32 | 2.52 | 2.68 | 2.82 | 3.07 |
| DCLS 2005-040 | | 4 | | | | 45 | 4 | 16,000 | 4.48 | 4.74 | 4.95 | 5.13 | 5.51 |
| DCLS 2005-060 | | 6 | | | | 45 | 4 | 16,000 | 6.60 | 6.91 | 7.15 | 7.40 | 7.96 |
| DCLS 2006-020 | 0.6 | 2 | 1.2 | 0.57 | 16° | 45 | 4 | 16,000 | 2.36 | 2.60 | 2.78 | 2.95 | 3.23 |
| DCLS 2006-040 | | 4 | | | | 45 | 4 | 16,000 | 4.55 | 4.85 | 5.08 | 5.29 | 5.68 |
| DCLS 2006-060 | | 6 | | | | 45 | 4 | 16,000 | 6.69 | 7.04 | 7.31 | 7.56 | 8.13 |
| DCLS 2006-080 | | 8 | | | | 45 | 4 | 16,000 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| DCLS 2006-100 | | 10 | | | | 45 | 4 | 16,000 | 10.90 | 11.33 | 11.71 | 12.12 | 13.03 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| DCLS 2007-040 | 0.7 | 4 | 1.4 | 0.67 | 16° | 45 | 4 | 16,000 | 4.55 | 4.85 | 5.08 | 5.29 | 5.68 |
| DCLS 2007-060 | | 6 | | | | 45 | 4 | 16,000 | 6.69 | 7.04 | 7.31 | 7.56 | 8.13 |
| DCLS 2007-080 | | 8 | | | | 45 | 4 | 16,000 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| DCLS 2007-100 | | 10 | | | | 45 | 4 | 16,000 | 10.90 | 11.33 | 11.71 | 12.12 | 13.03 |
| DCLS 2008-040 | 0.8 | 4 | 1.6 | 0.77 | 16° | 45 | 4 | 16,000 | 4.55 | 4.85 | 5.08 | 5.29 | 5.68 |
| DCLS 2008-060 | | 6 | | | | 45 | 4 | 16,000 | 6.69 | 7.04 | 7.31 | 7.56 | 8.13 |
| DCLS 2008-080 | | 8 | | | | 45 | 4 | 16,000 | 8.80 | 9.19 | 9.51 | 9.84 | 10.58 |
| DCLS 2008-100 | | 10 | | | | 45 | 4 | 16,000 | 10.90 | 11.33 | 11.71 | 12.12 | 13.03 |
| DCLS 2010-040 | 1 | 4 | 2 | 0.96 | 16° | 45 | 4 | 16,000 | 4.57 | 4.86 | 5.09 | 5.30 | 5.70 |
| DCLS 2010-060 | | 6 | | | | 45 | 4 | 16,000 | 6.70 | 7.05 | 7.32 | 7.57 | 8.14 |
| DCLS 2010-080 | | 8 | | | | 45 | 4 | 16,000 | 8.82 | 9.20 | 9.52 | 9.85 | 10.59 |
| DCLS 2010-100 | | 10 | | | | 45 | 4 | 16,000 | 10.91 | 11.34 | 11.72 | 12.13 | 13.04 |
| DCLS 2010-160 | | 16 | | | | 50 | 4 | 16,000 | 17.16 | 17.73 | 18.32 | 18.96 | 20.38 |
| DCLS 2010-210 | | 21 | | | | 55 | 4 | 16,000 | 22.33 | 23.05 | 23.82 | 24.65 | 26.50 |
| DCLS 2015-060 | 1.5 | 6 | 3 | 1.44 | 16° | 45 | 4 | 16,000 | 6.17 | 6.37 | 6.58 | 6.81 | 7.33 |
| DCLS 2015-100 | | 10 | | | | 45 | 4 | 16,000 | 10.29 | 10.63 | 10.98 | 11.37 | 12.22 |
| DCLS 2015-160 | | 16 | | | | 50 | 4 | 16,000 | 16.48 | 17.02 | 17.59 | 18.20 | 19.56 |
| DCLS 2015-210 | | 21 | | | | 55 | 4 | 16,000 | 21.64 | 22.34 | 23.09 | 23.89 | No Interference |
| DCLS 2020-060 | 2 | 6 | 4 | 1.9 | 16° | 50 | 4 | 16,000 | 6.22 | 6.42 | 6.64 | 6.87 | 7.39 |
| DCLS 2020-100 | | 10 | | | | 50 | 4 | 16,000 | 10.35 | 10.68 | 11.04 | 11.43 | 12.28 |
| DCLS 2020-160 | | 16 | | | | 50 | 4 | 16,000 | 16.53 | 17.07 | 17.65 | 18.26 | No Interference |
| DCLS 2020-210 | | 21 | | | | 55 | 4 | 16,000 | 21.69 | 22.40 | 23.15 | 23.95 | No Interference |
| DCLS 2020-260 | | 26 | | | | 55 | 4 | 16,000 | 26.85 | 27.72 | 28.65 | No Interference | No Interference |
| DCLS 2030-160 | 3 | 16 | 6 | 2.9 | 16° | 70 | 6 | 18,000 | 16.53 | 17.07 | 17.65 | 18.26 | 19.63 |
| DCLS 2030-210 | | 21 | | | | 70 | 6 | 20,000 | 21.69 | 22.40 | 23.15 | 23.95 | 25.74 |
| DCLS 2030-260 | | 26 | | | | 70 | 6 | 20,000 | 26.85 | 27.72 | 28.65 | 29.65 | No Interference |
| DCLS 2030-320 | | 32 | | | | 80 | 6 | 20,000 | 33.04 | 34.11 | 35.25 | 36.48 | No Interference |
| DCLS 2040-210 | 4 | 21 | 8 | 3.91 | 16° | 70 | 6 | 20,000 | 21.68 | 22.39 | 23.14 | 23.94 | No Interference |
| DCLS 2040-260 | | 26 | | | | 70 | 6 | 20,000 | 26.84 | 27.71 | 28.64 | No Interference | No Interference |
| DCLS 2040-320 | | 32 | | | | 70 | 6 | 20,000 | 33.03 | 34.10 | 35.24 | No Interference | No Interference |
| DCLS 2040-420 | | 42 | | | | 80 | 6 | 23,000 | 43.34 | 44.75 | No Interference | No Interference | No Interference |
| DCLS 2060-320 | 6 | 32 | 12 | 5.71 | — | 80 | 6 | 23,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLS 2060-420 | | 42 | | | | 80 | 6 | 23,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLS 2060-630 | | 63 | | | | 120 | 6 | 30,000 | No Interference | No Interference | No Interference | No Interference | No Interference |

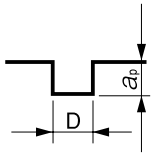
## Milling Conditions for DCLS

| WORK MATERIAL | | | GRAPHITE | | | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Side Milling | | Slotting |
| | | | | | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | $a_p$ Axial Depth (mm) |
| **2004-020** | **0.4** | 2 | 34,000 | 410 | 0.4 | 0.02 | 0.02 |
| **2004-040** | | 4 | 34,000 | 240 | 0.4 | 0.02 | 0.02 |
| **2004-060** | | 6 | 34,000 | 180 | 0.4 | 0.02 | 0.02 |
| **2005-020** | **0.5** | 2 | 34,000 | 540 | 0.5 | 0.025 | 0.025 |
| **2005-040** | | 4 | 34,000 | 350 | 0.5 | 0.025 | 0.025 |
| **2005-060** | | 6 | 34,000 | 240 | 0.5 | 0.025 | 0.025 |
| **2006-020** | **0.6** | 2 | 34,000 | 660 | 0.6 | 0.03 | 0.03 |
| **2006-040** | | 4 | 34,000 | 520 | 0.6 | 0.03 | 0.03 |
| **2006-060** | | 6 | 34,000 | 320 | 0.6 | 0.03 | 0.03 |
| **2006-080** | | 8 | 25,000 | 220 | 0.6 | 0.03 | 0.03 |
| **2006-100** | | 10 | 24,000 | 120 | 0.6 | 0.03 | 0.03 |
| **2007-040** | **0.7** | 4 | 34,000 | 600 | 0.7 | 0.035 | 0.035 |
| **2007-060** | | 6 | 34,000 | 380 | 0.7 | 0.035 | 0.035 |
| **2007-080** | | 8 | 25,000 | 260 | 0.7 | 0.035 | 0.035 |
| **2007-100** | | 10 | 24,000 | 140 | 0.7 | 0.035 | 0.035 |
| **2008-040** | **0.8** | 4 | 34,000 | 690 | 0.8 | 0.04 | 0.04 |
| **2008-060** | | 6 | 34,000 | 440 | 0.8 | 0.04 | 0.04 |
| **2008-080** | | 8 | 25,000 | 300 | 0.8 | 0.04 | 0.04 |
| **2008-100** | | 10 | 24,000 | 170 | 0.8 | 0.04 | 0.04 |
| **2010-040** | **1** | 4 | 34,000 | 1,170 | 1 | 0.05 | 0.1 |
| **2010-060** | | 6 | 26,000 | 850 | 1 | 0.05 | 0.1 |
| **2010-080** | | 8 | 22,000 | 660 | 1 | 0.05 | 0.1 |
| **2010-100** | | 10 | 22,100 | 530 | 1 | 0.05 | 0.1 |
| **2010-160** | | 16 | 14,300 | 300 | 1 | 0.05 | 0.1 |
| **2010-210** | | 21 | 12,500 | 200 | 1 | 0.05 | 0.1 |
| **2015-060** | **1.5** | 6 | 22,000 | 1,620 | 1.5 | 0.075 | 0.15 |
| **2015-100** | | 10 | 17,000 | 1,050 | 1.5 | 0.075 | 0.15 |
| **2015-160** | | 16 | 15,000 | 600 | 1.5 | 0.075 | 0.15 |
| **2015-210** | | 21 | 10,000 | 370 | 1.5 | 0.075 | 0.15 |
| **2020-060** | **2** | 6 | 25,500 | 2,175 | 2 | 0.1 | 0.2 |
| **2020-100** | | 10 | 21,000 | 1,680 | 2 | 0.1 | 0.2 |
| **2020-160** | | 16 | 19,500 | 1,230 | 2 | 0.1 | 0.2 |
| **2020-210** | | 21 | 16,500 | 750 | 2 | 0.1 | 0.2 |
| **2020-260** | | 26 | 12,000 | 590 | 2 | 0.1 | 0.2 |
| **2030-160** | **3** | 16 | 22,000 | 2,200 | 3 | 0.15 | 0.3 |
| **2030-210** | | 21 | 20,000 | 1,800 | 3 | 0.15 | 0.3 |
| **2030-260** | | 26 | 18,000 | 1,450 | 3 | 0.15 | 0.3 |
| **2030-320** | | 32 | 15,000 | 1,040 | 3 | 0.15 | 0.3 |
| **2040-210** | **4** | 21 | 14,000 | 1,760 | 4 | 0.2 | 0.4 |
| **2040-260** | | 26 | 13,500 | 1,450 | 4 | 0.2 | 0.4 |
| **2040-320** | | 32 | 13,000 | 1,160 | 4 | 0.2 | 0.4 |
| **2040-420** | | 42 | 11,000 | 900 | 4 | 0.2 | 0.4 |
| **2060-320** | **6** | 32 | 12,000 | 1,500 | 6 | 0.6 | 1.2 |
| **2060-420** | | 42 | 10,800 | 1,160 | 6 | 0.6 | 1.2 |
| **2060-630** | | 63 | 7,400 | 620 | 6 | 0.6 | 1.2 |

Slotting

$a_p$ : Axial Depth (mm)

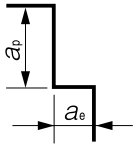
D : Outside Diameter (mm)




Side Milling

$a_p$ : Axial Depth (mm)

$a_e$ : Radial Depth (mm)




Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

## Size φ0.5～φ6

# CPR

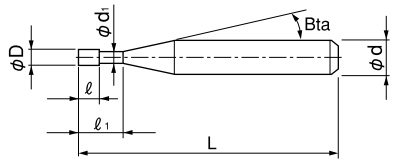
MG | 30° | Sharp Corner (φ0.5～φ2.5) | Flatland (φ3 or above) | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | | ◎ | ☆ | | | | | |

## Features

**Long Neck Square End Mills for milling Plastics.**
**Designed especially for deep rib milling using an under cut design.**




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

Total 64 models

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| CPR 2005-2 | 0.5 | 2 | 1 | 0.45 | 11° | 38 | 3 | 6,700 |
| CPR 2005-4 | | 4 | | | | 38 | 3 | 6,700 |
| CPR 2005-6 | | 6 | | | | 38 | 3 | 6,700 |
| CPR 2006-4 | 0.6 | 4 | 1.2 | 0.55 | 11° | 38 | 3 | 6,000 |
| CPR 2006-6 | | 6 | | | | 38 | 3 | 6,000 |
| CPR 2007-4 | 0.7 | 4 | 1.4 | 0.65 | 11° | 38 | 3 | 6,100 |
| CPR 2007-6 | | 6 | | | | 38 | 3 | 6,100 |
| CPR 2008-6 | 0.8 | 6 | 1.6 | 0.75 | 11° | 45 | 4 | 5,100 |
| CPR 2008-8 | | 8 | | | | 45 | 4 | 5,100 |
| CPR 2009-6 | 0.9 | 6 | 1.8 | 0.85 | 11° | 45 | 4 | 5,100 |
| CPR 2009-10 | | 10 | | | | 45 | 4 | 5,100 |
| CPR 2010-6 | 1 | 6 | 2 | 0.9 | 11° | 45 | 4 | 5,040 |
| CPR 2010-8 | | 8 | | | | 45 | 4 | 5,040 |
| CPR 2010-10 | | 10 | | | | 45 | 4 | 5,040 |
| CPR 2010-12 | | 12 | | | | 45 | 4 | 5,040 |
| CPR 2010-16 | | 16 | | | | 50 | 4 | 5,040 |
| CPR 2010-21 | | 21 | | | | 55 | 4 | 6,000 |
| CPR 2012-6 | 1.2 | 6 | 2.4 | 1.1 | 11° | 45 | 4 | 5,100 |
| CPR 2012-8 | | 8 | | | | 45 | 4 | 5,100 |
| CPR 2012-10 | | 10 | | | | 45 | 4 | 5,100 |
| CPR 2012-12 | | 12 | | | | 50 | 4 | 5,100 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **CPR 2014-6** | 1.4 | 6 | 2.8 | 1.3 | 11° | 45 | 4 | 5,100 |
| **CPR 2014-10** | | 10 | | | | 45 | 4 | 5,100 |
| **CPR 2014-16** | | 16 | | | | 50 | 4 | 5,100 |
| **CPR 2015-6** | 1.5 | 6 | 3 | 1.4 | 11° | 45 | 4 | 5,100 |
| **CPR 2015-10** | | 10 | | | | 45 | 4 | 5,100 |
| **CPR 2015-14** | | 14 | | | | 50 | 4 | 5,100 |
| **CPR 2015-16** | | 16 | | | | 50 | 4 | 5,100 |
| **CPR 2015-21** | | 21 | | | | 55 | 4 | 5,100 |
| **CPR 2016-6** | 1.6 | 6 | 3.2 | 1.5 | 11° | 50 | 4 | 5,100 |
| **CPR 2020-8** | 2 | 8 | 4 | 1.9 | 11° | 50 | 4 | 5,040 |
| **CPR 2020-10** | | 10 | | | | 50 | 4 | 5,040 |
| **CPR 2020-12** | | 12 | | | | 50 | 4 | 5,040 |
| **CPR 2020-14** | | 14 | | | | 50 | 4 | 5,040 |
| **CPR 2020-16** | | 16 | | | | 50 | 4 | 5,040 |
| **CPR 2020-18** | | 18 | | | | 55 | 4 | 5,040 |
| **CPR 2020-21** | | 21 | | | | 55 | 4 | 5,040 |
| **CPR 2020-26** | | 26 | | | | 55 | 4 | 5,100 |
| **CPR 2020-32** | | 32 | | | | 70 | 4 | 6,100 |
| **CPR 2025-12** | 2.5 | 12 | 5 | 2.3 | 11° | 55 | 4 | 5,600 |
| **CPR 2025-21** | | 21 | | | | 55 | 4 | 5,600 |
| **CPR 2030-8** | 3 | 8 | 6 | 2.8 | 11° | 70 | 6 | 6,510 |
| **CPR 2030-12** | | 12 | | | | 70 | 6 | 6,510 |
| **CPR 2030-16** | | 16 | | | | 70 | 6 | 6,510 |
| **CPR 2030-21** | | 21 | | | | 70 | 6 | 6,510 |
| **CPR 2030-26** | | 26 | | | | 70 | 6 | 6,510 |
| **CPR 2030-32** | | 32 | | | | 80 | 6 | 7,200 |
| **CPR 2030-42** | | 42 | | | | 90 | 6 | 8,400 |
| **CPR 2040-12** | 4 | 12 | 8 | 3.8 | 11° | 70 | 6 | 6,930 |
| **CPR 2040-16** | | 16 | | | | 70 | 6 | 6,930 |
| **CPR 2040-18** | | 18 | | | | 70 | 6 | 6,930 |
| **CPR 2040-21** | | 21 | | | | 70 | 6 | 6,930 |
| **CPR 2040-24** | | 24 | | | | 70 | 6 | 6,930 |
| **CPR 2040-32** | | 32 | | | | 70 | 6 | 6,930 |
| **CPR 2040-36** | | 36 | | | | 70 | 6 | 6,930 |
| **CPR 2040-42** | | 42 | | | | 80 | 6 | 7,250 |
| **CPR 2040-52** | | 52 | | | | 100 | 6 | 9,350 |
| **CPR 2050-16** | 5 | 16 | 10 | 4.8 | 11° | 80 | 6 | 7,980 |
| **CPR 2050-22** | | 22 | | | | 80 | 6 | 7,980 |
| **CPR 2050-32** | | 32 | | | | 80 | 6 | 7,980 |
| **CPR 2060-12** | 6 | No Under Cut | 12 | No Under Cut | — | 80 | 6 | 7,670 |
| **CPR 2060-42** | | 42 | | 5.8 | | 80 | 6 | 7,980 |
| **CPR 2060-52** | | 52 | | | | 120 | 6 | 11,030 |
| **CPR 2060-63** | | 63 | | | | 120 | 6 | 11,030 |

## Milling Conditions for CPR

| WORK MATERIAL | | | ABS / MC NYLON | | | ACRYLIC / POLYACETAL | | | POLYCARBONATE | | | GLASS FIBER REINFORCED POLYCARBONATE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) |
| **2005-2** | **0.5** | 2 | 6,000 | 300 | 0.2 | 15,000 | 300 | 0.2 | 9,000 | 300 | 0.2 | 9,000 | 450 | 0.2 |
| **2005-4** | | 4 | 6,000 | 300 | 0.2 | 15,000 | 300 | 0.2 | 9,000 | 300 | 0.2 | 9,000 | 450 | 0.2 |
| **2005-6** | | 6 | 6,000 | 300 | 0.2 | 15,000 | 300 | 0.2 | 9,000 | 300 | 0.2 | 9,000 | 450 | 0.2 |
| **2006-4** | **0.6** | 4 | 6,000 | 340 | 0.2 | 14,400 | 300 | 0.2 | 8,800 | 540 | 0.2 | 8,800 | 810 | 0.2 |
| **2006-6** | | 6 | 6,000 | 340 | 0.2 | 14,400 | 300 | 0.2 | 8,800 | 540 | 0.2 | 8,800 | 810 | 0.2 |
| **2007-4** | **0.7** | 4 | 6,000 | 380 | 0.2 | 13,800 | 300 | 0.2 | 8,600 | 780 | 0.2 | 8,600 | 1,170 | 0.2 |
| **2007-6** | | 6 | 6,000 | 380 | 0.2 | 13,800 | 300 | 0.2 | 8,600 | 780 | 0.2 | 8,600 | 1,170 | 0.2 |
| **2008-6** | **0.8** | 6 | 6,000 | 420 | 0.2 | 13,200 | 300 | 0.2 | 8,400 | 1,000 | 0.2 | 8,400 | 1,500 | 0.2 |
| **2008-8** | | 8 | 6,000 | 420 | 0.2 | 12,900 | 280 | 0.2 | 8,200 | 960 | 0.2 | 8,200 | 1,440 | 0.2 |
| **2009-6** | **0.9** | 6 | 6,000 | 460 | 0.2 | 12,600 | 300 | 0.2 | 8,200 | 1,300 | 0.2 | 8,200 | 1,950 | 0.2 |
| **2009-10** | | 10 | 6,000 | 460 | 0.2 | 11,800 | 260 | 0.2 | 7,800 | 1,000 | 0.2 | 7,800 | 1,500 | 0.2 |
| **2010-6** | **1** | 6 | 6,000 | 500 | 0.3 | 12,000 | 300 | 0.3 | 8,000 | 1,500 | 0.3 | 8,000 | 2,250 | 0.3 |
| **2010-8** | | 8 | 6,000 | 500 | 0.3 | 11,500 | 270 | 0.3 | 7,700 | 1,400 | 0.3 | 7,700 | 2,100 | 0.3 |
| **2010-10** | | 10 | 6,000 | 500 | 0.3 | 11,000 | 240 | 0.3 | 7,500 | 1,200 | 0.3 | 7,500 | 1,800 | 0.3 |
| **2010-12** | | 12 | 6,000 | 500 | 0.3 | 10,400 | 220 | 0.3 | 7,200 | 1,100 | 0.3 | 7,200 | 1,650 | 0.3 |
| **2010-16** | | 16 | 6,000 | 500 | 0.3 | 9,300 | 160 | 0.3 | 6,700 | 830 | 0.3 | 6,700 | 1,245 | 0.3 |
| **2010-21** | | 21 | 6,000 | 500 | 0.3 | 8,000 | 90 | 0.3 | 6,000 | 500 | 0.3 | 6,000 | 750 | 0.3 |
| **2012-6** | **1.2** | 6 | 6,000 | 610 | 0.4 | 11,700 | 330 | 0.4 | 8,000 | 1,500 | 0.4 | 8,000 | 2,250 | 0.4 |
| **2012-8** | | 8 | 6,000 | 610 | 0.4 | 11,200 | 300 | 0.4 | 7,700 | 1,400 | 0.4 | 7,700 | 2,100 | 0.4 |
| **2012-10** | | 10 | 6,000 | 600 | 0.4 | 10,700 | 280 | 0.4 | 7,500 | 1,300 | 0.4 | 7,500 | 1,950 | 0.4 |
| **2012-12** | | 12 | 6,000 | 600 | 0.4 | 10,200 | 250 | 0.4 | 7,200 | 1,200 | 0.4 | 7,200 | 1,800 | 0.4 |
| **2014-6** | **1.4** | 6 | 6,000 | 720 | 0.4 | 11,340 | 360 | 0.4 | 8,000 | 1,600 | 0.4 | 8,000 | 2,400 | 0.4 |
| **2014-10** | | 10 | 6,000 | 700 | 0.4 | 10,700 | 310 | 0.4 | 7,700 | 1,400 | 0.4 | 7,700 | 2,100 | 0.4 |
| **2014-16** | | 16 | 6,000 | 680 | 0.4 | 9,800 | 230 | 0.4 | 7,200 | 1,000 | 0.4 | 7,200 | 1,500 | 0.4 |
| **2015-6** | **1.5** | 6 | 6,100 | 780 | 0.5 | 11,200 | 380 | 0.5 | 8,000 | 1,600 | 0.5 | 8,000 | 1,700 | 0.5 |
| **2015-10** | | 10 | 6,000 | 760 | 0.5 | 10,200 | 330 | 0.5 | 7,500 | 1,400 | 0.5 | 7,500 | 1,600 | 0.5 |
| **2015-14** | | 14 | 6,000 | 730 | 0.5 | 9,600 | 270 | 0.5 | 7,000 | 1,100 | 0.5 | 7,000 | 1,400 | 0.5 |
| **2015-16** | | 16 | 6,000 | 730 | 0.5 | 8,800 | 250 | 0.5 | 6,700 | 1,000 | 0.5 | 6,700 | 1,400 | 0.5 |
| **2015-21** | | 21 | 5,900 | 700 | 0.5 | 7,600 | 180 | 0.5 | 6,100 | 750 | 0.5 | 6,100 | 1,200 | 0.5 |
| **2016-6** | **1.6** | 6 | 6,100 | 830 | 0.8 | 11,000 | 390 | 0.8 | 8,000 | 1,600 | 0.8 | 8,000 | 1,700 | 0.8 |
| **2020-8** | **2** | 8 | 6,100 | 1,000 | 1 | 10,100 | 440 | 1 | 7,900 | 1,700 | 1 | 7,900 | 1,800 | 1 |
| **2020-10** | | 10 | 6,000 | 980 | 1 | 9,800 | 420 | 1 | 7,700 | 1,600 | 1 | 7,700 | 1,800 | 1 |
| **2020-12** | | 12 | 6,000 | 970 | 1 | 9,500 | 400 | 1 | 7,500 | 1,600 | 1 | 7,500 | 1,700 | 1 |
| **2020-14** | | 14 | 5,900 | 950 | 1 | 9,100 | 380 | 1 | 7,300 | 1,500 | 1 | 7,300 | 1,700 | 1 |
| **2020-16** | | 16 | 5,900 | 930 | 1 | 8,800 | 360 | 1 | 7,100 | 1,400 | 1 | 7,100 | 1,600 | 1 |
| **2020-18** | | 18 | 5,800 | 920 | 1 | 8,500 | 340 | 1 | 6,900 | 1,300 | 1 | 6,900 | 1,600 | 1 |
| **2020-21** | | 21 | 5,700 | 890 | 1 | 8,000 | 300 | 1 | 6,500 | 1,200 | 1 | 6,500 | 1,500 | 1 |
| **2020-26** | | 26 | 5,600 | 850 | 1 | 7,200 | 250 | 1 | 6,000 | 1,100 | 1 | 6,000 | 1,400 | 1 |
| **2020-32** | | 32 | 5,400 | 800 | 1 | 6,200 | 190 | 1 | 5,400 | 850 | 1 | 5,400 | 1,300 | 1 |
| **2025-12** | **2.5** | 12 | 6,000 | 1,300 | 1.2 | 8,600 | 480 | 1.2 | 7,400 | 1,600 | 1.2 | 7,400 | 1,900 | 1.2 |
| **2025-21** | | 21 | 5,700 | 1,100 | 1 | 6,800 | 350 | 1 | 6,200 | 1,300 | 1 | 6,200 | 1,600 | 1 |

## Milling Conditions for CPR

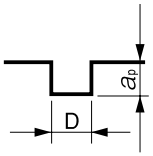
| WORK MATERIAL | | | ABS / MC NYLON | | | ACRYLIC / POLYACETAL | | | POLYCARBONATE | | | GLASS FIBER REINFORCED POLYCARBONATE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_D$ Axial Depth (mm) |
| **2030-8** | **3** | 8 | 6,200 | 1,600 | 1.5 | 8,700 | 610 | 1.5 | 8,000 | 1,900 | 1.5 | 8,000 | 2,200 | 1.5 |
| **2030-12** | | 12 | 6,000 | 1,500 | 1.5 | 8,000 | 560 | 1.5 | 7,500 | 1,800 | 1.5 | 7,500 | 2,100 | 1.5 |
| **2030-16** | | 16 | 5,800 | 1,400 | 1.5 | 7,300 | 510 | 1.5 | 7,000 | 1,700 | 1.5 | 7,000 | 2,000 | 1.5 |
| **2030-21** | | 21 | 5,600 | 1,300 | 1.5 | 6,400 | 440 | 1.5 | 6,300 | 1,500 | 1.5 | 6,300 | 1,800 | 1.5 |
| **2030-26** | | 26 | 5,400 | 1,200 | 1.5 | 5,500 | 370 | 1.5 | 5,600 | 1,400 | 1.5 | 5,600 | 1,700 | 1.5 |
| **2030-32** | | 32 | 5,200 | 1,100 | 1.5 | 4,500 | 290 | 1.5 | 4,800 | 1,200 | 1.5 | 4,800 | 1,400 | 1.5 |
| **2030-42** | | 42 | 4,800 | 960 | 1.5 | 2,700 | 160 | 1.5 | 3,500 | 840 | 1.5 | 3,500 | 1,000 | 1.5 |
| **2040-12** | **4** | 12 | 5,000 | 1,400 | 2 | 7,000 | 520 | 2 | 5,800 | 1,500 | 2 | 5,800 | 1,800 | 2 |
| **2040-16** | | 16 | 4,900 | 1,400 | 2 | 6,500 | 480 | 2 | 5,500 | 1,400 | 2 | 5,500 | 1,700 | 2 |
| **2040-18** | | 18 | 4,800 | 1,400 | 2 | 6,300 | 470 | 2 | 5,400 | 1,400 | 2 | 5,400 | 1,700 | 2 |
| **2040-21** | | 21 | 4,800 | 1,400 | 2 | 6,000 | 440 | 2 | 5,100 | 1,300 | 2 | 5,100 | 1,600 | 2 |
| **2040-24** | | 24 | 4,700 | 1,300 | 2 | 5,600 | 410 | 2 | 4,900 | 1,300 | 2 | 4,900 | 1,600 | 2 |
| **2040-32** | | 32 | 4,500 | 1,300 | 2 | 4,700 | 340 | 2 | 4,400 | 1,100 | 2 | 4,400 | 1,500 | 2 |
| **2040-36** | | 36 | 4,300 | 1,300 | 2 | 4,200 | 300 | 2 | 4,100 | 1,100 | 2 | 4,100 | 1,400 | 2 |
| **2040-42** | | 42 | 4,200 | 1,300 | 2 | 3,600 | 250 | 2 | 3,600 | 960 | 2 | 3,600 | 1,200 | 2 |
| **2040-52** | | 52 | 3,900 | 1,200 | 2 | 2,400 | 160 | 2 | 2,900 | 780 | 2 | 2,900 | 1,000 | 2 |
| **2050-16** | **5** | 16 | 3,400 | 1,200 | 2.5 | 5,800 | 470 | 2.5 | 4,000 | 1,200 | 2.5 | 4,000 | 1,400 | 2.5 |
| **2050-22** | | 22 | 3,300 | 1,100 | 2.5 | 5,100 | 390 | 2.5 | 3,600 | 1,100 | 2.5 | 3,600 | 1,300 | 2.5 |
| **2050-32** | | 32 | 3,200 | 1,100 | 2.5 | 3,900 | 260 | 2.5 | 2,900 | 910 | 2.5 | 2,900 | 1,100 | 2.5 |
| **2060-12** | **6** | 12 | 3,000 | 1,200 | 3 | 5,000 | 450 | 3 | 2,500 | 1,000 | 3 | 2,500 | 1,500 | 3 |
| **2060-42** | | 42 | 2,400 | 960 | 3 | 2,600 | 240 | 3 | 1,900 | 760 | 3 | 1,900 | 1,140 | 3 |
| **2060-52** | | 52 | 2,200 | 890 | 3 | 1,900 | 170 | 3 | 1,700 | 670 | 3 | 1,700 | 1,005 | 3 |
| **2060-63** | | 63 | 2,000 | 800 | 3 | 1,000 | 90 | 3 | 1,500 | 600 | 3 | 1,500 | 900 | 3 |

Milling Amount for Slotting (mm)

$a_p \leqq 0.5D$

$a_p$ : Axial Depth (mm)

D : Outside Diameter (mm)




CPR Finishing Conditions for Side Milling

Refer to the slotting parameters for speeds and feeds.

Set the milling amount as below during side milling finishing.

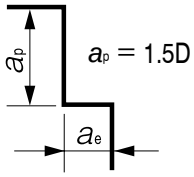
Milling Amount for Side Finishing (mm)

$a_p$ : Axial Depth (mm)

$a_e$ : Radial Depth (mm)

$a_e$ : 0.01 ~ 0.015D (Min 0.01 mm)

D : Outside Diameter (mm)




Note:

- Control the radial depth (ae) by approximately 0.01-0.015 times of the outside diameter or set to 0.01 mm the minimum during side milling finishing.
- Increase the feed rate per flute to reduce burring on surface of softer materials.
- Chattering may occur when using a spindle with low rigidity or when milling unstable work piece. Reduce the milling amount in this case.
- Recommend to reduce the milling amount when using a machine with low spindle speed. Not recommend to reduce the feed rate.
- Recommend water soluble coolant for Copper and Aluminum Alloys.
- Recommend air blow for Plastics.
- Remove chips from the work piece to keep the milling surface quality.
- If chips clog on the tool, stop the operation and remove them accordingly.

## Size φ0.5～φ4

# CPRL

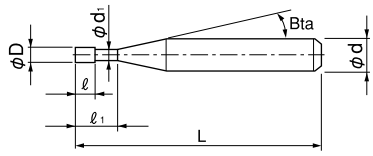
MG | 30° | Sharp Corner (φ0.5～φ2) | Flatland (φ3 or above) | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | | ◎ | ☆ | | | | | |

## Features

**Long Neck & Shank Square End Mills for milling Plastics.**
**High performance for deep rib cut milling.**
**Excellent cutting performance for milling Plastics.**




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

Total 36 models

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| CPRL 2005-4 | 0.5 | 4 | 1 | 0.45 | 11° | 80 | 4 | 8,000 |
| CPRL 2005-6 | | 6 | | | | 80 | 4 | 8,000 |
| CPRL 2005-8 | | 8 | | | | 80 | 4 | 9,000 |
| CPRL 2005-10 | | 10 | | | | 80 | 4 | 9,800 |
| CPRL 2010-6 | 1 | 6 | 2 | 0.9 | 11° | 80 | 4 | 6,000 |
| CPRL 2010-8 | | 8 | | | | 80 | 4 | 6,000 |
| CPRL 2010-10 | | 10 | | | | 80 | 4 | 6,000 |
| CPRL 2010-12 | | 12 | | | | 80 | 4 | 6,000 |
| CPRL 2010-14 | | 14 | | | | 80 | 4 | 6,000 |
| CPRL 2010-16 | | 16 | | | | 80 | 4 | 6,000 |
| CPRL 2010-18 | | 18 | | | | 80 | 4 | 7,200 |
| CPRL 2010-21 | | 21 | | | | 80 | 4 | 7,800 |
| CPRL 2015-6 | 1.5 | 6 | 3 | 1.4 | 11° | 80 | 4 | 6,000 |
| CPRL 2015-8 | | 8 | | | | 80 | 4 | 6,000 |
| CPRL 2015-10 | | 10 | | | | 80 | 4 | 6,000 |
| CPRL 2015-14 | | 14 | | | | 80 | 4 | 6,000 |
| CPRL 2015-16 | | 16 | | | | 80 | 4 | 6,000 |
| CPRL 2015-21 | | 21 | | | | 80 | 4 | 6,000 |

Next Page ➡

Unit（mm）

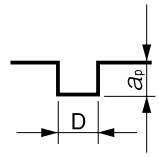
| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **CPRL 2020-8** | 2 | 8 | 4 | 1.9 | 11° | 80 | 4 | 6,000 |
| **CPRL 2020-10** | | 10 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-12** | | 12 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-14** | | 14 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-16** | | 16 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-18** | | 18 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-21** | | 21 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-26** | | 26 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-32** | | 32 | | | | 80 | 4 | 6,000 |
| **CPRL 2020-40** | | 40 | | | | 100 | 4 | 9,400 |
| **CPRL 2030-12** | 3 | 12 | 6 | 2.8 | 11° | 100 | 6 | 7,800 |
| **CPRL 2030-16** | | 16 | | | | 100 | 6 | 7,800 |
| **CPRL 2030-21** | | 21 | | | | 100 | 6 | 7,800 |
| **CPRL 2030-26** | | 26 | | | | 100 | 6 | 7,800 |
| **CPRL 2030-32** | | 32 | | | | 100 | 6 | 8,600 |
| **CPRL 2040-18** | 4 | 18 | 8 | 3.8 | 11° | 100 | 6 | 8,300 |
| **CPRL 2040-24** | | 24 | | | | 100 | 6 | 8,300 |
| **CPRL 2040-32** | | 32 | | | | 100 | 6 | 8,300 |

**CPRL Series Acrylic Milling Video**

## Milling Conditions for CPRL

| Model Number | Outside Diameter (mm) | Effective Length (mm) | ABS / MC NYLON | | | | ACRYLIC / POLYACETAL | | | | POLYCARBONATE | | | | GLASS FIBER REINFORCED POLYCARBONATE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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) |
| **2005-4** | **0.5** | 4 | 6,000 | 300 | 0.2 | 0.5 | 15,000 | 300 | 0.2 | 0.5 | 9,000 | 300 | 0.2 | 0.5 | 9,000 | 90 | 0.2 | 0.5 |
| **2005-6** | | 6 | 6,000 | 300 | 0.2 | 0.5 | 15,000 | 300 | 0.2 | 0.5 | 9,000 | 300 | 0.2 | 0.5 | 9,000 | 90 | 0.2 | 0.5 |
| **2005-8** | | 8 | 6,000 | 300 | 0.2 | 0.5 | 15,000 | 300 | 0.2 | 0.5 | 9,000 | 300 | 0.2 | 0.5 | 9,000 | 90 | 0.2 | 0.5 |
| **2005-10** | | 10 | 6,000 | 300 | 0.2 | 0.5 | 15,000 | 300 | 0.2 | 0.5 | 9,000 | 300 | 0.2 | 0.5 | 9,000 | 90 | 0.2 | 0.5 |
| **2010-6** | **1** | 6 | 6,000 | 500 | 0.3 | 1 | 12,000 | 300 | 0.3 | 1 | 8,000 | 1,500 | 0.3 | 1 | 8,000 | 1,500 | 0.3 | 1 |
| **2010-8** | | 8 | 6,000 | 500 | 0.3 | 1 | 11,500 | 270 | 0.3 | 1 | 7,700 | 1,400 | 0.3 | 1 | 7,700 | 1,400 | 0.3 | 1 |
| **2010-10** | | 10 | 6,000 | 500 | 0.3 | 1 | 11,000 | 240 | 0.3 | 1 | 7,500 | 1,200 | 0.3 | 1 | 7,500 | 1,400 | 0.3 | 1 |
| **2010-12** | | 12 | 6,000 | 500 | 0.3 | 1 | 10,400 | 220 | 0.3 | 1 | 7,200 | 1,100 | 0.3 | 1 | 7,200 | 1,300 | 0.3 | 1 |
| **2010-14** | | 14 | 6,000 | 500 | 0.3 | 1 | 9,900 | 190 | 0.3 | 1 | 6,900 | 970 | 0.3 | 1 | 6,900 | 1,200 | 0.3 | 1 |
| **2010-16** | | 16 | 6,000 | 500 | 0.3 | 1 | 9,300 | 160 | 0.3 | 1 | 6,700 | 830 | 0.3 | 1 | 6,700 | 1,200 | 0.3 | 1 |
| **2010-18** | | 18 | 6,000 | 500 | 0.3 | 1 | 8,800 | 130 | 0.3 | 1 | 6,400 | 700 | 0.3 | 1 | 6,400 | 1,100 | 0.3 | 1 |
| **2010-21** | | 21 | 6,000 | 500 | 0.3 | 1 | 8,000 | 90 | 0.3 | 1 | 6,000 | 500 | 0.3 | 1 | 6,000 | 1,000 | 0.3 | 1 |
| **2015-6** | **1.5** | 6 | 6,100 | 780 | 0.5 | 1.5 | 11,200 | 380 | 0.5 | 1.5 | 8,000 | 1,600 | 0.5 | 1.5 | 8,000 | 1,700 | 0.5 | 1.5 |
| **2015-8** | | 8 | 6,100 | 770 | 0.5 | 1.5 | 10,700 | 350 | 0.5 | 1.5 | 7,700 | 1,500 | 0.5 | 1.5 | 7,700 | 1,600 | 0.5 | 1.5 |
| **2015-10** | | 10 | 6,000 | 760 | 0.5 | 1.5 | 10,200 | 330 | 0.5 | 1.5 | 7,500 | 1,400 | 0.5 | 1.5 | 7,500 | 1,600 | 0.5 | 1.5 |
| **2015-14** | | 14 | 6,000 | 730 | 0.5 | 1.5 | 9,600 | 270 | 0.5 | 1.5 | 7,000 | 1,100 | 0.5 | 1.5 | 7,000 | 1,400 | 0.5 | 1.5 |
| **2015-16** | | 16 | 6,000 | 730 | 0.5 | 1.5 | 8,800 | 250 | 0.5 | 1.5 | 6,700 | 1,000 | 0.5 | 1.5 | 6,700 | 1,400 | 0.5 | 1.5 |
| **2015-21** | | 21 | 5,900 | 700 | 0.5 | 1.5 | 7,600 | 180 | 0.5 | 1.5 | 6,100 | 750 | 0.5 | 1.5 | 6,100 | 1,200 | 0.5 | 1.5 |
| **2020-8** | **2** | 8 | 6,100 | 1,000 | 1 | 2 | 10,100 | 440 | 1 | 2 | 7,900 | 1,700 | 1 | 2 | 7,900 | 1,800 | 1 | 2 |
| **2020-10** | | 10 | 6,000 | 980 | 1 | 2 | 9,800 | 420 | 1 | 2 | 7,700 | 1,600 | 1 | 2 | 7,700 | 1,800 | 1 | 2 |
| **2020-12** | | 12 | 6,000 | 970 | 1 | 2 | 9,500 | 400 | 1 | 2 | 7,500 | 1,600 | 1 | 2 | 7,500 | 1,700 | 1 | 2 |
| **2020-14** | | 14 | 5,900 | 950 | 1 | 2 | 9,100 | 380 | 1 | 2 | 7,300 | 1,500 | 1 | 2 | 7,300 | 1,700 | 1 | 2 |
| **2020-16** | | 16 | 5,900 | 930 | 1 | 2 | 8,800 | 360 | 1 | 2 | 7,100 | 1,400 | 1 | 2 | 7,100 | 1,600 | 1 | 2 |
| **2020-18** | | 18 | 5,800 | 920 | 1 | 2 | 8,500 | 340 | 1 | 2 | 6,900 | 1,300 | 1 | 2 | 6,900 | 1,600 | 1 | 2 |
| **2020-21** | | 21 | 5,700 | 890 | 1 | 2 | 8,000 | 300 | 1 | 2 | 6,500 | 1,200 | 1 | 2 | 6,500 | 1,500 | 1 | 2 |
| **2020-26** | | 26 | 5,600 | 850 | 1 | 2 | 7,200 | 250 | 1 | 2 | 6,000 | 1,100 | 1 | 2 | 6,000 | 1,400 | 1 | 2 |
| **2020-32** | | 32 | 5,400 | 800 | 1 | 2 | 6,200 | 190 | 1 | 2 | 5,400 | 850 | 1 | 2 | 5,400 | 1,300 | 1 | 2 |
| **2020-40** | | 40 | 5,200 | 730 | 1 | 2 | 4,900 | 110 | 1 | 2 | 4,600 | 570 | 1 | 2 | 4,600 | 1,100 | 1 | 2 |
| **2030-12** | **3** | 12 | 6,000 | 1,500 | 1.5 | 3 | 8,000 | 560 | 1.5 | 3 | 7,500 | 1,800 | 1.5 | 3 | 7,500 | 2,100 | 1.5 | 3 |
| **2030-16** | | 16 | 5,800 | 1,400 | 1.5 | 3 | 7,300 | 510 | 1.5 | 3 | 7,000 | 1,700 | 1.5 | 3 | 7,000 | 2,000 | 1.5 | 3 |
| **2030-21** | | 21 | 5,600 | 1,300 | 1.5 | 3 | 6,400 | 440 | 1.5 | 3 | 6,300 | 1,500 | 1.5 | 3 | 6,300 | 1,800 | 1.5 | 3 |
| **2030-26** | | 26 | 5,400 | 1,200 | 1.5 | 3 | 5,500 | 370 | 1.5 | 3 | 5,600 | 1,400 | 1.5 | 3 | 5,600 | 1,700 | 1.5 | 3 |
| **2030-32** | | 32 | 5,200 | 1,100 | 1.5 | 3 | 4,500 | 290 | 1.5 | 3 | 4,800 | 1,200 | 1.5 | 3 | 4,800 | 1,400 | 1.5 | 3 |
| **2040-18** | **4** | 18 | 4,800 | 1,400 | 2 | 4 | 6,300 | 470 | 2 | 4 | 5,400 | 1,400 | 2 | 4 | 5,400 | 1,700 | 2 | 4 |
| **2040-24** | | 24 | 4,700 | 1,300 | 2 | 4 | 5,600 | 410 | 2 | 4 | 4,900 | 1,300 | 2 | 4 | 4,900 | 1,600 | 2 | 4 |
| **2040-32** | | 32 | 4,500 | 1,300 | 2 | 4 | 4,700 | 340 | 2 | 4 | 4,400 | 1,100 | 2 | 4 | 4,400 | 1,500 | 2 | 4 |

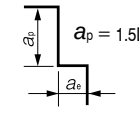
Milling Amount for Slotting (mm)
$a_p \leqq 0.5D$
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)




CPRL Finishing Conditions for Side Milling

Refer to the slotting parameters for speeds and feeds.
Set the milling amount as below during side milling finishing.

Milling Amount for Side Finishing (mm)
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
$a_e$ : 0.01 ~ 0.015D (Min 0.01 mm)
D : Outside Diameter (mm)



## Milling Conditions for CPRL

Note:
- Control the radial depth ($a_e$) by approximately 0.01-0.015 times of the outside diameter or set to 0.01 mm the minimum during side milling finishing.
- Increase the feed per tooth to reduce burr on surface of softer materials.
- Chattering may occur when using a spindle with low rigidity or when milling unstable work piece. Reduce the milling amount in this case.
- Recommend to reduce the milling amount when using a machine with low spindle speed. Not recommend to reduce the feed rate.
- Recommend water soluble coolant for Copper and Aluminum Alloys.
- Recommend air blow for Plastics.
- Remove chips from the work piece to keep the milling surface quality.
- If chips clog on the tool, stop the operation and remove them accordingly.

## Size φ1～φ12

# AZS

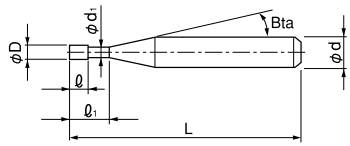
Super MG | 45° | Flatland | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ☆ | | ○ | ○ | | | | | |

## Features

**Capable of verical milling into a flat surface.**
**Achieves shorter processing time by removing pre-drilling or ramping cycle.**
**45° helix angle offers excellent chip evacuation.**
**The flute shape is specifically designed for reducing burrs on Aluminum Alloys.**
**The micro flatland design greatly helps control of chipping.**

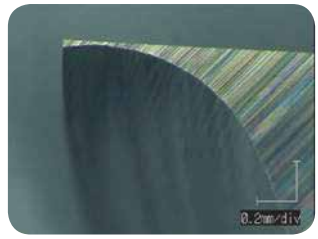



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Diameter Tolerance

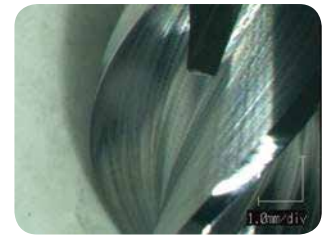
| Outside Diameter（φD） | Tolerance |
|---|---|
| φ1～φ6、φ7、φ9、φ11 | 0 -0.015 |
| φ8、φ10、φ12 | 0 -0.005 |

■ Micro Flatland Design



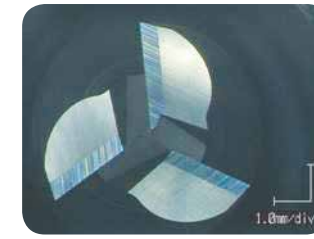

Excellent sharpness + Chipping protection design

■ Smooth Flute Design




Outstanding chip evacuation by seamless flute.

■ 3 Flute Design




Highly efficient 3 flutes. Significant productivity improvement.

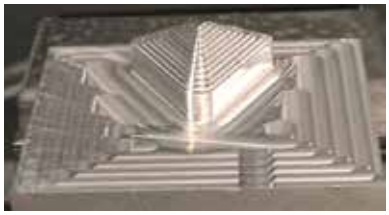
Total 28 models

Unit（mm）

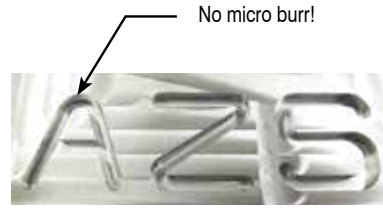
| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| AZS 3010-030 | 1 | 3 | 2 | 0.95 | 16° | 60 | 4 | 5,880 |
| AZS 3010-050 | | 5 | | | | 60 | 4 | 6,400 |
| AZS 3015-045 | 1.5 | 4.5 | 3 | 1.43 | 16° | 60 | 4 | 5,880 |
| AZS 3020-060 | 2 | 6 | 4 | 1.93 | 16° | 60 | 4 | 5,880 |
| AZS 3020-100 | | 10 | | | | 60 | 4 | 6,400 |
| AZS 3025-075 | 2.5 | 7.5 | 5 | 2.4 | 16° | 60 | 4 | 7,080 |
| AZS 3030-090 | 3 | 9 | 6 | 2.9 | 16° | 70 | 6 | 7,080 |
| AZS 3030-150 | | 15 | | | | 70 | 6 | 7,700 |
| AZS 3035-105 | 3.5 | 10.5 | 7 | 3.4 | 16° | 70 | 6 | 7,320 |
| AZS 3040-120 | 4 | 12 | 8 | 3.9 | 16° | 70 | 6 | 7,320 |
| AZS 3040-200 | | 20 | | | | 70 | 6 | 8,000 |
| AZS 3045-135 | 4.5 | 13.5 | 9 | 4.4 | 16° | 70 | 6 | 7,920 |
| AZS 3050-150 | 5 | 15 | 10 | 4.9 | 16° | 70 | 6 | 7,920 |
| AZS 3050-250 | | 25 | | | | 70 | 6 | 8,700 |
| AZS 3060-180 | 6 | 18 | 12 | 5.8 | — | 70 | 6 | 8,280 |
| AZS 3060-300 | | 30 | | | | 70 | 6 | 9,100 |
| AZS 3070-210 | 7 | 21 | 14 | 6.82 | 16° | 80 | 8 | 11,040 |
| AZS 3070-350 | | 35 | | | | 80 | 8 | 12,100 |
| AZS 3080-240 | 8 | 24 | 16 | 7.82 | — | 80 | 8 | 11,040 |
| AZS 3080-400 | | 40 | | | | 80 | 8 | 12,100 |
| AZS 3090-270 | 9 | 27 | 18 | 8.82 | 16° | 90 | 10 | 13,920 |
| AZS 3090-450 | | 45 | | | | 90 | 10 | 15,300 |
| AZS 3100-300 | 10 | 30 | 20 | 9.82 | — | 90 | 10 | 13,920 |
| AZS 3100-500 | | 50 | | | | 90 | 10 | 15,300 |
| AZS 3110-330 | 11 | 33 | 22 | 10.82 | 16° | 110 | 12 | 19,560 |
| AZS 3110-550 | | 55 | | | | 110 | 12 | 21,500 |
| AZS 3120-360 | 12 | 36 | 24 | 11.82 | — | 110 | 12 | 19,560 |
| AZS 3120-600 | | 60 | | | | 110 | 12 | 21,500 |

## Roughing Example A5052

| Model Number | Milling Process | Spindle Speed | Z Feed Rate | XY Feed Rate | Axial Depth $a_p$ | Radial Depth $a_e$ | Cycle Time |
|---|---|---|---|---|---|---|---|
| AZS 3100-300 (φ10 × Effective Length 30) | Drilling ① | 6,480 min$^{-1}$ | 180 mm/min | — | 10 mm | — | 6 min 35 sec |
| | Roughing | | — | 1,500 mm/min | 10 mm | 5 mm | |
| | Drilling ② | | 180 mm/min | — | 20 mm | — | |
| | Roughing | | — | 1,500 mm/min | 20 mm | 5 mm | |
| AZS 3030-090 (φ3 × Effective Length 9) | Drilling + Slotting | 14,000 min$^{-1}$ | 145 mm/min | 1,450 mm/min | 3 mm | — | 30 sec |



Coolant : Water Soluble

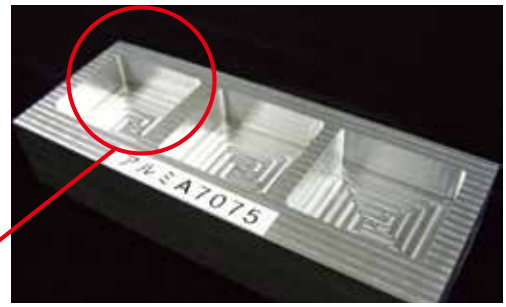



## Pocket Milling Example A7075

| Tool | AZS 3060-180 (φ6 × Effective Length 18) | |
|---|---|---|
| Milling Process | Roughing | Finishing |
| Spindle Speed | 17,600 min$^{-1}$ | 17,600 min$^{-1}$ |
| Feed Rate | 3,000 mm/min | 2,000 mm/min |
| Axial Depth $a_p$ | 6 mm | 6 mm |
| Radial Depth $a_e$ | 4.8 mm | 0.3 mm |

**AZS series A7075 Milling Video**

Bottom




Pocket size : 50 mm x 50 mm x 18 mm
Coolant : Oil Mist

**Milling from roughing to finishing with 1 pc.**

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball
Ball / Long Shank Ball
Long Neck Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data

Size φ1～φ12

# DLC-AZS

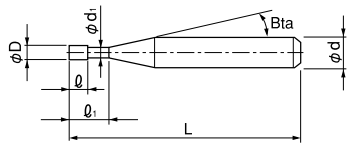
Super MG | DLC | 45° | Flatland | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ☆ | | ○ | ○ | | | | | |

## Features

**Capable of vertical milling directly into a plane surface.**
**Achieves shorter processing time by removing pre-drilling or ramping cycle.**
**DLC COAT offers excellent resistance to wear and welding.**
**45° helix angle offers excellent chip evacuation.**
**The flute shape is specifically designed for reducing burrs on Aluminum Alloys.**
**The micro flatland design greatly helps control of chipping.**




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

Diameter Tolerance

| Outside Diameter (φD) | Tolerance |
|---|---|
| φ1～φ6、φ7、φ9、φ11 | 0 -0.015 |
| φ8、φ10、φ12 | 0 -0.005 |

Total 28 models

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **DLC-AZS 3010-030** | 1 | 3 | 2 | 0.95 | 16° | 60 | 4 | 6,200 |
| **DLC-AZS 3010-050** | | 5 | | | | 60 | 4 | 6,750 |
| **DLC-AZS 3015-045** | 1.5 | 4.5 | 3 | 1.43 | 16° | 60 | 4 | 6,200 |
| **DLC-AZS 3020-060** | 2 | 6 | 4 | 1.93 | 16° | 60 | 4 | 6,200 |
| **DLC-AZS 3020-100** | | 10 | | | | 60 | 4 | 6,750 |
| **DLC-AZS 3025-075** | 2.5 | 7.5 | 5 | 2.4 | 16° | 60 | 4 | 7,400 |
| **DLC-AZS 3030-090** | 3 | 9 | 6 | 2.9 | 16° | 70 | 6 | 7,400 |
| **DLC-AZS 3030-150** | | 15 | | | | 70 | 6 | 8,050 |

Unit（mm）

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **DLC-AZS 3035-105** | 3.5 | 10.5 | 7 | 3.4 | 16° | 70 | 6 | 7,700 |
| **DLC-AZS 3040-120** | 4 | 12 | 8 | 3.9 | 16° | 70 | 6 | 7,700 |
| **DLC-AZS 3040-200** | | 20 | | | | 70 | 6 | 8,420 |
| **DLC-AZS 3045-135** | 4.5 | 13.5 | 9 | 4.4 | 16° | 70 | 6 | 8,300 |
| **DLC-AZS 3050-150** | 5 | 15 | 10 | 4.9 | 16° | 70 | 6 | 8,300 |
| **DLC-AZS 3050-250** | | 25 | | | | 70 | 6 | 9,120 |
| **DLC-AZS 3060-180** | 6 | 18 | 12 | 5.8 | — | 70 | 6 | 8,700 |
| **DLC-AZS 3060-300** | | 30 | | | | 70 | 6 | 9,560 |
| **DLC-AZS 3070-210** | 7 | 21 | 14 | 6.82 | 16° | 80 | 8 | 11,600 |
| **DLC-AZS 3070-350** | | 35 | | | | 80 | 8 | 12,710 |
| **DLC-AZS 3080-240** | 8 | 24 | 16 | 7.82 | — | 80 | 8 | 11,600 |
| **DLC-AZS 3080-400** | | 40 | | | | 80 | 8 | 12,710 |
| **DLC-AZS 3090-270** | 9 | 27 | 18 | 8.82 | 16° | 90 | 10 | 14,600 |
| **DLC-AZS 3090-450** | | 45 | | | | 90 | 10 | 16,050 |
| **DLC-AZS 3100-300** | 10 | 30 | 20 | 9.82 | — | 90 | 10 | 14,600 |
| **DLC-AZS 3100-500** | | 50 | | | | 90 | 10 | 16,050 |
| **DLC-AZS 3110-330** | 11 | 33 | 22 | 10.82 | 16° | 110 | 12 | 20,500 |
| **DLC-AZS 3110-550** | | 55 | | | | 110 | 12 | 22,530 |
| **DLC-AZS 3120-360** | 12 | 36 | 24 | 11.82 | — | 110 | 12 | 20,500 |
| **DLC-AZS 3120-600** | | 60 | | | | 110 | 12 | 22,530 |

## Milling Conditions for AZS / DLC-AZS

◆ High speed & highly efficient milling conditions

| WORK MATERIAL | | | A5052 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **3010-030** | **1** | 3 | 30,000 | 150 | 0.75 | 900 | 0.75 | 1,100 | 0.75 | 0.3 |
| **3010-050** | | 5 | 22,500 | 100 | 0.75 | 600 | 0.75 | 800 | 0.75 | 0.3 |
| **3015-045** | **1.5** | 4.5 | 30,000 | 180 | 1.125 | 1,350 | 1.125 | 1,630 | 1.125 | 0.45 |
| **3020-060** | **2** | 6 | 30,000 | 225 | 1.5 | 1,800 | 1.5 | 2,150 | 1.5 | 0.6 |
| **3020-100** | | 10 | 22,500 | 150 | 1.5 | 1,300 | 1.5 | 1,500 | 1.5 | 0.6 |
| **3025-075** | **2.5** | 7.5 | 25,000 | 225 | 1.875 | 1,900 | 1.875 | 2,300 | 1.875 | 0.75 |
| **3030-090** | **3** | 9 | 21,600 | 225 | 2.25 | 2,000 | 2.25 | 2,400 | 2.25 | 0.9 |
| **3030-150** | | 15 | 16,200 | 150 | 2.25 | 1,400 | 2.25 | 1,700 | 2.25 | 0.9 |
| **3035-105** | **3.5** | 10.5 | 18,500 | 270 | 2.625 | 2,000 | 2.625 | 2,400 | 2.625 | 1.05 |
| **3040-120** | **4** | 12 | 16,200 | 300 | 3 | 2,000 | 3 | 2,400 | 3 | 1.2 |
| **3040-200** | | 20 | 12,200 | 200 | 3 | 1,400 | 3 | 1,700 | 3 | 1.2 |
| **3045-135** | **4.5** | 13.5 | 14,400 | 300 | 3.375 | 2,000 | 3.375 | 2,400 | 3.375 | 1.35 |
| **3050-150** | **5** | 15 | 12,960 | 300 | 3.75 | 2,000 | 3.75 | 2,400 | 3.75 | 1.5 |
| **3050-250** | | 25 | 9,700 | 200 | 3.75 | 1,400 | 3.75 | 1,700 | 3.75 | 1.5 |
| **3060-180** | **6** | 18 | 10,800 | 300 | 4.5 | 2,000 | 4.5 | 2,400 | 4.5 | 1.8 |
| **3060-300** | | 30 | 8,100 | 200 | 4.5 | 1,400 | 4.5 | 1,700 | 4.5 | 1.8 |
| **3070-210** | **7** | 21 | 9,300 | 300 | 5.25 | 2,000 | 5.25 | 2,400 | 5.25 | 2.1 |
| **3070-350** | | 35 | 6,900 | 200 | 5.25 | 1,400 | 5.25 | 1,700 | 5.25 | 2.1 |
| **3080-240** | **8** | 24 | 11,400 | 300 | 6 | 2,200 | 6 | 2,600 | 6 | 2.4 |
| **3080-400** | | 40 | 8,600 | 200 | 6 | 1,500 | 6 | 1,800 | 6 | 2.4 |
| **3090-270** | **9** | 27 | 7,200 | 275 | 6.75 | 2,000 | 6.75 | 2,400 | 6.75 | 2.7 |
| **3090-450** | | 45 | 5,400 | 180 | 6.75 | 1,400 | 6.75 | 1,700 | 6.75 | 2.7 |
| **3100-300** | **10** | 30 | 9,100 | 250 | 7.5 | 2,200 | 7.5 | 2,600 | 7.5 | 3 |
| **3100-500** | | 50 | 6,800 | 160 | 7.5 | 1,500 | 7.5 | 1,800 | 7.5 | 3 |
| **3110-330** | **11** | 33 | 5,900 | 225 | 8.25 | 2,000 | 8.25 | 2,400 | 8.25 | 3.3 |
| **3110-550** | | 55 | 4,400 | 145 | 8.25 | 1,400 | 8.25 | 1,700 | 8.25 | 3.3 |
| **3120-360** | **12** | 36 | 7,600 | 200 | 9 | 2,200 | 9 | 2,600 | 9 | 3.6 |
| **3120-600** | | 60 | 5,700 | 130 | 9 | 1,500 | 9 | 1,800 | 9 | 3.6 |
| Milling Amount (mm) | | | | $a_p$=0.75D | | $a_p$=0.75D | | $a_p$=0.75D | $a_e$=0.3D | |

# Milling Conditions for AZS / DLC-AZS

| WORK MATERIAL | | | A7075 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **3010-030** | **1** | 3 | 30,000 | 150 | 0.75 | 540 | 0.75 | 860 | 0.75 | 0.3 |
| **3010-050** | | 5 | 22,500 | 100 | 0.75 | 400 | 0.75 | 600 | 0.75 | 0.3 |
| **3015-045** | **1.5** | 4.5 | 30,000 | 180 | 1.125 | 820 | 1.125 | 1,230 | 1.125 | 0.45 |
| **3020-060** | **2** | 6 | 30,000 | 225 | 1.5 | 1,100 | 1.5 | 1,600 | 1.5 | 0.6 |
| **3020-100** | | 10 | 22,500 | 150 | 1.5 | 800 | 1.5 | 1,100 | 1.5 | 0.6 |
| **3025-075** | **2.5** | 7.5 | 23,400 | 220 | 1.875 | 1,070 | 1.875 | 1,550 | 1.875 | 0.75 |
| **3030-090** | **3** | 9 | 20,200 | 225 | 2.25 | 1,100 | 2.25 | 1,600 | 2.25 | 0.9 |
| **3030-150** | | 15 | 15,200 | 150 | 2.25 | 800 | 2.25 | 1,100 | 2.25 | 0.9 |
| **3035-105** | **3.5** | 10.5 | 17,300 | 270 | 2.625 | 1,100 | 2.625 | 1,600 | 2.625 | 1.05 |
| **3040-120** | **4** | 12 | 15,200 | 300 | 3 | 1,100 | 3 | 1,600 | 3 | 1.2 |
| **3040-200** | | 20 | 11,400 | 200 | 3 | 800 | 3 | 1,100 | 3 | 1.2 |
| **3045-135** | **4.5** | 13.5 | 13,500 | 300 | 3.375 | 1,100 | 3.375 | 1,600 | 3.375 | 1.35 |
| **3050-150** | **5** | 15 | 12,200 | 300 | 3.75 | 1,100 | 3.75 | 1,600 | 3.75 | 1.5 |
| **3050-250** | | 25 | 9,200 | 200 | 3.75 | 800 | 3.75 | 1,100 | 3.75 | 1.5 |
| **3060-180** | **6** | 18 | 10,100 | 300 | 4.5 | 1,100 | 4.5 | 1,600 | 4.5 | 1.8 |
| **3060-300** | | 30 | 7,600 | 200 | 4.5 | 800 | 4.5 | 1,100 | 4.5 | 1.8 |
| **3070-210** | **7** | 21 | 8,700 | 250 | 5.25 | 1,100 | 5.25 | 1,600 | 5.25 | 2.1 |
| **3070-350** | | 35 | 6,500 | 160 | 5.25 | 800 | 5.25 | 1,100 | 5.25 | 2.1 |
| **3080-240** | **8** | 24 | 12,000 | 250 | 6 | 1,800 | 6 | 2,400 | 6 | 2.4 |
| **3080-400** | | 40 | 9,000 | 160 | 6 | 1,300 | 6 | 1,700 | 6 | 2.4 |
| **3090-270** | **9** | 27 | 6,700 | 250 | 6.75 | 1,100 | 6.75 | 1,600 | 6.75 | 2.7 |
| **3090-450** | | 45 | 5,100 | 160 | 6.75 | 800 | 6.75 | 1,100 | 6.75 | 2.7 |
| **3100-300** | **10** | 30 | 9,600 | 250 | 7.5 | 1,800 | 7.5 | 2,400 | 7.5 | 3 |
| **3100-500** | | 50 | 7,200 | 160 | 7.5 | 1,300 | 7.5 | 1,700 | 7.5 | 3 |
| **3110-330** | **11** | 33 | 5,500 | 250 | 8.25 | 1,100 | 8.25 | 1,600 | 8.25 | 3.3 |
| **3110-550** | | 55 | 4,100 | 160 | 8.25 | 800 | 8.25 | 1,100 | 8.25 | 3.3 |
| **3120-360** | **12** | 36 | 8,000 | 250 | 9 | 1,800 | 9 | 2,400 | 9 | 3.6 |
| **3120-600** | | 60 | 6,000 | 160 | 9 | 1,300 | 9 | 1,700 | 9 | 3.6 |
| Milling Amount (mm) | | | | $a_p$=0.75D | | $a_p$=0.75D | | $a_p$=0.75D | $a_e$=0.3D | |

## Milling Conditions for AZS / DLC-AZS

◆ Low speed & highly efficient milling conditions (Assumed maximum spindle speed: 10,000 $min^{-1}$ or below)

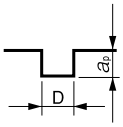
| WORK MATERIAL | | | A5052 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **3010-030** | **1** | 3 | 10,000 | 50 | 0.3 | 400 | 0.3 | 900 | 1 | 0.15 |
| **3015-045** | **1.5** | 4.5 | 10,000 | 80 | 0.45 | 600 | 0.45 | 1,250 | 1.5 | 0.225 |
| **3020-060** | **2** | 6 | 10,000 | 100 | 0.6 | 800 | 0.6 | 1,600 | 2 | 0.3 |
| **3025-075** | **2.5** | 7.5 | 10,000 | 130 | 0.75 | 1,000 | 0.75 | 2,050 | 2.5 | 0.375 |
| **3030-090** | **3** | 9 | 10,000 | 150 | 0.9 | 1,200 | 0.9 | 2,500 | 3 | 0.45 |
| **3035-105** | **3.5** | 10.5 | 10,000 | 180 | 1.05 | 1,400 | 1.05 | 2,600 | 3.5 | 0.525 |
| **3040-120** | **4** | 12 | 10,000 | 200 | 1.2 | 1,600 | 1.2 | 2,700 | 4 | 0.6 |
| **3045-135** | **4.5** | 13.5 | 10,000 | 230 | 1.35 | 1,800 | 1.35 | 3,050 | 4.5 | 0.675 |
| **3050-150** | **5** | 15 | 10,000 | 250 | 1.5 | 2,000 | 1.5 | 3,400 | 5 | 0.75 |
| **3060-180** | **6** | 18 | 10,000 | 300 | 1.8 | 2,400 | 1.8 | 4,000 | 6 | 0.9 |
| **3070-210** | **7** | 21 | 8,600 | 300 | 2.1 | 2,400 | 2.1 | 4,000 | 7 | 1.05 |
| **3080-240** | **8** | 24 | 8,100 | 300 | 2.4 | 3,000 | 2.4 | 4,800 | 8 | 1.2 |
| **3090-270** | **9** | 27 | 6,700 | 275 | 2.7 | 2,400 | 2.7 | 4,000 | 9 | 1.35 |
| **3100-300** | **10** | 30 | 6,480 | 250 | 3 | 3,000 | 3 | 4,800 | 10 | 1.5 |
| **3110-330** | **11** | 33 | 5,500 | 225 | 3.3 | 2,400 | 3.3 | 4,000 | 11 | 1.65 |
| **3120-360** | **12** | 36 | 5,400 | 200 | 3.6 | 3,000 | 3.6 | 4,800 | 12 | 1.8 |
| Milling Amount (mm) | | | | $a_p$=0.3D | | $a_p$=0.3D | | $a_p$=1.0D | $a_e$=0.15D | |

# Milling Conditions for AZS / DLC-AZS

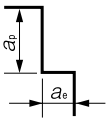


| WORK MATERIAL | | | A7075 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Vertical | | Slotting | | Side Milling | | |
| | | | | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | Feed Rate (mm/min) | $a_p$ (mm) | $a_e$ (mm) |
| **3010-030** | **1** | 3 | 10,000 | 50 | 0.3 | 400 | 0.3 | 750 | 1 | 0.15 |
| **3015-045** | **1.5** | 4.5 | 10,000 | 80 | 0.45 | 600 | 0.45 | 1,130 | 1.5 | 0.225 |
| **3020-060** | **2** | 6 | 10,000 | 100 | 0.6 | 800 | 0.6 | 1,500 | 2 | 0.3 |
| **3025-075** | **2.5** | 7.5 | 10,000 | 130 | 0.75 | 1,000 | 0.75 | 1,880 | 2.5 | 0.375 |
| **3030-090** | **3** | 9 | 10,000 | 150 | 0.9 | 1,200 | 0.9 | 2,250 | 3 | 0.45 |
| **3035-105** | **3.5** | 10.5 | 10,000 | 180 | 1.05 | 1,400 | 1.05 | 2,380 | 3.5 | 0.525 |
| **3040-120** | **4** | 12 | 10,000 | 200 | 1.2 | 1,600 | 1.2 | 2,500 | 4 | 0.6 |
| **3045-135** | **4.5** | 13.5 | 10,000 | 230 | 1.35 | 1,800 | 1.35 | 2,750 | 4.5 | 0.675 |
| **3050-150** | **5** | 15 | 9,600 | 250 | 1.5 | 2,000 | 1.5 | 3,000 | 5 | 0.75 |
| **3060-180** | **6** | 18 | 8,000 | 250 | 1.8 | 2,000 | 1.8 | 3,000 | 6 | 0.9 |
| **3070-210** | **7** | 21 | 6,900 | 200 | 2.1 | 2,000 | 2.1 | 3,000 | 7 | 1.05 |
| **3080-240** | **8** | 24 | 10,000 | 200 | 2.4 | 2,400 | 2.4 | 4,100 | 8 | 1.2 |
| **3090-270** | **9** | 27 | 5,300 | 200 | 2.7 | 2,000 | 2.7 | 3,000 | 9 | 1.35 |
| **3100-300** | **10** | 30 | 8,100 | 200 | 3 | 2,400 | 3 | 4,200 | 10 | 1.5 |
| **3110-330** | **11** | 33 | 4,400 | 200 | 3.3 | 2,000 | 3.3 | 3,000 | 11 | 1.65 |
| **3120-360** | **12** | 36 | 6,800 | 200 | 3.6 | 2,400 | 3.6 | 4,200 | 12 | 1.8 |
| Milling Amount (mm) | | | | $a_p$=0.3D | | $a_p$=0.3D | | $a_p$=1.0D $a_e$=0.15D | | |

Note:
- Recommend using a non-contact measuring device to avoid damaging the sharp bottom corner.
- Decrease both spindle speed and feed rate proportionally in case of chattering.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Spindle rigidity should be considered when setting milling parameters, especially for Z-Axis drilling.
- When slotting, using Z-Axis drilling, the milling parameters should promote good chip evacuation.
- Reduce the milling amount when chips clog on the tool during Z-Axis drilling.
- Set axial depth ($a_p$) to 1/3 ($a_p$=0.25D) in the area closest to a vertical wall with more than 2D work depth.
- These are milling parameters under the work material is firmly fixed. Decrease spindle speed and feed rate according to the condition.
- Recommend water soluble coolant.




$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

**Size φ1～φ6**

# HLS4000

Super MG | HARD MAX | 30° | Flatland | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

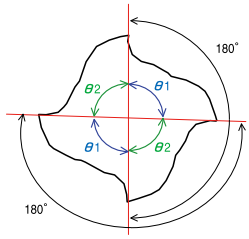
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | |

## Features

Feature1 : Variable pitch

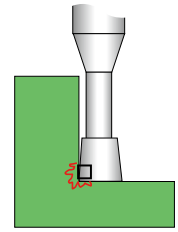
θ1 > θ2 : The unequal division reduces chattering and tip damage.

θ1 + θ2 = 180° : Easy to measure diameter.

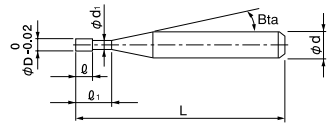


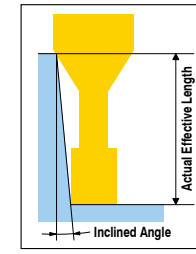

Feature2 : Back taper geometry

Back taper geometry reduces cutting force.



Feature3 : HARDMAX coating with high level of heat resistance, durability and lubrication.
Feature4 : Improved new 4 flute design offers improved chip evacuation and achieves high feed and milling precision.




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

**Refer to page 230 for 2 flute HLS.**

Total 84 models

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30' | 1° | 1° 30' | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HLS 4010-040 | 1 | 4 | 1 | 0.95 | 16° | 50 | 4 | 4,800 | 4.66 | 4.93 | 5.15 | 5.34 | 5.74 |
| HLS 4010-060 | | 6 | | | | 50 | 4 | 4,800 | 6.78 | 7.10 | 7.36 | 7.62 | 8.19 |
| HLS 4010-080 | | 8 | | | | 50 | 4 | 4,800 | 8.88 | 9.25 | 9.56 | 9.90 | 10.64 |
| HLS 4010-100 | | 10 | | | | 50 | 4 | 4,800 | 10.97 | 11.38 | 11.76 | 12.17 | 13.09 |
| HLS 4010-120 | | 12 | | | | 50 | 4 | 4,800 | 13.06 | 13.51 | 13.97 | 14.45 | 15.53 |
| HLS 4010-160 | | 16 | | | | 60 | 4 | 7,680 | 17.20 | 17.77 | 18.37 | 19.01 | 20.43 |
| HLS 4012-060 | 1.2 | 6 | 1.2 | 1.14 | 16° | 50 | 4 | 4,800 | 6.18 | 6.38 | 6.60 | 6.83 | 7.34 |
| HLS 4012-080 | | 8 | | | | 50 | 4 | 4,800 | 8.24 | 8.51 | 8.80 | 9.11 | 9.79 |
| HLS 4012-100 | | 10 | | | | 50 | 4 | 4,800 | 10.31 | 10.64 | 11.00 | 11.38 | 12.24 |
| HLS 4012-120 | | 12 | | | | 50 | 4 | 4,800 | 12.37 | 12.77 | 13.20 | 13.66 | 14.68 |
| HLS 4012-160 | | 16 | | | | 60 | 4 | 6,720 | 16.49 | 17.03 | 17.60 | 18.22 | 19.58 |





Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 4014-060 | 1.4 | 6 | 1.4 | 1.34 | 16° | 50 | 4 | 4,800 | 6.18 | 6.38 | 6.60 | 6.83 | 7.34 |
| HLS 4014-080 | | 8 | | | | 50 | 4 | 4,800 | 8.24 | 8.51 | 8.80 | 9.11 | 9.79 |
| HLS 4014-100 | | 10 | | | | 50 | 4 | 4,800 | 10.31 | 10.64 | 11.00 | 11.38 | 12.24 |
| HLS 4014-120 | | 12 | | | | 50 | 4 | 4,800 | 12.37 | 12.77 | 13.20 | 13.66 | 14.68 |
| HLS 4014-140 | | 14 | | | | 60 | 4 | 4,800 | 14.43 | 14.90 | 15.40 | 15.94 | 17.13 |
| HLS 4014-160 | | 16 | | | | 60 | 4 | 6,720 | 16.49 | 17.03 | 17.60 | 18.22 | 19.58 |
| HLS 4014-220 | | 22 | | | | 60 | 4 | 8,640 | 22.68 | 23.42 | 24.21 | 25.05 | No Interference |
| HLS 4015-060 | 1.5 | 6 | 1.5 | 1.44 | 16° | 50 | 4 | 4,800 | 6.18 | 6.38 | 6.60 | 6.83 | 7.34 |
| HLS 4015-080 | | 8 | | | | 50 | 4 | 4,800 | 8.24 | 8.51 | 8.80 | 9.11 | 9.79 |
| HLS 4015-100 | | 10 | | | | 50 | 4 | 4,800 | 10.31 | 10.64 | 11.00 | 11.38 | 12.24 |
| HLS 4015-120 | | 12 | | | | 50 | 4 | 4,800 | 12.37 | 12.77 | 13.20 | 13.66 | 14.68 |
| HLS 4015-140 | | 14 | | | | 60 | 4 | 4,800 | 14.43 | 14.90 | 15.40 | 15.94 | 17.13 |
| HLS 4015-160 | | 16 | | | | 60 | 4 | 4,800 | 16.49 | 17.03 | 17.60 | 18.22 | 19.58 |
| HLS 4015-180 | | 18 | | | | 60 | 4 | 4,800 | 18.56 | 19.16 | 19.80 | 20.49 | 22.03 |
| HLS 4015-200 | | 20 | | | | 60 | 4 | 4,800 | 20.62 | 21.29 | 22.00 | 22.77 | No Interference |
| HLS 4016-060 | 1.6 | 6 | 1.6 | 1.51 | 16° | 50 | 4 | 4,800 | 6.22 | 6.42 | 6.64 | 6.87 | 7.39 |
| HLS 4016-080 | | 8 | | | | 50 | 4 | 4,800 | 8.28 | 8.55 | 8.84 | 9.15 | 9.83 |
| HLS 4016-100 | | 10 | | | | 50 | 4 | 4,800 | 10.34 | 10.68 | 11.04 | 11.42 | 12.28 |
| HLS 4016-120 | | 12 | | | | 50 | 4 | 4,800 | 12.40 | 12.81 | 13.24 | 13.70 | 14.73 |
| HLS 4016-140 | | 14 | | | | 60 | 4 | 4,800 | 14.47 | 14.94 | 15.44 | 15.98 | 17.17 |
| HLS 4016-160 | | 16 | | | | 60 | 4 | 4,800 | 16.53 | 17.07 | 17.64 | 18.26 | 19.62 |
| HLS 4016-180 | | 18 | | | | 60 | 4 | 4,800 | 18.59 | 19.20 | 19.84 | 20.53 | 22.07 |
| HLS 4016-200 | | 20 | | | | 60 | 4 | 4,800 | 20.66 | 21.33 | 22.04 | 22.81 | No Interference |
| HLS 4016-260 | | 26 | | | | 60 | 4 | 11,040 | 26.84 | 27.72 | 28.65 | 29.64 | No Interference |
| HLS 4018-060 | 1.8 | 6 | 1.8 | 1.71 | 16° | 50 | 4 | 4,800 | 6.22 | 6.42 | 6.64 | 6.87 | 7.39 |
| HLS 4018-080 | | 8 | | | | 50 | 4 | 4,800 | 8.28 | 8.55 | 8.84 | 9.15 | 9.83 |
| HLS 4018-100 | | 10 | | | | 50 | 4 | 4,800 | 10.34 | 10.68 | 11.04 | 11.42 | 12.28 |
| HLS 4018-120 | | 12 | | | | 50 | 4 | 4,800 | 12.40 | 12.81 | 13.24 | 13.70 | 14.73 |
| HLS 4018-140 | | 14 | | | | 60 | 4 | 4,800 | 14.47 | 14.94 | 15.44 | 15.98 | 17.17 |
| HLS 4018-160 | | 16 | | | | 60 | 4 | 4,800 | 16.53 | 17.07 | 17.64 | 18.26 | 19.62 |
| HLS 4018-180 | | 18 | | | | 60 | 4 | 4,800 | 18.59 | 19.20 | 19.84 | 20.53 | No Interference |
| HLS 4018-200 | | 20 | | | | 60 | 4 | 4,800 | 20.66 | 21.33 | 22.04 | 22.81 | No Interference |
| HLS 4018-250 | | 25 | | | | 70 | 4 | 6,720 | 25.81 | 26.65 | 27.55 | 28.50 | No Interference |
| HLS 4020-060 | 2 | 6 | 2 | 1.91 | 16° | 50 | 4 | 4,800 | 6.22 | 6.42 | 6.64 | 6.87 | 7.39 |
| HLS 4020-080 | | 8 | | | | 50 | 4 | 4,800 | 8.28 | 8.55 | 8.84 | 9.15 | 9.83 |
| HLS 4020-100 | | 10 | | | | 50 | 4 | 4,800 | 10.34 | 10.68 | 11.04 | 11.42 | 12.28 |
| HLS 4020-120 | | 12 | | | | 50 | 4 | 4,800 | 12.40 | 12.81 | 13.24 | 13.70 | 14.73 |
| HLS 4020-140 | | 14 | | | | 60 | 4 | 4,800 | 14.47 | 14.94 | 15.44 | 15.98 | 17.17 |
| HLS 4020-160 | | 16 | | | | 60 | 4 | 4,800 | 16.53 | 17.07 | 17.64 | 18.26 | No Interference |
| HLS 4020-180 | | 18 | | | | 60 | 4 | 4,800 | 18.59 | 19.20 | 19.84 | 20.53 | No Interference |
| HLS 4020-200 | | 20 | | | | 60 | 4 | 4,800 | 20.66 | 21.33 | 22.04 | 22.81 | No Interference |
| HLS 4020-250 | | 25 | | | | 70 | 4 | 5,280 | 25.81 | 26.65 | 27.55 | 28.50 | No Interference |
| HLS 4020-300 | | 30 | | | | 70 | 4 | 6,720 | 30.97 | 31.97 | 33.05 | No Interference | No Interference |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1° 30' | 2° | 3° |
| HLS 4025-080 | 2.5 | 8 | 2.5 | 2.41 | 16° | 50 | 4 | 4,800 | 8.28 | 8.55 | 8.84 | 9.15 | 9.83 |
| HLS 4025-120 | | 12 | | | | 50 | 4 | 4,800 | 12.40 | 12.81 | 13.24 | 13.70 | No Interference |
| HLS 4025-160 | | 16 | | | | 60 | 4 | 4,800 | 16.53 | 17.07 | 17.64 | 18.26 | No Interference |
| HLS 4025-200 | | 20 | | | | 60 | 4 | 4,800 | 20.66 | 21.33 | 22.04 | No Interference | No Interference |
| HLS 4025-250 | | 25 | | | | 70 | 4 | 4,800 | 25.81 | 26.65 | 27.55 | No Interference | No Interference |
| HLS 4025-300 | | 30 | | | | 70 | 4 | 5,280 | 30.97 | 31.97 | No Interference | No Interference | No Interference |
| HLS 4030-080 | 3 | 8 | 3 | 2.92 | 16° | 50 | 6 | 6,720 | 8.28 | 8.55 | 8.84 | 9.15 | 9.83 |
| HLS 4030-120 | | 12 | | | | 50 | 6 | 6,720 | 12.40 | 12.81 | 13.24 | 13.70 | 14.73 |
| HLS 4030-160 | | 16 | | | | 60 | 6 | 6,720 | 16.53 | 17.07 | 17.64 | 18.26 | 19.62 |
| HLS 4030-200 | | 20 | | | | 60 | 6 | 6,720 | 20.66 | 21.33 | 22.04 | 22.81 | 24.52 |
| HLS 4030-250 | | 25 | | | | 70 | 6 | 6,720 | 25.81 | 26.65 | 27.55 | 28.50 | No Interference |
| HLS 4030-300 | | 30 | | | | 70 | 6 | 8,640 | 30.97 | 31.97 | 33.05 | 34.20 | No Interference |
| HLS 4030-400 | | 40 | | | | 80 | 6 | 8,640 | 41.28 | 42.62 | 44.05 | No Interference | No Interference |
| HLS 4040-120 | 4 | 12 | 4 | 3.82 | 16° | 50 | 6 | 7,560 | 12.58 | 12.99 | 13.43 | 13.90 | 14.94 |
| HLS 4040-160 | | 16 | | | | 60 | 6 | 7,560 | 16.71 | 17.25 | 17.83 | 18.45 | No Interference |
| HLS 4040-200 | | 20 | | | | 60 | 6 | 7,560 | 20.84 | 21.51 | 22.24 | 23.01 | No Interference |
| HLS 4040-250 | | 25 | | | | 70 | 6 | 7,560 | 25.99 | 26.84 | 27.74 | 28.70 | No Interference |
| HLS 4040-300 | | 30 | | | | 70 | 6 | 7,560 | 31.15 | 32.16 | 33.24 | No Interference | No Interference |
| HLS 4040-350 | | 35 | | | | 80 | 6 | 7,560 | 36.31 | 37.48 | No Interference | No Interference | No Interference |
| HLS 4040-400 | | 40 | | | | 90 | 6 | 9,600 | 41.46 | 42.81 | No Interference | No Interference | No Interference |
| HLS 4040-450 | | 45 | | | | 90 | 6 | 11,520 | 46.62 | 48.13 | No Interference | No Interference | No Interference |
| HLS 4040-500 | | 50 | | | | 100 | 6 | 14,520 | 51.78 | 53.46 | No Interference | No Interference | No Interference |
| HLS 4050-160 | 5 | 16 | 5 | 4.82 | 16° | 60 | 6 | 9,600 | 16.78 | 17.25 | 18.02 | No Interference | No Interference |
| HLS 4050-250 | | 25 | | | | 70 | 6 | 9,600 | 25.99 | 26.84 | No Interference | No Interference | No Interference |
| HLS 4050-350 | | 35 | | | | 80 | 6 | 9,600 | 36.31 | No Interference | No Interference | No Interference | No Interference |
| HLS 4050-500 | | 50 | | | | 110 | 6 | 14,520 | 51.78 | No Interference | No Interference | No Interference | No Interference |
| HLS 4060-200 | 6 | 20 | 6 | 5.82 | — | 80 | 6 | 9,600 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 4060-300 | | 30 | | | | 90 | 6 | 9,600 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 4060-400 | | 40 | | | | 100 | 6 | 11,520 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLS 4060-500 | | 50 | | | | 110 | 6 | 14,520 | No Interference | No Interference | No Interference | No Interference | No Interference |

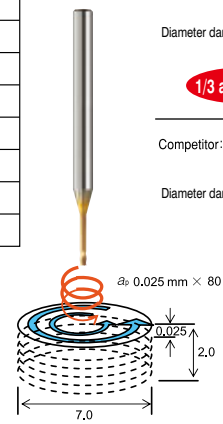
## Circle Pocket Milling Example

SKD11 (60HRC)

Tool: HLS φ1.5 × Effective Length 10 mm

| | |
|---|---|
| Spindle Speed | 7,000 min$^{-1}$ |
| Feed Rate | 230 mm/min |
| Axial Depth $a_p$ | 0.025 mm |
| Radial Depth $a_e$ | 1.2 mm |
| Coolant | Air blow (Nozzle) |
| Overhang Length | 18 mm |
| Pocket Size | φ7 × 2 mm |
| Cycle Time | 17 min |

SKD11 (60HRC)




HLS 4 Flutes φ1.5 x 10

Diameter damage: 0.091 mm

1/3 and under!

Competitor: 4 Flutes φ1.5 x 10

Diameter damage: 0.296 mm

## Milling Conditions for HLS（4 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD(30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| 4010 | 1 | 4 | 24,700 | 1,180 | 0.04 | 0.351 | 21,000 | 950 | 0.036 | 0.332 | 21,500 | 660 | 0.028 | 0.312 | 17,200 | 470 | 0.02 | 0.293 | 10,100 | 240 | 0.01 | 0.195 |
| | | 6 | 22,800 | 1,060 | 0.024 | 0.104 | 19,400 | 840 | 0.021 | 0.099 | 16,400 | 590 | 0.016 | 0.093 | 13,100 | 420 | 0.012 | 0.087 | 9,400 | 210 | 0.007 | 0.058 |
| | | 8 | 20,900 | 950 | 0.021 | 0.043 | 17,800 | 740 | 0.018 | 0.041 | 14,600 | 500 | 0.014 | 0.038 | 11,700 | 360 | 0.01 | 0.036 | 8,700 | 190 | 0.006 | 0.024 |
| | | 10 | 19,100 | 840 | 0.018 | 0.023 | 16,200 | 630 | 0.015 | 0.022 | 13,000 | 450 | 0.013 | 0.021 | 10,400 | 320 | 0.009 | 0.02 | 8,100 | 160 | 0.005 | 0.013 |
| | | 12 | 17,300 | 730 | 0.015 | 0.013 | 14,700 | 530 | 0.013 | 0.012 | 11,300 | 380 | 0.011 | 0.011 | 9,000 | 270 | 0.008 | 0.011 | 7,400 | 130 | 0.004 | 0.007 |
| | | 16 | 13,500 | 500 | 0.009 | 0.005 | 11,500 | 320 | 0.008 | 0.005 | 11,000 | 220 | 0.007 | 0.005 | 8,800 | 160 | 0.005 | 0.005 | 6,000 | 80 | 0.003 | 0.003 |
| 4012 | 1.2 | 6 | 21,400 | 1,290 | 0.04 | 0.216 | 18,200 | 1,020 | 0.034 | 0.204 | 15,400 | 710 | 0.027 | 0.192 | 12,300 | 510 | 0.019 | 0.18 | 8,900 | 260 | 0.011 | 0.12 |
| | | 8 | 19,700 | 1,160 | 0.035 | 0.092 | 16,700 | 890 | 0.03 | 0.087 | 13,800 | 620 | 0.024 | 0.082 | 11,000 | 440 | 0.017 | 0.077 | 8,200 | 230 | 0.01 | 0.051 |
| | | 10 | 17,900 | 1,020 | 0.03 | 0.047 | 15,200 | 770 | 0.026 | 0.044 | 12,100 | 530 | 0.021 | 0.042 | 9,700 | 380 | 0.015 | 0.039 | 7,600 | 200 | 0.009 | 0.026 |
| | | 12 | 16,200 | 880 | 0.025 | 0.027 | 13,800 | 640 | 0.021 | 0.026 | 10,500 | 450 | 0.018 | 0.024 | 8,400 | 320 | 0.013 | 0.023 | 6,900 | 160 | 0.007 | 0.015 |
| | | 16 | 12,600 | 610 | 0.015 | 0.011 | 10,700 | 330 | 0.013 | 0.01 | 9,900 | 270 | 0.007 | 0.01 | 7,900 | 190 | 0.005 | 0.009 | 5,600 | 100 | 0.005 | 0.006 |
| 4014 | 1.4 | 6 | 20,200 | 1,440 | 0.068 | 0.4 | 17,200 | 1,140 | 0.058 | 0.377 | 14,500 | 800 | 0.046 | 0.355 | 11,600 | 570 | 0.033 | 0.333 | 8,400 | 290 | 0.019 | 0.222 |
| | | 8 | 19,000 | 1,290 | 0.06 | 0.169 | 16,200 | 900 | 0.051 | 0.16 | 13,000 | 690 | 0.041 | 0.15 | 10,400 | 490 | 0.029 | 0.141 | 7,800 | 260 | 0.017 | 0.094 |
| | | 10 | 17,000 | 1,140 | 0.051 | 0.086 | 14,500 | 860 | 0.043 | 0.082 | 11,500 | 600 | 0.036 | 0.077 | 9,200 | 430 | 0.026 | 0.072 | 7,100 | 220 | 0.014 | 0.048 |
| | | 12 | 15,300 | 990 | 0.043 | 0.05 | 13,000 | 710 | 0.036 | 0.048 | 10,000 | 500 | 0.03 | 0.045 | 8,000 | 360 | 0.022 | 0.042 | 6,500 | 180 | 0.012 | 0.028 |
| | | 14 | 13,700 | 840 | 0.034 | 0.032 | 11,600 | 570 | 0.029 | 0.031 | 9,800 | 410 | 0.025 | 0.029 | 7,800 | 290 | 0.018 | 0.027 | 5,900 | 140 | 0.01 | 0.018 |
| | | 16 | 11,900 | 680 | 0.026 | 0.022 | 10,100 | 350 | 0.022 | 0.02 | 9,100 | 310 | 0.02 | 0.019 | 7,300 | 220 | 0.014 | 0.018 | 5,300 | 110 | 0.008 | 0.012 |
| | | 22 | 9,000 | 340 | 0.013 | 0.009 | 6,000 | 230 | 0.011 | 0.009 | 7,800 | 170 | 0.01 | 0.008 | 6,200 | 120 | 0.007 | 0.008 | 3,500 | 50 | 0.001 | 0.005 |
| 4015 | 1.5 | 6 | 19,800 | 1,520 | 0.08 | 0.527 | 16,800 | 1,200 | 0.068 | 0.498 | 14,300 | 840 | 0.054 | 0.469 | 11,400 | 600 | 0.039 | 0.44 | 8,200 | 310 | 0.022 | 0.293 |
| | | 8 | 18,200 | 1,360 | 0.07 | 0.223 | 15,500 | 930 | 0.06 | 0.211 | 12,800 | 730 | 0.048 | 0.198 | 10,200 | 520 | 0.034 | 0.186 | 7,600 | 270 | 0.02 | 0.124 |
| | | 10 | 16,600 | 1,200 | 0.06 | 0.113 | 14,100 | 900 | 0.051 | 0.107 | 11,300 | 630 | 0.042 | 0.101 | 9,000 | 450 | 0.03 | 0.095 | 7,000 | 230 | 0.017 | 0.063 |
| | | 12 | 15,000 | 1,040 | 0.05 | 0.067 | 12,800 | 720 | 0.043 | 0.063 | 9,800 | 530 | 0.036 | 0.059 | 7,800 | 380 | 0.026 | 0.056 | 6,400 | 190 | 0.014 | 0.037 |
| | | 14 | 13,400 | 880 | 0.04 | 0.041 | 11,400 | 600 | 0.034 | 0.039 | 9,500 | 420 | 0.03 | 0.037 | 7,600 | 300 | 0.021 | 0.035 | 5,800 | 150 | 0.012 | 0.023 |
| | | 16 | 11,700 | 720 | 0.03 | 0.027 | 9,900 | 370 | 0.026 | 0.026 | 8,900 | 320 | 0.024 | 0.024 | 7,100 | 230 | 0.017 | 0.023 | 5,200 | 120 | 0.009 | 0.015 |
| | | 18 | 10,100 | 560 | 0.02 | 0.02 | 9,600 | 310 | 0.017 | 0.019 | 8,400 | 240 | 0.017 | 0.018 | 6,700 | 170 | 0.012 | 0.017 | 4,600 | 80 | 0.007 | 0.011 |
| | | 20 | 8,500 | 400 | 0.01 | 0.014 | 9,000 | 280 | 0.011 | 0.014 | 7,900 | 210 | 0.011 | 0.013 | 6,300 | 150 | 0.008 | 0.012 | 4,000 | 40 | 0.004 | 0.008 |
| 4016 | 1.6 | 6 | 19,200 | 1,670 | 0.08 | 0.682 | 15,100 | 1,320 | 0.068 | 0.644 | 13,900 | 920 | 0.054 | 0.606 | 11,100 | 660 | 0.039 | 0.569 | 8,000 | 340 | 0.022 | 0.379 |
| | | 8 | 17,000 | 1,500 | 0.07 | 0.288 | 15,000 | 950 | 0.06 | 0.272 | 12,400 | 800 | 0.048 | 0.256 | 9,900 | 570 | 0.034 | 0.24 | 7,400 | 300 | 0.02 | 0.16 |
| | | 10 | 16,100 | 1,320 | 0.06 | 0.148 | 12,700 | 930 | 0.051 | 0.139 | 10,900 | 700 | 0.042 | 0.131 | 8,700 | 500 | 0.03 | 0.123 | 6,800 | 250 | 0.017 | 0.082 |
| | | 12 | 14,500 | 1,140 | 0.05 | 0.085 | 11,500 | 750 | 0.043 | 0.08 | 9,500 | 590 | 0.036 | 0.075 | 7,600 | 420 | 0.026 | 0.071 | 6,200 | 210 | 0.014 | 0.047 |
| | | 14 | 13,000 | 970 | 0.04 | 0.054 | 10,300 | 660 | 0.034 | 0.051 | 9,100 | 460 | 0.03 | 0.048 | 7,300 | 330 | 0.021 | 0.045 | 5,600 | 170 | 0.012 | 0.03 |
| | | 16 | 11,400 | 790 | 0.03 | 0.036 | 9,500 | 380 | 0.02 | 0.034 | 8,500 | 350 | 0.024 | 0.032 | 6,800 | 250 | 0.017 | 0.03 | 5,000 | 130 | 0.009 | 0.02 |
| | | 18 | 9,800 | 620 | 0.02 | 0.025 | 9,300 | 340 | 0.017 | 0.024 | 8,000 | 250 | 0.017 | 0.022 | 6,400 | 180 | 0.012 | 0.021 | 4,500 | 80 | 0.007 | 0.014 |
| | | 20 | 8,200 | 440 | 0.011 | 0.018 | 8,700 | 300 | 0.011 | 0.017 | 7,600 | 220 | 0.011 | 0.016 | 6,100 | 160 | 0.008 | 0.015 | 3,900 | 40 | 0.004 | 0.01 |
| | | 26 | 8,000 | 300 | 0.007 | 0.009 | 7,400 | 210 | 0.006 | 0.009 | 6,600 | 170 | 0.006 | 0.008 | 5,300 | 120 | 0.004 | 0.008 | 2,400 | 20 | 0.002 | 0.005 |
| 4018 | 1.8 | 6 | 18,500 | 1,820 | 0.08 | 1.094 | 14,900 | 1,440 | 0.068 | 1.034 | 13,300 | 1,010 | 0.054 | 0.973 | 10,600 | 720 | 0.039 | 0.912 | 7,600 | 370 | 0.022 | 0.608 |
| | | 8 | 16,900 | 1,630 | 0.07 | 0.461 | 14,600 | 980 | 0.06 | 0.435 | 11,900 | 870 | 0.048 | 0.41 | 9,500 | 620 | 0.034 | 0.384 | 7,100 | 320 | 0.02 | 0.256 |
| | | 10 | 15,400 | 1,440 | 0.06 | 0.236 | 12,500 | 950 | 0.051 | 0.223 | 10,500 | 760 | 0.042 | 0.21 | 8,400 | 540 | 0.03 | 0.197 | 6,500 | 280 | 0.017 | 0.131 |
| | | 12 | 13,900 | 1,250 | 0.05 | 0.137 | 11,000 | 770 | 0.043 | 0.129 | 9,100 | 640 | 0.036 | 0.122 | 7,300 | 460 | 0.026 | 0.114 | 6,000 | 230 | 0.014 | 0.076 |
| | | 14 | 12,400 | 1,060 | 0.04 | 0.086 | 9,500 | 720 | 0.034 | 0.082 | 8,400 | 500 | 0.03 | 0.077 | 6,700 | 360 | 0.021 | 0.072 | 5,400 | 180 | 0.012 | 0.048 |
| | | 16 | 10,900 | 860 | 0.03 | 0.058 | 9,000 | 450 | 0.026 | 0.054 | 7,900 | 390 | 0.024 | 0.051 | 6,300 | 280 | 0.017 | 0.048 | 4,800 | 140 | 0.009 | 0.032 |
| | | 18 | 9,400 | 670 | 0.02 | 0.041 | 8,700 | 380 | 0.017 | 0.039 | 7,400 | 270 | 0.017 | 0.037 | 5,900 | 190 | 0.012 | 0.035 | 4,300 | 100 | 0.007 | 0.023 |
| | | 20 | 7,900 | 480 | 0.015 | 0.029 | 8,400 | 340 | 0.013 | 0.027 | 7,000 | 240 | 0.011 | 0.026 | 5,600 | 170 | 0.008 | 0.024 | 3,700 | 50 | 0.004 | 0.016 |
| | | 25 | 7,800 | 350 | 0.01 | 0.014 | 7,300 | 260 | 0.008 | 0.014 | 6,300 | 200 | 0.007 | 0.013 | 5,000 | 140 | 0.005 | 0.012 | 2,400 | 20 | 0.002 | 0.008 |

## Milling Conditions for HLS（4 Flutes）

| WORK MATERIAL | | | CARBON STEELS S45C / S50C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| 4020 | 2 | 6 | 17,900 | 1,980 | 0.08 | 1.667 | 14,500 | 1,560 | 0.068 | 1.574 | 12,900 | 1,090 | 0.054 | 1.482 | 10,300 | 780 | 0.039 | 1.389 | 7,400 | 400 | 0.022 | 0.926 |
| | | 8 | 16,400 | 1,770 | 0.07 | 0.704 | 14,200 | 1,000 | 0.06 | 0.665 | 11,500 | 950 | 0.048 | 0.626 | 9,200 | 680 | 0.034 | 0.587 | 6,800 | 350 | 0.02 | 0.391 |
| | | 10 | 14,900 | 1,560 | 0.06 | 0.36 | 12,000 | 980 | 0.051 | 0.34 | 10,100 | 830 | 0.042 | 0.32 | 8,100 | 590 | 0.03 | 0.3 | 6,300 | 300 | 0.017 | 0.2 |
| | | 12 | 13,500 | 1,350 | 0.05 | 0.209 | 10,500 | 790 | 0.043 | 0.197 | 8,800 | 690 | 0.036 | 0.186 | 7,000 | 490 | 0.026 | 0.174 | 5,800 | 250 | 0.014 | 0.116 |
| | | 14 | 12,000 | 1,140 | 0.04 | 0.131 | 9,400 | 780 | 0.034 | 0.124 | 8,300 | 550 | 0.03 | 0.117 | 6,600 | 390 | 0.021 | 0.11 | 5,200 | 200 | 0.012 | 0.073 |
| | | 16 | 10,600 | 940 | 0.03 | 0.088 | 9,000 | 500 | 0.026 | 0.083 | 7,600 | 420 | 0.024 | 0.078 | 6,100 | 300 | 0.017 | 0.074 | 4,700 | 160 | 0.009 | 0.049 |
| | | 18 | 9,100 | 730 | 0.022 | 0.061 | 8,700 | 420 | 0.02 | 0.058 | 7,300 | 290 | 0.017 | 0.054 | 5,800 | 210 | 0.012 | 0.051 | 4,100 | 100 | 0.007 | 0.034 |
| | | 20 | 7,700 | 520 | 0.018 | 0.045 | 8,100 | 380 | 0.016 | 0.043 | 6,900 | 270 | 0.013 | 0.04 | 5,500 | 190 | 0.009 | 0.038 | 3,600 | 50 | 0.004 | 0.025 |
| | | 25 | 7,500 | 390 | 0.012 | 0.023 | 7,100 | 290 | 0.011 | 0.022 | 6,100 | 220 | 0.008 | 0.021 | 4,900 | 160 | 0.006 | 0.02 | 2,400 | 20 | 0.002 | 0.013 |
| | | 30 | 7,000 | 310 | 0.008 | 0.013 | 6,300 | 230 | 0.007 | 0.012 | 5,600 | 180 | 0.006 | 0.011 | 4,500 | 130 | 0.004 | 0.011 | 2,400 | 10 | 0.001 | 0.007 |
| 4025 | 2.5 | 8 | | | | | 12,800 | 1,020 | 0.081 | 1.622 | 9,600 | 980 | 0.055 | 1.526 | 7,700 | 700 | 0.039 | 1.431 | 6,200 | 370 | 0.023 | 0.954 |
| | | 12 | | | | | 10,000 | 810 | 0.056 | 0.481 | 7,900 | 700 | 0.042 | 0.453 | 6,300 | 500 | 0.03 | 0.425 | 5,600 | 350 | 0.018 | 0.283 |
| | | 16 | | | | | 8,400 | 590 | 0.04 | 0.202 | 6,900 | 450 | 0.031 | 0.19 | 5,500 | 320 | 0.022 | 0.179 | 4,400 | 320 | 0.013 | 0.119 |
| | | 20 | | | | | 7,300 | 490 | 0.03 | 0.104 | 6,500 | 420 | 0.024 | 0.098 | 5,200 | 300 | 0.017 | 0.092 | 3,500 | 290 | 0.01 | 0.061 |
| | | 25 | | | | | 6,400 | 390 | 0.019 | 0.053 | 6,000 | 380 | 0.015 | 0.05 | 4,800 | 270 | 0.011 | 0.047 | 2,400 | 250 | 0.005 | 0.031 |
| | | 30 | | | | | 5,700 | 320 | 0.012 | 0.031 | 4,400 | 350 | 0.01 | 0.029 | 3,500 | 250 | 0.007 | 0.027 | 2,300 | 220 | 0.003 | 0.018 |
| 4030 | 3 | 8 | | | | | 10,900 | 1,080 | 0.093 | 2.361 | 7,400 | 1,010 | 0.073 | 2.222 | 5,900 | 720 | 0.052 | 2.084 | 5,900 | 440 | 0.031 | 1.389 |
| | | 12 | | | | | 8,700 | 830 | 0.073 | 0.996 | 7,000 | 730 | 0.057 | 0.938 | 5,600 | 520 | 0.041 | 0.879 | 5,000 | 400 | 0.024 | 0.586 |
| | | 16 | | | | | 7,400 | 670 | 0.058 | 0.42 | 6,600 | 520 | 0.045 | 0.395 | 5,300 | 370 | 0.032 | 0.371 | 4,000 | 370 | 0.019 | 0.247 |
| | | 20 | | | | | 6,600 | 560 | 0.045 | 0.216 | 6,100 | 490 | 0.035 | 0.203 | 4,900 | 350 | 0.025 | 0.191 | 3,400 | 340 | 0.015 | 0.127 |
| | | 25 | | | | | 5,800 | 460 | 0.032 | 0.111 | 5,600 | 450 | 0.025 | 0.14 | 4,500 | 320 | 0.018 | 0.098 | 2,400 | 290 | 0.011 | 0.065 |
| | | 30 | | | | | 5,200 | 390 | 0.023 | 0.065 | 4,300 | 410 | 0.02 | 0.061 | 3,400 | 290 | 0.014 | 0.057 | 2,300 | 250 | 0.009 | 0.038 |
| | | 40 | | | | | 4,500 | 280 | 0.012 | 0.027 | 4,100 | 320 | 0.014 | 0.026 | 3,300 | 230 | 0.01 | 0.024 | 2,000 | 170 | 0.006 | 0.016 |
| 4040 | 4 | 12 | | | | | 7,100 | 950 | 0.101 | 3.148 | 5,100 | 740 | 0.101 | 2.963 | 4,100 | 530 | 0.072 | 2.778 | 4,100 | 460 | 0.043 | 1.852 |
| | | 16 | | | | | 6,000 | 770 | 0.084 | 1.328 | 4,900 | 600 | 0.092 | 1.25 | 3,900 | 430 | 0.066 | 1.172 | 3,700 | 420 | 0.04 | 0.781 |
| | | 20 | | | | | 5,200 | 650 | 0.069 | 0.68 | 4,500 | 560 | 0.084 | 0.64 | 3,600 | 400 | 0.06 | 0.6 | 3,300 | 380 | 0.036 | 0.4 |
| | | 25 | | | | | 4,600 | 540 | 0.055 | 0.349 | 4,100 | 520 | 0.076 | 0.328 | 3,300 | 370 | 0.054 | 0.308 | 2,400 | 340 | 0.032 | 0.205 |
| | | 30 | | | | | 4,100 | 460 | 0.043 | 0.202 | 3,800 | 460 | 0.059 | 0.19 | 3,000 | 330 | 0.042 | 0.179 | 2,300 | 290 | 0.027 | 0.119 |
| | | 35 | | | | | 3,800 | 400 | 0.034 | 0.128 | 3,400 | 420 | 0.05 | 0.12 | 2,700 | 300 | 0.036 | 0.113 | 2,200 | 240 | 0.023 | 0.075 |
| | | 40 | | | | | 3,500 | 350 | 0.027 | 0.085 | 3,000 | 380 | 0.042 | 0.08 | 2,400 | 270 | 0.03 | 0.075 | 1,900 | 190 | 0.018 | 0.05 |
| | | 45 | | | | | 3,300 | 300 | 0.021 | 0.06 | 2,600 | 320 | 0.025 | 0.056 | 2,100 | 230 | 0.018 | 0.053 | 1,800 | 140 | 0.014 | 0.035 |
| | | 50 | | | | | 3,100 | 270 | 0.016 | 0.044 | 2,300 | 280 | 0.017 | 0.042 | 1,800 | 200 | 0.012 | 0.039 | 1,700 | 100 | 0.009 | 0.026 |
| 4050 | 5 | 16 | | | | | 5,100 | 860 | 0.128 | 3.242 | 4,100 | 670 | 0.108 | 3.051 | 3,300 | 480 | 0.077 | 2.861 | 3,300 | 480 | 0.048 | 1.907 |
| | | 25 | | | | | 3,800 | 600 | 0.102 | 0.85 | 3,600 | 570 | 0.088 | 0.8 | 2,900 | 410 | 0.063 | 0.75 | 2,400 | 380 | 0.037 | 0.5 |
| | | 35 | | | | | 3,100 | 450 | 0.077 | 0.309 | 2,900 | 480 | 0.059 | 0.291 | 2,300 | 340 | 0.042 | 0.273 | 2,000 | 270 | 0.026 | 0.182 |
| | | 50 | | | | | 2,400 | 300 | 0.034 | 0.107 | 2,000 | 320 | 0.022 | 0.101 | 1,600 | 230 | 0.016 | 0.095 | 1,500 | 110 | 0.01 | 0.063 |
| 4060 | 6 | 20 | | | | | 3,800 | 780 | 0.17 | 3.443 | 3,300 | 700 | 0.139 | 3.24 | 2,600 | 500 | 0.099 | 3.038 | 3,300 | 610 | 0.06 | 2.025 |
| | | 30 | | | | | 2,800 | 540 | 0.128 | 1.02 | 2,800 | 590 | 0.101 | 0.96 | 2,200 | 420 | 0.072 | 0.9 | 2,200 | 360 | 0.045 | 0.6 |
| | | 40 | | | | | 2,300 | 410 | 0.085 | 0.43 | 2,100 | 460 | 0.063 | 0.405 | 1,700 | 330 | 0.045 | 0.38 | 1,700 | 240 | 0.03 | 0.253 |
| | | 50 | | | | | 1,900 | 310 | 0.049 | 0.221 | 1,600 | 350 | 0.038 | 0.208 | 1,300 | 250 | 0.027 | 0.195 | 1,300 | 120 | 0.015 | 0.13 |

Recommend 2 flute HLS or C-CER.

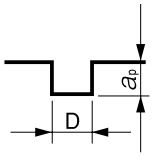
UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Ball
Long Neck Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data

# Milling Conditions for HLS（4 Flutes）

Slotting

$a_p$ : Axial Depth (mm)

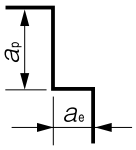
D : Outside Diameter (mm)




Side Milling

$a_p$ : Axial Depth (mm)

$a_e$ : Radial Depth (mm)




Note:
- Recommend using a non-contact measuring device to avoid damaging the precision tip point.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- Every coolant offers stable milling.
- Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
- Recommend wet coolant for Copper.

## Size φ1～φ12

# CXS

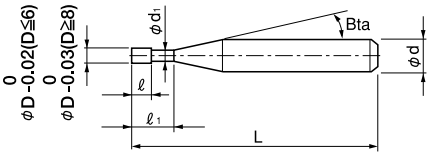
Super MG | UT COAT | 37°~40° | Flatland | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**Variable Pitch & Helix design minimizes vibration and chattering.**
**Selected high toughness and chip resistant carbide material.**
**Optimized flute design offers outstanding high efficiency milling and fine finishing.**
**Low friction coating resulting in excellent chip evacuation and resistance to wear.**




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

Total 33 models

Unit（mm）

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30' | 1° | 1°30' | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CXS 4010-030 | 1 | 3 | 1.5 | 0.96 | 16° | 50 | 4 | 6,520 | 3.25 | 3.35 | 3.47 | 3.59 | 3.86 |
| CXS 4010-050 | | 5 | | | | 70 | 4 | 6,920 | 5.31 | 5.48 | 5.67 | 5.87 | 6.31 |
| CXS 4010-060 | | 6 | | | | 70 | 4 | 7,110 | 6.34 | 6.55 | 6.77 | 7.00 | 7.53 |
| CXS 4015-045 | 1.5 | 4.5 | 2.25 | 1.46 | 16° | 50 | 4 | 6,520 | 4.66 | 4.81 | 4.97 | 5.15 | 5.53 |
| CXS 4015-070 | | 7 | | | | 70 | 4 | 6,920 | 7.23 | 7.47 | 7.72 | 7.99 | 8.59 |
| CXS 4015-085 | | 8.5 | | | | 70 | 4 | 7,110 | 8.78 | 9.07 | 9.37 | 9.70 | 10.43 |
| CXS 4020-060 | 2 | 6 | 3 | 1.94 | 16° | 50 | 4 | 6,100 | 6.24 | 6.44 | 6.66 | 6.89 | 7.41 |
| CXS 4020-090 | | 9 | | | | 70 | 4 | 6,480 | 9.33 | 9.64 | 9.96 | 10.31 | 11.08 |
| CXS 4020-110 | | 11 | | | | 70 | 4 | 6,650 | 11.40 | 11.77 | 12.16 | 12.59 | 13.53 |
| CXS 4025-075 | 2.5 | 7.5 | 3.75 | 2.44 | 16° | 50 | 4 | 6,100 | 7.79 | 8.04 | 8.31 | 8.60 | 9.25 |
| CXS 4025-110 | | 11 | | | | 70 | 4 | 6,480 | 11.40 | 11.77 | 12.16 | 12.59 | 13.53 |
| CXS 4025-135 | | 13.5 | | | | 70 | 4 | 6,650 | 13.97 | 14.43 | 14.91 | 15.43 | No Interference |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30' | 1° | 1°30' | 2° | 3° |
| **CXS 4030-090** | 3 | 9 | 4.5 | 2.95 | 16° | 50 | 6 | 7,000 | 9.34 | 9.64 | 9.97 | 10.31 | 11.09 |
| **CXS 4030-130** | | 13 | | | | 70 | 6 | 7,430 | 13.46 | 13.90 | 14.37 | 14.87 | 15.98 |
| **CXS 4030-160** | | 16 | | | | 70 | 6 | 7,630 | 16.56 | 17.10 | 17.67 | 18.28 | 19.65 |
| **CXS 4040-120** | 4 | 12 | 6 | 3.86 | 16° | 50 | 6 | 7,350 | 12.61 | 13.02 | 13.46 | 13.92 | 14.97 |
| **CXS 4040-170** | | 17 | | | | 70 | 6 | 7,800 | 17.76 | 18.34 | 18.96 | 19.62 | No Interference |
| **CXS 4040-210** | | 21 | | | | 70 | 6 | 8,010 | 21.89 | 22.60 | 23.36 | 24.17 | No Interference |
| **CXS 4050-150** | 5 | 15 | 7.5 | 4.86 | 16° | 50 | 6 | 7,900 | 15.70 | 16.21 | 16.76 | No Interference | No Interference |
| **CXS 4050-210** | | 21 | | | | 70 | 6 | 8,380 | 21.89 | 22.60 | No Interference | No Interference | No Interference |
| **CXS 4050-260** | | 26 | | | | 70 | 6 | 8,610 | 27.05 | 27.93 | No Interference | No Interference | No Interference |
| **CXS 4060-180** | 6 | 18 | 9 | 5.86 | — | 50 | 6 | 8,500 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4060-260** | | 26 | | | | 70 | 6 | 9,020 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4060-320** | | 32 | | | | 70 | 6 | 9,270 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4080-240** | 8 | 24 | 12 | 7.82 | — | 60 | 8 | 10,500 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4080-340** | | 34 | | | | 90 | 8 | 11,140 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4080-420** | | 42 | | | | 90 | 8 | 11,450 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4100-300** | 10 | 30 | 15 | 9.82 | — | 70 | 10 | 12,500 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4100-420** | | 42 | | | | 100 | 10 | 13,270 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4100-520** | | 52 | | | | 100 | 10 | 13,630 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4120-360** | 12 | 36 | 18 | 11.82 | — | 90 | 12 | 17,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4120-520** | | 52 | | | | 110 | 12 | 18,880 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CXS 4120-620** | | 62 | | | | 110 | 12 | 19,400 | No Interference | No Interference | No Interference | No Interference | No Interference |

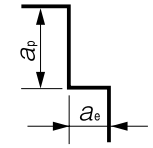
## Milling Conditions for CXS

### Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **4010-030** | **1** | 3 | 18,000 | 780 | 1 | 0.3 | 18,000 | 600 | 1 | 0.3 | 14,500 | 400 | 1 | 0.3 |
| **4010-050** | | 5 | 18,000 | 780 | 1 | 0.23 | 15,330 | 520 | 1 | 0.23 | 12,570 | 350 | 1 | 0.23 |
| **4010-060** | | 6 | 18,000 | 780 | 1 | 0.2 | 14,000 | 480 | 1 | 0.2 | 11,600 | 320 | 1 | 0.2 |
| **4015-045** | **1.5** | 4.5 | 13,500 | 970 | 1.5 | 0.45 | 13,500 | 750 | 1.5 | 0.45 | 13,300 | 420 | 1.5 | 0.45 |
| **4015-070** | | 7 | 13,500 | 970 | 1.5 | 0.36 | 11,810 | 660 | 1.5 | 0.36 | 11,610 | 360 | 1.5 | 0.36 |
| **4015-085** | | 8.5 | 13,500 | 970 | 1.5 | 0.3 | 10,800 | 600 | 1.5 | 0.3 | 10,600 | 330 | 1.5 | 0.3 |
| **4020-060** | **2** | 6 | 11,000 | 1,170 | 2 | 0.6 | 11,000 | 900 | 2 | 0.6 | 12,200 | 450 | 2 | 0.6 |
| **4020-090** | | 9 | 11,000 | 1,170 | 2 | 0.48 | 9,680 | 790 | 2 | 0.48 | 10,730 | 400 | 2 | 0.48 |
| **4020-110** | | 11 | 11,000 | 1,170 | 2 | 0.4 | 8,800 | 720 | 2 | 0.4 | 9,750 | 360 | 2 | 0.4 |
| **4025-075** | **2.5** | 7.5 | 9,500 | 1,180 | 2.5 | 0.75 | 9,500 | 900 | 2.5 | 0.75 | 11,000 | 550 | 2.5 | 0.75 |
| **4025-110** | | 11 | 9,500 | 1,180 | 2.5 | 0.6 | 8,390 | 800 | 2.5 | 0.6 | 9,720 | 490 | 2.5 | 0.6 |
| **4025-135** | | 13.5 | 9,500 | 1,180 | 2.5 | 0.5 | 7,600 | 720 | 2.5 | 0.5 | 8,800 | 440 | 2.5 | 0.5 |
| **4030-090** | **3** | 9 | 8,500 | 1,200 | 3 | 0.9 | 8,500 | 900 | 3 | 0.9 | 10,000 | 640 | 3 | 0.9 |
| **4030-130** | | 13 | 8,500 | 1,200 | 3 | 0.73 | 7,530 | 800 | 3 | 0.73 | 8,860 | 570 | 3 | 0.73 |
| **4030-160** | | 16 | 8,500 | 1,200 | 3 | 0.6 | 6,800 | 720 | 3 | 0.6 | 8,000 | 510 | 3 | 0.6 |
| **4040-120** | **4** | 12 | 7,200 | 1,350 | 4 | 1.2 | 6,700 | 1,000 | 4 | 1.2 | 7,500 | 730 | 4 | 1.2 |
| **4040-170** | | 17 | 7,200 | 1,350 | 4 | 0.98 | 5,920 | 890 | 4 | 0.98 | 6,670 | 650 | 4 | 0.98 |
| **4040-210** | | 21 | 7,200 | 1,350 | 4 | 0.8 | 5,300 | 800 | 4 | 0.8 | 6,000 | 580 | 4 | 0.8 |
| **4050-150** | **5** | 15 | 6,000 | 1,500 | 5 | 1.5 | 5,400 | 1,100 | 5 | 1.5 | 5,400 | 810 | 5 | 1.5 |
| **4050-210** | | 21 | 6,000 | 1,500 | 5 | 1.23 | 4,800 | 980 | 5 | 1.23 | 4,800 | 720 | 5 | 1.23 |
| **4050-260** | | 26 | 6,000 | 1,500 | 5 | 1 | 4,300 | 880 | 5 | 1 | 4,300 | 640 | 5 | 1 |
| **4060-180** | **6** | 18 | 5,000 | 1,600 | 6 | 1.8 | 4,500 | 1,200 | 6 | 1.8 | 4,500 | 810 | 6 | 1.8 |
| **4060-260** | | 26 | 5,000 | 1,600 | 6 | 1.46 | 3,990 | 1,060 | 6 | 1.46 | 3,990 | 710 | 6 | 1.46 |
| **4060-320** | | 32 | 5,000 | 1,600 | 6 | 1.2 | 3,600 | 960 | 6 | 1.2 | 3,600 | 640 | 6 | 1.2 |
| **4080-240** | **8** | 24 | 3,000 | 1,300 | 8 | 2.4 | 2,900 | 1,050 | 8 | 2.4 | 2,900 | 720 | 8 | 2.4 |
| **4080-340** | | 34 | 3,000 | 1,300 | 8 | 1.96 | 2,570 | 930 | 8 | 1.96 | 2,570 | 640 | 8 | 1.96 |
| **4080-420** | | 42 | 3,000 | 1,300 | 8 | 1.6 | 2,300 | 840 | 8 | 1.6 | 2,300 | 570 | 8 | 1.6 |
| **4100-300** | **10** | 30 | 1,600 | 1,000 | 10 | 3 | 1,500 | 900 | 10 | 3 | 1,500 | 580 | 10 | 3 |
| **4100-420** | | 42 | 1,600 | 1,000 | 10 | 2.45 | 1,340 | 800 | 10 | 2.45 | 1,340 | 510 | 10 | 2.45 |
| **4100-520** | | 52 | 1,600 | 1,000 | 10 | 2 | 1,200 | 720 | 10 | 2 | 1,200 | 460 | 10 | 2 |
| **4120-360** | **12** | 36 | 1,200 | 800 | 12 | 3.6 | 1,200 | 750 | 12 | 3.6 | 1,200 | 540 | 12 | 3.6 |
| **4120-520** | | 52 | 1,200 | 800 | 12 | 2.86 | 1,050 | 660 | 12 | 2.86 | 1,050 | 470 | 12 | 2.86 |
| **4120-620** | | 62 | 1,200 | 800 | 12 | 2.4 | 950 | 600 | 12 | 2.4 | 950 | 430 | 12 | 2.4 |

# Milling Conditions for CXS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **4010-030** | | 3 | 12,900 | 400 | 1 | 0.3 | 12,900 | 180 | 1 | 0.15 |
| **4010-050** | **1** | 5 | 11,170 | 350 | 1 | 0.23 | 12,900 | 180 | 1 | 0.12 |
| **4010-060** | | 6 | 10,300 | 320 | 1 | 0.2 | 12,900 | 180 | 1 | 0.1 |
| **4015-045** | | 4.5 | 10,500 | 500 | 1.5 | 0.45 | 9,500 | 280 | 1.5 | 0.225 |
| **4015-070** | **1.5** | 7 | 9,190 | 440 | 1.5 | 0.36 | 9,500 | 280 | 1.5 | 0.18 |
| **4015-085** | | 8.5 | 8,400 | 400 | 1.5 | 0.3 | 9,500 | 280 | 1.5 | 0.15 |
| **4020-060** | | 6 | 9,350 | 560 | 2 | 0.6 | 8,200 | 390 | 2 | 0.3 |
| **4020-090** | **2** | 9 | 8,210 | 490 | 2 | 0.48 | 8,200 | 390 | 2 | 0.24 |
| **4020-110** | | 11 | 7,450 | 440 | 2 | 0.4 | 8,200 | 390 | 2 | 0.2 |
| **4025-075** | | 7.5 | 8,300 | 610 | 2.5 | 0.75 | 7,800 | 510 | 2.5 | 0.375 |
| **4025-110** | **2.5** | 11 | 7,340 | 530 | 2.5 | 0.6 | 7,800 | 510 | 2.5 | 0.3 |
| **4025-135** | | 13.5 | 6,650 | 480 | 2.5 | 0.5 | 7,800 | 510 | 2.5 | 0.25 |
| **4030-090** | | 9 | 7,400 | 630 | 3 | 0.9 | 7,400 | 630 | 3 | 0.45 |
| **4030-130** | **3** | 13 | 6,540 | 560 | 3 | 0.73 | 7,400 | 630 | 3 | 0.36 |
| **4030-160** | | 16 | 5,900 | 500 | 3 | 0.6 | 7,400 | 630 | 3 | 0.3 |
| **4040-120** | | 12 | 5,900 | 650 | 4 | 1.2 | 5,900 | 650 | 4 | 0.6 |
| **4040-170** | **4** | 17 | 5,230 | 580 | 4 | 0.98 | 5,900 | 650 | 4 | 0.49 |
| **4040-210** | | 21 | 4,700 | 520 | 4 | 0.8 | 5,900 | 650 | 4 | 0.4 |
| **4050-150** | | 15 | 4,800 | 680 | 5 | 1.5 | 4,800 | 670 | 5 | 0.75 |
| **4050-210** | **5** | 21 | 4,250 | 600 | 5 | 1.23 | 4,800 | 670 | 5 | 0.61 |
| **4050-260** | | 26 | 3,800 | 540 | 5 | 1 | 4,800 | 670 | 5 | 0.5 |
| **4060-180** | | 18 | 4,000 | 680 | 6 | 1.8 | 4,000 | 680 | 6 | 0.9 |
| **4060-260** | **6** | 26 | 3,540 | 600 | 6 | 1.46 | 4,000 | 680 | 6 | 0.73 |
| **4060-320** | | 32 | 3,200 | 540 | 6 | 1.2 | 4,000 | 680 | 6 | 0.6 |
| **4080-240** | | 24 | 2,500 | 600 | 8 | 2.4 | 2,500 | 630 | 8 | 1.2 |
| **4080-340** | **8** | 34 | 2,220 | 530 | 8 | 1.96 | 2,500 | 630 | 8 | 0.98 |
| **4080-420** | | 42 | 2,000 | 480 | 8 | 1.6 | 2,500 | 630 | 8 | 0.8 |
| **4100-300** | | 30 | 1,500 | 430 | 10 | 3 | 1,500 | 570 | 10 | 1.5 |
| **4100-420** | **10** | 42 | 1,340 | 380 | 10 | 2.45 | 1,500 | 570 | 10 | 1.23 |
| **4100-520** | | 52 | 1,200 | 340 | 10 | 2 | 1,500 | 570 | 10 | 1 |
| **4120-360** | | 36 | 1,000 | 320 | 12 | 3.6 | 1,200 | 530 | 12 | 1.8 |
| **4120-520** | **12** | 52 | 880 | 280 | 12 | 2.86 | 1,200 | 500 | 12 | 1.43 |
| **4120-620** | | 62 | 800 | 250 | 12 | 2.4 | 1,200 | 480 | 12 | 1.2 |




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## Milling Conditions for CXS

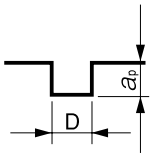
### Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | STAINLESS STEELS SUS304 Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4010-030** | **1** | 3 | 18,000 | 300 | 1 | 18,000 | 300 | 1 | 14,500 | 280 | 0.5 |
| **4010-050** | | 5 | 18,000 | 300 | 0.67 | 15,330 | 260 | 0.67 | 12,570 | 240 | 0.37 |
| **4010-060** | | 6 | 18,000 | 300 | 0.5 | 14,000 | 240 | 0.5 | 11,600 | 220 | 0.3 |
| **4015-045** | **1.5** | 4.5 | 13,500 | 450 | 1.5 | 13,500 | 400 | 1.5 | 13,300 | 300 | 0.75 |
| **4015-070** | | 7 | 13,500 | 450 | 1.03 | 11,810 | 350 | 1.03 | 11,610 | 260 | 0.56 |
| **4015-085** | | 8.5 | 13,500 | 450 | 0.75 | 10,800 | 320 | 0.75 | 10,600 | 240 | 0.45 |
| **4020-060** | **2** | 6 | 11,000 | 600 | 2 | 11,000 | 400 | 2 | 12,200 | 320 | 1 |
| **4020-090** | | 9 | 11,000 | 600 | 1.4 | 9,680 | 350 | 1.4 | 10,730 | 280 | 0.76 |
| **4020-110** | | 11 | 11,000 | 600 | 1 | 8,800 | 320 | 1 | 9,750 | 250 | 0.6 |
| **4025-075** | **2.5** | 7.5 | 9,500 | 600 | 2.5 | 9,500 | 400 | 2.5 | 11,000 | 340 | 1.25 |
| **4025-110** | | 11 | 9,500 | 600 | 1.77 | 8,390 | 350 | 1.77 | 9,720 | 300 | 0.96 |
| **4025-135** | | 13.5 | 9,500 | 600 | 1.25 | 7,600 | 320 | 1.25 | 8,800 | 270 | 0.75 |
| **4030-090** | **3** | 9 | 8,500 | 600 | 3 | 8,500 | 400 | 3 | 10,000 | 360 | 1.5 |
| **4030-130** | | 13 | 8,500 | 600 | 2.57 | 7,530 | 350 | 2.14 | 8,860 | 310 | 1.16 |
| **4030-160** | | 16 | 8,500 | 600 | 2.25 | 6,800 | 320 | 1.5 | 8,000 | 280 | 0.9 |
| **4040-120** | **4** | 12 | 7,200 | 650 | 4 | 6,700 | 450 | 4 | 7,500 | 400 | 2 |
| **4040-170** | | 17 | 7,200 | 650 | 3.44 | 5,920 | 400 | 2.89 | 6,670 | 360 | 1.56 |
| **4040-210** | | 21 | 7,200 | 650 | 3 | 5,300 | 360 | 2 | 6,000 | 320 | 1.2 |
| **4050-150** | **5** | 15 | 6,000 | 700 | 5 | 5,400 | 500 | 5 | 5,400 | 460 | 2.5 |
| **4050-210** | | 21 | 6,000 | 700 | 4.32 | 4,800 | 450 | 3.64 | 4,800 | 410 | 1.95 |
| **4050-260** | | 26 | 6,000 | 700 | 3.75 | 4,300 | 400 | 2.5 | 4,300 | 360 | 1.5 |
| **4060-180** | **6** | 18 | 5,000 | 700 | 6 | 4,500 | 500 | 6 | 4,500 | 460 | 3 |
| **4060-260** | | 26 | 5,000 | 700 | 5.14 | 3,990 | 440 | 4.29 | 3,990 | 400 | 2.31 |
| **4060-320** | | 32 | 5,000 | 700 | 4.5 | 3,600 | 400 | 3 | 3,600 | 360 | 1.8 |
| **4080-240** | **8** | 24 | 3,000 | 500 | 8 | 2,900 | 360 | 8 | 2,900 | 360 | 4 |
| **4080-340** | | 34 | 3,000 | 500 | 6.89 | 2,570 | 320 | 5.78 | 2,570 | 320 | 3.11 |
| **4080-420** | | 42 | 3,000 | 500 | 6 | 2,300 | 280 | 4 | 2,300 | 280 | 2.4 |
| **4100-300** | **10** | 30 | 1,600 | 380 | 10 | 1,500 | 270 | 10 | 1,500 | 220 | 5 |
| **4100-420** | | 42 | 1,600 | 380 | 8.64 | 1,340 | 240 | 7.27 | 1,340 | 190 | 3.91 |
| **4100-520** | | 52 | 1,600 | 380 | 7.5 | 1,200 | 210 | 5 | 1,200 | 170 | 3 |
| **4120-360** | **12** | 36 | 1,200 | 300 | 12 | 1,200 | 210 | 12 | 1,200 | 180 | 6 |
| **4120-520** | | 52 | 1,200 | 300 | 10.15 | 1,050 | 180 | 8.31 | 1,050 | 160 | 4.52 |
| **4120-620** | | 62 | 1,200 | 300 | 9 | 950 | 160 | 6 | 950 | 140 | 3.6 |

# Milling Conditions for CXS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4010-030** | **1** | 3 | 12,900 | 170 | 1 | 12,900 | 60 | 0.25 |
| **4010-050** | | 5 | 11,170 | 140 | 0.67 | setting disable | setting disable | setting disable |
| **4010-060** | | 6 | 10,300 | 130 | 0.5 | setting disable | setting disable | setting disable |
| **4015-045** | **1.5** | 4.5 | 10,500 | 230 | 1.5 | 9,500 | 120 | 0.375 |
| **4015-070** | | 7 | 9,190 | 200 | 1.03 | setting disable | setting disable | setting disable |
| **4015-085** | | 8.5 | 8,400 | 180 | 0.75 | setting disable | setting disable | setting disable |
| **4020-060** | **2** | 6 | 9,350 | 280 | 2 | 8,200 | 180 | 0.5 |
| **4020-090** | | 9 | 8,210 | 240 | 1.4 | setting disable | setting disable | setting disable |
| **4020-110** | | 11 | 7,450 | 220 | 1 | setting disable | setting disable | setting disable |
| **4025-075** | **2.5** | 7.5 | 8,300 | 300 | 2.5 | 7,800 | 270 | 0.625 |
| **4025-110** | | 11 | 7,340 | 270 | 1.77 | setting disable | setting disable | setting disable |
| **4025-135** | | 13.5 | 6,650 | 240 | 1.25 | setting disable | setting disable | setting disable |
| **4030-090** | **3** | 9 | 7,400 | 320 | 3 | 7,400 | 360 | 1.5 |
| **4030-130** | | 13 | 6,540 | 280 | 2.14 | setting disable | setting disable | setting disable |
| **4030-160** | | 16 | 5,900 | 250 | 1.5 | setting disable | setting disable | setting disable |
| **4040-120** | **4** | 12 | 5,900 | 390 | 4 | 5,900 | 380 | 2 |
| **4040-170** | | 17 | 5,230 | 350 | 2.89 | setting disable | setting disable | setting disable |
| **4040-210** | | 21 | 4,700 | 310 | 2 | setting disable | setting disable | setting disable |
| **4050-150** | **5** | 15 | 4,800 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4050-210** | | 21 | 4,250 | 390 | 3.64 | setting disable | setting disable | setting disable |
| **4050-260** | | 26 | 3,800 | 350 | 2.5 | setting disable | setting disable | setting disable |
| **4060-180** | **6** | 18 | 4,000 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-260** | | 26 | 3,540 | 390 | 4.29 | setting disable | setting disable | setting disable |
| **4060-320** | | 32 | 3,200 | 350 | 3 | setting disable | setting disable | setting disable |
| **4080-240** | **8** | 24 | 2,500 | 390 | 8 | 2,500 | 340 | 4 |
| **4080-340** | | 34 | 2,220 | 350 | 5.78 | setting disable | setting disable | setting disable |
| **4080-420** | | 42 | 2,000 | 310 | 4 | setting disable | setting disable | setting disable |
| **4100-300** | **10** | 30 | 1,500 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-420** | | 42 | 1,340 | 190 | 7.27 | setting disable | setting disable | setting disable |
| **4100-520** | | 52 | 1,200 | 170 | 5 | setting disable | setting disable | setting disable |
| **4120-360** | **12** | 36 | 1,000 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-520** | | 52 | 880 | 160 | 8.31 | setting disable | setting disable | setting disable |
| **4120-620** | | 62 | 800 | 140 | 6 | setting disable | setting disable | setting disable |

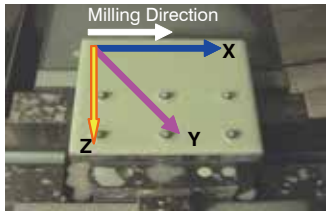
Contact our sales when milling hardened steels with L/D=5 or longer effective length tools.




Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

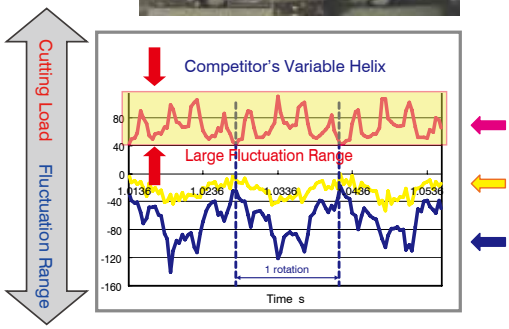
Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・These milling parameters are calculated based on the shortest overhang length.
Longer overhangs may require an adjustment to the milling parameters.
・Reduce the milling amount and feed rate in accordance with required milling precision.
・Every coolant offers stable milling.
・Recommend water soluble or oil coolant for Stainless Steels and Copper.

## Cutting Load Comparison CXS φ8 SKD61 (50HRC)

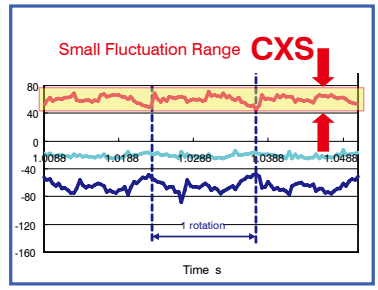



◆Milling Conditions

| | |
|---|---|
| Spindle Speed | 4,200 min$^{-1}$ |
| Feed Rate | **770 mm/min** |
| Axial Depth $a_p$ | 8 mm |
| Radial Depth $a_e$ | **0.3 mm** |
| Coolant | Water Soluble |




Tool damage and surface quality will be influenced by the cutting load fluctuation range.




CXS has a small fluctuation range and the tool is hard to chatter.

## High Efficiency Milling Example CXS φ8 SUS304

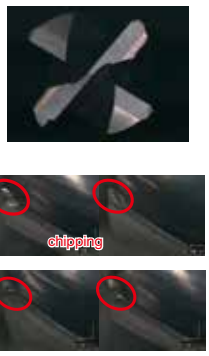
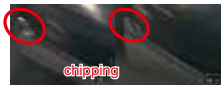
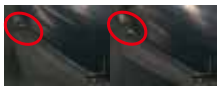
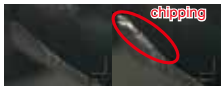
◆Milling Conditions

| | |
|---|---|
| Spindle Speed | 5,000 min$^{-1}$ |
| Feed Rate | **600 mm/min** |
| Axial Depth $a_p$ | 8 mm |
| Radial Depth $a_e$ | **3 mm** |
| Coolant | Water Soluble |
| Milling Distance | 5.4 m |

※Using company B's milling condition

**No tool damage on peripheral flute.**

## Milling Example by Different Work Materials ① CXS φ8 SKD61 (50HRC)

| CXS | Competitor A: Variable Helix | Competitor B: Variable Helix |
|---|---|---|
| |  | |
|  |   | |
|  |  |   |
| **Milling Distance** 77 m | **Milling Distance** 44 m | **Milling Distance** 22 m |

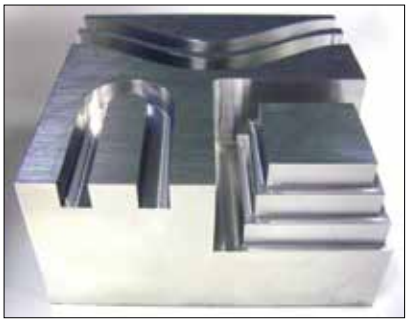
◆Milling Conditions

| | |
|---|---|
| Spindle Speed | 4,200 $min^{-1}$ |
| Feed Rate | **770 mm/min** |
| Axial Depth $a_p$ | 8 mm |
| Radial Depth $a_e$ | **1 mm** |
| Coolant | Water Soluble |

※Using company B's milling condition

**Designed for a heavy roughing cut, even up to 50HRC**

## Milling Example by Different Work Materials ② CXS φ8 SUS304



Size : 100 × 100 × 50 mm

◆Milling Conditions

| | |
|---|---|
| Milling Method | Side Milling, Slotting (One Direction) |
| Spindle Speed | 2,900 $min^{-1}$ |
| Feed Rate | 360 mm/min (Slotting)<br>720 mm/min (Side Milling) |
| Axial Depth $a_p$ | **8 mm (1D)** |
| Radial Depth $a_e$ | 2.4 mm |
| Coolant | Water Soluble |
| Cycle Time | **5 min** |

**High efficiency milling of difficult-to-cut material (SUS304).**

◆Tool after Milling

| Flatland | Tool Tip Relief Surface | **8 mm from Tip Point (ap : 8 mm)** |
|---|---|---|
| | | |

**Excellent tool life for high efficiency milling and finishing process.**

**CXS Series SUS304 Milling Video**

Size φ1～φ12

# C-CRS

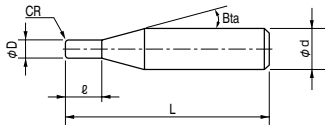
Super MG | UT COAT | 30° | R | R ±0.02 | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**Various range of Corner Radius.**
**Broad application range from Copper and Carbon Steels up to Hardened Steels (55HRC).**




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

Total 46 models

Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CRS 2010-02 | 1 | R0.2 | 2 | 16° | 45 | 4 | 7,900 |
| C-CRS 2010-03 | | R0.3 | | | 45 | 4 | 7,900 |
| C-CRS 2015-02 | 1.5 | R0.2 | 3 | 16° | 45 | 4 | 7,900 |
| C-CRS 2015-03 | | R0.3 | | | 45 | 4 | 7,900 |
| C-CRS 2015-05 | | R0.5 | | | 45 | 4 | 7,900 |
| C-CRS 2020-02 | 2 | R0.2 | 4 | 16° | 45 | 4 | 7,900 |
| C-CRS 2020-03 | | R0.3 | | | 45 | 4 | 7,900 |
| C-CRS 2020-05 | | R0.5 | | | 45 | 4 | 7,900 |
| C-CRS 2025-02 | 2.5 | R0.2 | 5 | 16° | 45 | 4 | 7,900 |
| C-CRS 2025-03 | | R0.3 | | | 45 | 4 | 7,900 |
| C-CRS 2025-05 | | R0.5 | | | 45 | 4 | 8,600 |
| C-CRS 2030-02 | 3 | R0.2 | 10 | 16° | 45 | 6 | 9,030 |
| C-CRS 2030-03 | | R0.3 | | | 45 | 6 | 9,030 |
| C-CRS 2030-05 | | R0.5 | | | 45 | 6 | 9,980 |
| C-CRS 2030-10 | | R1 | | | 45 | 6 | 10,710 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CRS 2040-02 | 4 | R0.2 | 12 | 16° | 45 | 6 | 9,140 |
| C-CRS 2040-03 | | R0.3 | | | 45 | 6 | 9,140 |
| C-CRS 2040-05 | | R0.5 | | | 45 | 6 | 10,080 |
| C-CRS 2040-10 | | R1 | | | 45 | 6 | 10,820 |
| C-CRS 2050-02 | 5 | R0.2 | 15 | 16° | 50 | 6 | 9,240 |
| C-CRS 2050-03 | | R0.3 | | | 50 | 6 | 9,240 |
| C-CRS 2050-05 | | R0.5 | | | 50 | 6 | 10,190 |
| C-CRS 2050-10 | | R1 | | | 50 | 6 | 10,920 |
| C-CRS 2060-02 | 6 | R0.2 | 15 | — | 50 | 6 | 10,190 |
| C-CRS 2060-03 | | R0.3 | | | 50 | 6 | 10,190 |
| C-CRS 2060-05 | | R0.5 | | | 50 | 6 | 10,400 |
| C-CRS 2060-10 | | R1 | | | 50 | 6 | 11,130 |
| C-CRS 2060-15 | | R1.5 | | | 50 | 6 | 11,550 |
| C-CRS 2060-20 | | R2 | | | 50 | 6 | 11,870 |
| C-CRS 2080-05 | 8 | R0.5 | 20 | — | 60 | 8 | 14,740 |
| C-CRS 2080-10 | | R1 | | | 60 | 8 | 15,510 |
| C-CRS 2080-15 | | R1.5 | | | 60 | 8 | 15,950 |
| C-CRS 2080-20 | | R2 | | | 60 | 8 | 16,280 |
| C-CRS 2080-25 | | R2.5 | | | 60 | 8 | 16,720 |
| C-CRS 2100-05 | 10 | R0.5 | 25 | — | 70 | 10 | 19,140 |
| C-CRS 2100-10 | | R1 | | | 70 | 10 | 19,910 |
| C-CRS 2100-15 | | R1.5 | | | 70 | 10 | 20,350 |
| C-CRS 2100-20 | | R2 | | | 70 | 10 | 20,680 |
| C-CRS 2100-25 | | R2.5 | | | 70 | 10 | 21,120 |
| C-CRS 2100-30 | | R3 | | | 70 | 10 | 21,120 |
| C-CRS 2120-05 | 12 | R0.5 | 25 | — | 75 | 12 | 23,980 |
| C-CRS 2120-10 | | R1 | | | 75 | 12 | 24,750 |
| C-CRS 2120-15 | | R1.5 | | | 75 | 12 | 25,190 |
| C-CRS 2120-20 | | R2 | | | 75 | 12 | 25,520 |
| C-CRS 2120-25 | | R2.5 | | | 75 | 12 | 25,960 |
| C-CRS 2120-30 | | R3 | | | 75 | 12 | 25,960 |

## Milling Conditions for C-CRS

| WORK MATERIAL | | CARBON STEELS S45C / S50C (~225HB) | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2010** | **1** | 16,000 | 340 | 0.25 | 12,700 | 120 | 0.25 |
| **2020** | **2** | 8,000 | 200 | 0.5 | 6,400 | 120 | 0.5 |
| **2025** | **2.5** | 6,300 | 200 | 0.63 | 5,100 | 120 | 0.63 |
| **2030** | **3** | 5,000 | 200 | 1.5 | 4,200 | 120 | 1.5 |
| **2040** | **4** | 4,000 | 240 | 2 | 3,200 | 150 | 2 |
| **2050** | **5** | 3,200 | 240 | 2.5 | 2,550 | 150 | 2.5 |
| **2060** | **6** | 2,650 | 240 | 3 | 2,120 | 150 | 3 |
| **2080** | **8** | 2,000 | 240 | 4 | 1,600 | 150 | 4 |
| **2100** | **10** | 1,600 | 240 | 5 | 1,270 | 150 | 5 |
| **2120** | **12** | 1,330 | 240 | 6 | 1,060 | 150 | 6 |

| WORK MATERIAL | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | HARDENED STEELS SKD / SKT (45~50HRC) | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2010** | **1** | 9,550 | 65 | 0.25 | 5,580 | 22 | 0.05 |
| **2020** | **2** | 4,800 | 55 | 0.5 | 2,790 | 31 | 0.1 |
| **2025** | **2.5** | 3,800 | 55 | 0.63 | 2,250 | 31 | 0.13 |
| **2030** | **3** | 3,180 | 55 | 1.5 | 2,120 | 33 | 0.15 |
| **2040** | **4** | 2,390 | 65 | 2 | 1,590 | 39 | 0.2 |
| **2050** | **5** | 1,910 | 65 | 2.5 | 1,270 | 39 | 0.25 |
| **2060** | **6** | 1,590 | 65 | 3 | 1,060 | 39 | 0.3 |
| **2080** | **8** | 1,190 | 70 | 4 | 800 | 39 | 0.4 |
| **2100** | **10** | 950 | 70 | 5 | 640 | 39 | 0.5 |
| **2120** | **12** | 800 | 70 | 6 | 530 | 39 | 0.6 |

Milling Amount for Slotting(mm)

45HRC or below

D＜φ3　$a_p$=0.25D

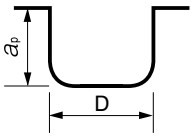
D≧φ3　$a_p$=0.5D

45HRC or above

$a_p$=0.05D

$a_p$：Axial Depth(mm)

D ：Outside Diameter(mm)




Note:
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

## Size φ6～φ12

# CNRS

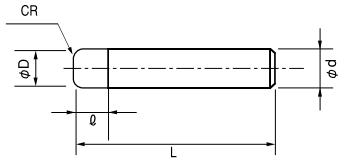
Super MG | UT COAT | 45° | R | R ±0.01 (φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ☆ | ☆ | | |

## Features

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




Total 12 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **CNRS 4060-05-16** | 6 | R0.5 | 16 | 90 | 6 | 15,000 |
| **CNRS 4060-10-16** | | R1 | | 90 | 6 | 15,000 |
| **CNRS 4080-05-16** | 8 | R0.5 | 16 | 100 | 8 | 17,800 |
| **CNRS 4080-10-16** | | R1 | | 100 | 8 | 17,800 |
| **CNRS 4100-05-26** | 10 | R0.5 | 26 | 110 | 10 | 21,800 |
| **CNRS 4100-10-26** | | R1 | | 110 | 10 | 21,800 |
| **CNRS 4100-15-26** | | R1.5 | | 110 | 10 | 21,800 |
| **CNRS 4100-20-26** | | R2 | | 110 | 10 | 21,800 |
| **CNRS 4120-05-26** | 12 | R0.5 | 26 | 120 | 12 | 27,700 |
| **CNRS 4120-10-26** | | R1 | | 120 | 12 | 27,700 |
| **CNRS 4120-15-26** | | R1.5 | | 120 | 12 | 27,700 |
| **CNRS 4120-20-26** | | R2 | | 120 | 12 | 27,700 |

# Milling Conditions for CNRS

◆Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C | | | | ALLOY STEELS SK / SCM | | | | STAINLESS STEELS SUS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4060-05-16** | **6** | R0.5 | 5,180 | 1,330 | 9.6 | 0.9 | 4,920 | 1,330 | 7.2 | 0.6 | 3,520 | 740 | 4.8 | 0.3 |
| **4060-10-16** | | R1 | 5,180 | 1,330 | 9.6 | 0.9 | 5,180 | 1,330 | 7.2 | 0.6 | 3,700 | 740 | 4.8 | 0.3 |
| **4080-05-16** | **8** | R0.5 | 3,920 | 1,260 | 12.8 | 1.2 | 3,720 | 1,260 | 9.6 | 0.8 | 2,660 | 700 | 6.4 | 0.4 |
| **4080-10-16** | | R1 | 3,920 | 1,260 | 12.8 | 1.2 | 3,920 | 1,260 | 9.6 | 0.8 | 2,800 | 700 | 6.4 | 0.4 |
| **4100-05-26** | **10** | R0.5 | 2,770 | 1,225 | 16 | 1.5 | 2,630 | 1,220 | 12 | 1 | 1,880 | 680 | 8 | 0.5 |
| **4100-10-26** | | R1 | 2,770 | 1,225 | 16 | 1.5 | 2,770 | 1,220 | 12 | 1 | 1,980 | 680 | 8 | 0.5 |
| **4100-15-26** | | R1.5 | 2,770 | 1,225 | 16 | 1.5 | 2,930 | 1,220 | 12 | 1 | 2,090 | 680 | 8 | 0.5 |
| **4100-20-26** | | R2 | 2,770 | 1,225 | 16 | 1.5 | 3,080 | 1,220 | 12 | 1 | 2,200 | 680 | 8 | 0.5 |
| **4120-05-26** | **12** | R0.5 | 2,330 | 1,170 | 19.2 | 1.8 | 2,210 | 1,170 | 14.4 | 1.2 | 1,580 | 650 | 9.6 | 0.6 |
| **4120-10-26** | | R1 | 2,330 | 1,170 | 19.2 | 1.8 | 2,330 | 1,170 | 14.4 | 1.2 | 1,670 | 650 | 9.6 | 0.6 |
| **4120-15-26** | | R1.5 | 2,330 | 1,170 | 19.2 | 1.8 | 2,470 | 1,170 | 14.4 | 1.2 | 1,760 | 650 | 9.6 | 0.6 |
| **4120-20-26** | | R2 | 2,330 | 1,170 | 19.2 | 1.8 | 2,590 | 1,170 | 14.4 | 1.2 | 1,850 | 650 | 9.6 | 0.6 |

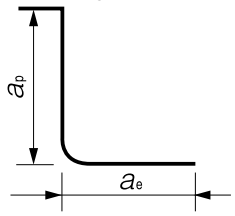
| WORK MATERIAL | | | TITANIUM / TITANIUM ALLOYS Ti-6Al-4V | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4060-05-16** | **6** | R0.5 | 3,520 | 740 | 4.8 | 0.3 | 1,710 | 300 | 4.8 | 0.3 |
| **4060-10-16** | | R1 | 3,700 | 740 | 4.8 | 0.3 | 1,800 | 300 | 4.8 | 0.3 |
| **4080-05-16** | **8** | R0.5 | 2,660 | 700 | 6.4 | 0.4 | 1,570 | 280 | 6.4 | 0.4 |
| **4080-10-16** | | R1 | 2,800 | 700 | 6.4 | 0.4 | 1,650 | 280 | 6.4 | 0.4 |
| **4100-05-26** | **10** | R0.5 | 1,880 | 680 | 8 | 0.5 | 1,110 | 250 | 8 | 0.5 |
| **4100-10-26** | | R1 | 1,980 | 680 | 8 | 0.5 | 1,170 | 250 | 8 | 0.5 |
| **4100-15-26** | | R1.5 | 2,090 | 680 | 8 | 0.5 | 1,240 | 250 | 8 | 0.5 |
| **4100-20-26** | | R2 | 2,200 | 680 | 8 | 0.5 | 1,300 | 250 | 8 | 0.5 |
| **4120-05-26** | **12** | R0.5 | 1,580 | 650 | 9.6 | 0.6 | 940 | 220 | 9.6 | 0.6 |
| **4120-10-26** | | R1 | 1,670 | 650 | 9.6 | 0.6 | 990 | 220 | 9.6 | 0.6 |
| **4120-15-26** | | R1.5 | 1,760 | 650 | 9.6 | 0.6 | 1,050 | 220 | 9.6 | 0.6 |
| **4120-20-26** | | R2 | 1,850 | 650 | 9.6 | 0.6 | 1,100 | 220 | 9.6 | 0.6 |

Please adjust milling parameters referring following table.

D : $\phi$ 6 ~ $\phi$ 12

| Overhang Lengh | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| ~D×4 | ×1 | ×1 | ×1 | ×1 |
| ~D×5 | ×0.7 | ×0.7 | ×0.7 | ×0.8 |
| ~D×6 | ×0.5 | ×0.5 | ×0.6 | ×0.7 |

Side Milling




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## Milling Conditions for CNRS

◆Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C | | | ALLOY STEELS SK / SCM | | | STAINLESS STEELS SUS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4060-05-16** | **6** | R0.5 | 2,035 | 250 | 6 | 1,930 | 360 | 3 | 1,760 | 330 | 1.5 |
| **4060-10-16** | | R1 | 2,035 | 250 | 6 | 2,040 | 360 | 3 | 1,850 | 330 | 1.5 |
| **4080-05-16** | **8** | R0.5 | 1,550 | 210 | 8 | 1,470 | 300 | 4 | 1,340 | 270 | 2 |
| **4080-10-16** | | R1 | 1,550 | 210 | 8 | 1,550 | 300 | 4 | 1,410 | 270 | 2 |
| **4100-05-26** | **10** | R0.5 | 1,260 | 210 | 10 | 1,200 | 300 | 5 | 1,090 | 270 | 2.5 |
| **4100-10-26** | | R1 | 1,260 | 210 | 10 | 1,260 | 300 | 5 | 1,150 | 270 | 2.5 |
| **4100-15-26** | | R1.5 | 1,260 | 210 | 10 | 1,330 | 300 | 5 | 1,210 | 270 | 2.5 |
| **4100-20-26** | | R2 | 1,260 | 210 | 10 | 1,400 | 300 | 5 | 1,270 | 270 | 2.5 |
| **4120-05-26** | **12** | R0.5 | 1,020 | 200 | 12 | 970 | 290 | 6 | 880 | 260 | 3 |
| **4120-10-26** | | R1 | 1,020 | 200 | 12 | 1,020 | 290 | 6 | 930 | 260 | 3 |
| **4120-15-26** | | R1.5 | 1,020 | 200 | 12 | 1,080 | 290 | 6 | 980 | 260 | 3 |
| **4120-20-26** | | R2 | 1,020 | 200 | 12 | 1,140 | 290 | 6 | 1,030 | 260 | 3 |

| WORK MATERIAL | | | TITANIUM / TITANIUM ALLOYS Ti-6Al-4V | | | HEAT RESISTANT ALLOYS Inconel718 | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4060-05-16** | **6** | R0.5 | 1,600 | 300 | 0.6 | 810 | 100 | 0.6 |
| **4060-10-16** | | R1 | 1,680 | 300 | 0.6 | 850 | 100 | 0.6 |
| **4080-05-16** | **8** | R0.5 | 1,220 | 250 | 0.8 | 620 | 90 | 0.8 |
| **4080-10-16** | | R1 | 1,280 | 250 | 0.8 | 650 | 90 | 0.8 |
| **4100-05-26** | **10** | R0.5 | 990 | 250 | 1 | 460 | 80 | 1 |
| **4100-10-26** | | R1 | 1,040 | 250 | 1 | 490 | 80 | 1 |
| **4100-15-26** | | R1.5 | 1,100 | 250 | 1 | 520 | 80 | 1 |
| **4100-20-26** | | R2 | 1,160 | 250 | 1 | 540 | 80 | 1 |
| **4120-05-26** | **12** | R0.5 | 800 | 240 | 1.2 | 380 | 70 | 1.2 |
| **4120-10-26** | | R1 | 840 | 240 | 1.2 | 410 | 70 | 1.2 |
| **4120-15-26** | | R1.5 | 890 | 240 | 1.2 | 430 | 70 | 1.2 |
| **4120-20-26** | | R2 | 940 | 240 | 1.2 | 450 | 70 | 1.2 |

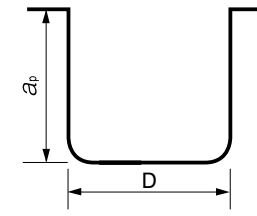
Please adjust milling parameters referring following table.

D : $\phi$ 6 ~ $\phi$ 12

| Overhang Length | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| ~D×4 | ×1 | ×1 | ×1 | ×1 |
| ~D×5 | ×0.7 | ×0.7 | ×0.7 | ×0.8 |
| ~D×6 | ×0.5 | ×0.5 | ×0.6 | ×0.7 |

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Recommend water soluble or oil coolant.

Slotting




$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

## Pocket Milling Example: Milling with CNRS $\phi$10 × CR2 — Ti6Al-4V (30HRC)

### Stable milling on hard-to-cut materials

| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Cycle Time | Coolant | Pocket Size |
|---|---|---|---|---|---|---|---|
| 1,820 min$^{-1}$ $V_c$= 57 m/min | 700 mm/min fz= 0.096 mm/t | 0.5 mm | 5 mm | 45 mm (4.5D) | 30 min | Water Soluble (Through Spindle) | 70 × 44 × 13 mm |

### CNRS

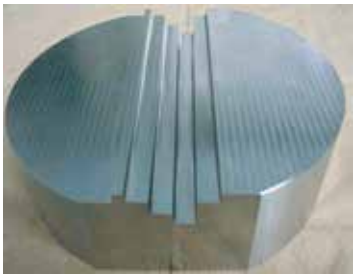
Continuous cutting is possible after 60 min milling.

### Competitor's Tool

Corner radius is broken after 30min (one pocket) milling.

## Slotting Example: Milling with CNRS $\phi$8 × CR1 — Inconel718 (40HRC)

| Milling Process | Roughing | | Finishing |
|---|---|---|---|
| Milling Method | Slotting | Side Milling | |
| Spindle Speed | 576 min$^{-1}$ ($V_c$=14.5 m/min) | 1,650 min$^{-1}$ ($V_c$=41.5 m/min) | |
| Feed Rate | 72 mm/min (fz=0.03 mm/t) | 280 mm/min (fz=0.04 mm/t) | 200 mm/min (fz=0.03 mm/t) |
| Axial Depth $a_p$ | 0.8 mm | 6.4 mm | 0.1 mm |
| Radial Depth $a_e$ | — | 0.4 mm | 0.1 mm |
| Overhang Length | 30 mm (3.75D) | | |
| Coolant | Water Soluble (Nozzle) | | |
| Cycle Time | 105 min | | 10 min |



**Reduces burrs in step milling process. Offers better surface finish with unique cutting edge.**

Size φ1～φ12

# CXERS

Super MG | UT COAT | 37°~40° | R | R ±0.005 (φ1～φ3) | R ±0.01 (φ4～φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

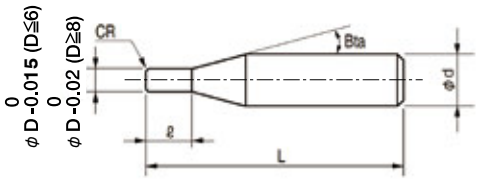
Additional 10 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**Variable Division & Variable Helix design minimizes vibration and chattering.**
**Selected carbide material with high toughness & high chip resistance.**
**Excellent wear-resistance for the wide range of milling applications, from highly efficient milling to finishing.**
**Low friction coating resulting in excellent chip evacuation and resistance to wear.**
**Decreasing cutting resistance and offering stable milling by the original corner R design.**




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

Total 56 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|
| CXERS 4010-01-025 | 1 | R0.1 | 2.5 | 16° | 50 | 4 | 6,850 |
| CXERS 4010-02-025 | | R0.2 | | | 50 | 4 | 6,850 |
| CXERS 4010-03-025 | | R0.3 | | | 50 | 4 | 7,300 |
| CXERS 4015-01-0375 | 1.5 | R0.1 | 3.75 | 16° | 50 | 4 | 6,850 |
| CXERS 4015-02-0375 | | R0.2 | | | 50 | 4 | 6,850 |
| CXERS 4015-03-0375 | | R0.3 | | | 50 | 4 | 7,300 |
| CXERS 4020-01-050 | 2 | R0.1 | 5 | 16° | 50 | 4 | 6,410 |
| CXERS 4020-02-050 | | R0.2 | | | 50 | 4 | 6,410 |
| CXERS 4020-03-050 | | R0.3 | | | 50 | 4 | 6,850 |
| CXERS 4020-05-050 | | R0.5 | | | 50 | 4 | 6,850 |
| CXERS 4025-03-0625 | 2.5 | R0.3 | 6.25 | 16° | 50 | 4 | 6,850 |
| CXERS 4025-05-0625 | | R0.5 | | | 50 | 4 | 6,850 |
| CXERS 4030-02-075 | 3 | R0.2 | 7.5 | 16° | 60 | 6 | 7,350 |
| CXERS 4030-03-075 | | R0.3 | | | 60 | 6 | 7,850 |
| CXERS 4030-05-075 | | R0.5 | | | 60 | 6 | 7,850 |

Next Page ➡

Unit（mm）

| | Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| | CXERS 4040-02-100 | 4 | R0.2 | 10 | 16° | 60 | 6 | 7,720 |
| | CXERS 4040-03-100 | | R0.3 | | | 60 | 6 | 8,250 |
| ※ | CXERS 4040-04-100 | | R0.4 | | | 60 | 6 | 8,250 |
| | CXERS 4040-05-100 | | R0.5 | | | 60 | 6 | 8,250 |
| | CXERS 4040-10-100 | | R1 | | | 60 | 6 | 8,250 |
| | CXERS 4050-02-125 | 5 | R0.2 | 12.5 | 16° | 60 | 6 | 8,300 |
| | CXERS 4050-03-125 | | R0.3 | | | 60 | 6 | 8,850 |
| ※ | CXERS 4050-04-125 | | R0.4 | | | 60 | 6 | 8,850 |
| | CXERS 4050-05-125 | | R0.5 | | | 60 | 6 | 8,850 |
| | CXERS 4050-10-125 | | R1 | | | 60 | 6 | 8,850 |
| | CXERS 4060-02-150 | 6 | R0.2 | 15 | — | 60 | 6 | 8,640 |
| | CXERS 4060-03-150 | | R0.3 | | | 60 | 6 | 8,640 |
| ※ | CXERS 4060-04-150 | | R0.4 | | | 60 | 6 | 9,500 |
| | CXERS 4060-05-150 | | R0.5 | | | 60 | 6 | 9,500 |
| | CXERS 4060-10-150 | | R1 | | | 60 | 6 | 9,500 |
| ※ | CXERS 4060-12-150 | | R1.2 | | | 60 | 6 | 9,500 |
| | CXERS 4080-02-200 | 8 | R0.2 | 20 | — | 70 | 8 | 11,000 |
| | CXERS 4080-03-200 | | R0.3 | | | 70 | 8 | 11,000 |
| ※ | CXERS 4080-04-200 | | R0.4 | | | 70 | 8 | 11,800 |
| | CXERS 4080-05-200 | | R0.5 | | | 70 | 8 | 11,800 |
| | CXERS 4080-10-200 | | R1 | | | 70 | 8 | 11,800 |
| ※ | CXERS 4080-12-200 | | R1.2 | | | 70 | 8 | 11,800 |
| | CXERS 4080-15-200 | | R1.5 | | | 70 | 8 | 11,800 |
| | CXERS 4080-20-200 | | R2 | | | 70 | 8 | 11,800 |
| | CXERS 4100-02-250 | 10 | R0.2 | 25 | — | 80 | 10 | 13,100 |
| | CXERS 4100-03-250 | | R0.3 | | | 80 | 10 | 13,100 |
| ※ | CXERS 4100-04-250 | | R0.4 | | | 80 | 10 | 14,000 |
| | CXERS 4100-05-250 | | R0.5 | | | 80 | 10 | 14,000 |
| | CXERS 4100-10-250 | | R1 | | | 80 | 10 | 14,000 |
| ※ | CXERS 4100-12-250 | | R1.2 | | | 80 | 10 | 14,000 |
| | CXERS 4100-15-250 | | R1.5 | | | 80 | 10 | 14,000 |
| | CXERS 4100-20-250 | | R2 | | | 80 | 10 | 14,000 |
| | CXERS 4120-02-300 | 12 | R0.2 | 30 | — | 100 | 12 | 18,750 |
| | CXERS 4120-03-300 | | R0.3 | | | 100 | 12 | 20,000 |
| ※ | CXERS 4120-04-300 | | R0.4 | | | 100 | 12 | 20,000 |
| | CXERS 4120-05-300 | | R0.5 | | | 100 | 12 | 20,000 |
| | CXERS 4120-10-300 | | R1 | | | 100 | 12 | 20,000 |
| ※ | CXERS 4120-12-300 | | R1.2 | | | 100 | 12 | 20,000 |
| | CXERS 4120-15-300 | | R1.5 | | | 100 | 12 | 20,000 |
| | CXERS 4120-20-300 | | R2 | | | 100 | 12 | 20,000 |
| | CXERS 4120-30-300 | | R3 | | | 100 | 12 | 20,000 |

※Additional model

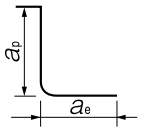
## Milling Conditions for CXERS

◆Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | | STAINLESS STEELS SUS304 ※Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4010-01-025** | **1** | R0.1 | 21,600 | 490 | 2.5 | 0.1 | 21,600 | 360 | 2.5 | 0.1 | 17,400 | 250 | 2.5 | 0.1 |
| **4010-02-025** | | R0.2 | 21,600 | 490 | 2.5 | 0.1 | 21,600 | 360 | 2.5 | 0.1 | 17,400 | 250 | 2.5 | 0.1 |
| **4010-03-025** | | R0.3 | 21,600 | 490 | 2.5 | 0.1 | 21,600 | 360 | 2.5 | 0.1 | 17,400 | 250 | 2.5 | 0.1 |
| **4015-01-0375** | **1.5** | R0.1 | 16,200 | 610 | 3.75 | 0.15 | 16,200 | 450 | 3.75 | 0.15 | 15,960 | 270 | 3.75 | 0.15 |
| **4015-02-0375** | | R0.2 | 16,200 | 610 | 3.75 | 0.15 | 16,200 | 450 | 3.75 | 0.15 | 15,960 | 270 | 3.75 | 0.15 |
| **4015-03-0375** | | R0.3 | 16,200 | 610 | 3.75 | 0.15 | 16,200 | 450 | 3.75 | 0.15 | 15,960 | 270 | 3.75 | 0.15 |
| **4020-01-050** | **2** | R0.1 | 13,200 | 740 | 5 | 0.2 | 13,200 | 550 | 5 | 0.2 | 14,640 | 280 | 5 | 0.2 |
| **4020-02-050** | | R0.2 | 13,200 | 740 | 5 | 0.2 | 13,200 | 550 | 5 | 0.2 | 14,640 | 280 | 5 | 0.2 |
| **4020-03-050** | | R0.3 | 13,200 | 740 | 5 | 0.2 | 13,200 | 550 | 5 | 0.2 | 14,640 | 280 | 5 | 0.2 |
| **4020-05-050** | | R0.5 | 13,200 | 740 | 5 | 0.2 | 13,200 | 550 | 5 | 0.2 | 14,640 | 280 | 5 | 0.2 |
| **4025-03-0625** | **2.5** | R0.3 | 11,400 | 840 | 6.25 | 0.25 | 11,400 | 640 | 6.25 | 0.25 | 13,200 | 390 | 6.25 | 0.25 |
| **4025-05-0625** | | R0.5 | 11,400 | 840 | 6.25 | 0.25 | 11,400 | 640 | 6.25 | 0.25 | 13,200 | 390 | 6.25 | 0.25 |
| **4030-02-075** | **3** | R0.2 | 10,200 | 960 | 7.5 | 0.3 | 10,200 | 720 | 7.5 | 0.3 | 12,000 | 510 | 7.5 | 0.3 |
| **4030-03-075** | | R0.3 | 10,200 | 960 | 7.5 | 0.3 | 10,200 | 720 | 7.5 | 0.3 | 12,000 | 510 | 7.5 | 0.3 |
| **4030-05-075** | | R0.5 | 10,200 | 960 | 7.5 | 0.3 | 10,200 | 720 | 7.5 | 0.3 | 12,000 | 510 | 7.5 | 0.3 |
| **4040-02-100** | **4** | R0.2 | 8,640 | 1,350 | 10 | 0.8 | 8,040 | 1,000 | 10 | 0.8 | 9,000 | 730 | 10 | 0.4 |
| **4040-03-100** | | R0.3 | 8,640 | 1,350 | 10 | 0.8 | 8,040 | 1,000 | 10 | 0.8 | 9,000 | 730 | 10 | 0.4 |
| **4040-04-100** | | R0.4 | 8,640 | 1,350 | 10 | 0.8 | 8,040 | 1,000 | 10 | 0.8 | 9,000 | 730 | 10 | 0.4 |
| **4040-05-100** | | R0.5 | 8,640 | 1,350 | 10 | 0.8 | 8,040 | 1,000 | 10 | 0.8 | 9,000 | 730 | 10 | 0.4 |
| **4040-10-100** | | R1 | 8,640 | 1,350 | 10 | 0.8 | 8,040 | 1,000 | 10 | 0.8 | 9,000 | 730 | 10 | 0.4 |
| **4050-02-125** | **5** | R0.2 | 7,200 | 1,500 | 12.5 | 1 | 6,480 | 1,100 | 12.5 | 1 | 6,480 | 810 | 12.5 | 0.5 |
| **4050-03-125** | | R0.3 | 7,200 | 1,500 | 12.5 | 1 | 6,480 | 1,100 | 12.5 | 1 | 6,480 | 810 | 12.5 | 0.5 |
| **4050-04-125** | | R0.4 | 7,200 | 1,500 | 12.5 | 1 | 6,480 | 1,100 | 12.5 | 1 | 6,480 | 810 | 12.5 | 0.5 |
| **4050-05-125** | | R0.5 | 7,200 | 1,500 | 12.5 | 1 | 6,480 | 1,100 | 12.5 | 1 | 6,480 | 810 | 12.5 | 0.5 |
| **4050-10-125** | | R1 | 7,200 | 1,500 | 12.5 | 1 | 6,480 | 1,100 | 12.5 | 1 | 6,480 | 810 | 12.5 | 0.5 |
| **4060-02-150** | **6** | R0.2 | 6,000 | 1,600 | 15 | 1.2 | 5,400 | 1,200 | 15 | 1.2 | 5,400 | 810 | 15 | 0.6 |
| **4060-03-150** | | R0.3 | 6,000 | 1,600 | 15 | 1.2 | 5,400 | 1,200 | 15 | 1.2 | 5,400 | 810 | 15 | 0.6 |
| **4060-04-150** | | R0.4 | 6,000 | 1,600 | 15 | 1.2 | 5,400 | 1,200 | 15 | 1.2 | 5,400 | 810 | 15 | 0.6 |
| **4060-05-150** | | R0.5 | 6,000 | 1,600 | 15 | 1.2 | 5,400 | 1,200 | 15 | 1.2 | 5,400 | 810 | 15 | 0.6 |
| **4060-10-150** | | R1 | 6,000 | 1,600 | 15 | 1.2 | 5,400 | 1,200 | 15 | 1.2 | 5,400 | 810 | 15 | 0.6 |
| **4060-12-150** | | R1.2 | 6,000 | 1,600 | 15 | 1.2 | 5,400 | 1,200 | 15 | 1.2 | 5,400 | 810 | 15 | 0.6 |
| **4080-02-200** | **8** | R0.2 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-03-200** | | R0.3 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-04-200** | | R0.4 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-05-200** | | R0.5 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-10-200** | | R1 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-12-200** | | R1.2 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-15-200** | | R1.5 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| **4080-20-200** | | R2 | 3,600 | 1,300 | 20 | 1.6 | 3,480 | 1,050 | 20 | 1.6 | 3,480 | 720 | 20 | 0.8 |
| Milling Amount (mm) | | | $a_p$ : All Flute<br>$a_e$ : 0.1D($\phi$D<4)<br>$a_e$ : 0.2D($\phi$D≧4) | | | | $a_p$ : All Flute<br>$a_e$ : 0.1D($\phi$D<4)<br>$a_e$ : 0.2D($\phi$D≧4) | | | | $a_p$ : All Flute<br>$a_e$ : 0.1D | | | |

# Milling Conditions for CXERS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4010-01-025** | **1** | R0.1 | 15,480 | 250 | 2.5 | 0.1 | 12,900 | 180 | 2.5 | 0.05 |
| **4010-02-025** | | R0.2 | 15,480 | 250 | 2.5 | 0.1 | 12,900 | 180 | 2.5 | 0.05 |
| **4010-03-025** | | R0.3 | 15,480 | 250 | 2.5 | 0.1 | 12,900 | 180 | 2.5 | 0.05 |
| **4015-01-0375** | **1.5** | R0.1 | 12,600 | 310 | 3.75 | 0.15 | 9,300 | 280 | 3.75 | 0.075 |
| **4015-02-0375** | | R0.2 | 12,600 | 310 | 3.75 | 0.15 | 9,300 | 280 | 3.75 | 0.075 |
| **4015-03-0375** | | R0.3 | 12,600 | 310 | 3.75 | 0.15 | 9,300 | 280 | 3.75 | 0.075 |
| **4020-01-050** | **2** | R0.1 | 11,220 | 360 | 5 | 0.2 | 7,600 | 390 | 5 | 0.1 |
| **4020-02-050** | | R0.2 | 11,220 | 360 | 5 | 0.2 | 7,600 | 390 | 5 | 0.1 |
| **4020-03-050** | | R0.3 | 11,220 | 360 | 5 | 0.2 | 7,600 | 390 | 5 | 0.1 |
| **4020-05-050** | | R0.5 | 11,220 | 360 | 5 | 0.2 | 7,600 | 390 | 5 | 0.1 |
| **4025-03-0625** | **2.5** | R0.3 | 9,960 | 430 | 6.25 | 0.25 | 6,500 | 510 | 6.25 | 0.125 |
| **4025-05-0625** | | R0.5 | 9,960 | 430 | 6.25 | 0.25 | 6,500 | 510 | 6.25 | 0.125 |
| **4030-02-075** | **3** | R0.2 | 8,880 | 500 | 7.5 | 0.3 | 5,900 | 500 | 7.5 | 0.3 |
| **4030-03-075** | | R0.3 | 8,880 | 500 | 7.5 | 0.3 | 5,900 | 500 | 7.5 | 0.3 |
| **4030-05-075** | | R0.5 | 8,880 | 500 | 7.5 | 0.3 | 5,900 | 500 | 7.5 | 0.3 |
| **4040-02-100** | **4** | R0.2 | 7,080 | 650 | 10 | 0.8 | 4,700 | 520 | 10 | 0.4 |
| **4040-03-100** | | R0.3 | 7,080 | 650 | 10 | 0.8 | 4,700 | 520 | 10 | 0.4 |
| **4040-04-100** | | R0.4 | 7,080 | 650 | 10 | 0.8 | 4,700 | 520 | 10 | 0.4 |
| **4040-05-100** | | R0.5 | 7,080 | 650 | 10 | 0.8 | 4,700 | 520 | 10 | 0.4 |
| **4040-10-100** | | R1 | 7,080 | 650 | 10 | 0.8 | 4,700 | 520 | 10 | 0.4 |
| **4050-02-125** | **5** | R0.2 | 5,760 | 680 | 12.5 | 1 | 3,850 | 530 | 12.5 | 0.5 |
| **4050-03-125** | | R0.3 | 5,760 | 680 | 12.5 | 1 | 3,850 | 530 | 12.5 | 0.5 |
| **4050-04-125** | | R0.4 | 5,760 | 680 | 12.5 | 1 | 3,850 | 530 | 12.5 | 0.5 |
| **4050-05-125** | | R0.5 | 5,760 | 680 | 12.5 | 1 | 3,850 | 530 | 12.5 | 0.5 |
| **4050-10-125** | | R1 | 5,760 | 680 | 12.5 | 1 | 3,850 | 530 | 12.5 | 0.5 |
| **4060-02-150** | **6** | R0.2 | 4,800 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4060-03-150** | | R0.3 | 4,800 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4060-04-150** | | R0.4 | 4,800 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4060-05-150** | | R0.5 | 4,800 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4060-10-150** | | R1 | 4,800 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4060-12-150** | | R1.2 | 4,800 | 680 | 15 | 1.2 | 3,200 | 540 | 15 | 0.6 |
| **4080-02-200** | **8** | R0.2 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-03-200** | | R0.3 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-04-200** | | R0.4 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-05-200** | | R0.5 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-10-200** | | R1 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-12-200** | | R1.2 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-15-200** | | R1.5 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| **4080-20-200** | | R2 | 3,000 | 600 | 20 | 1.6 | 2,000 | 500 | 20 | 0.8 |
| Milling Amount (mm) | | | $a_p$ : All Flute<br>$a_e$ : 0.1D($\phi$D<4)<br>$a_e$ : 0.2D($\phi$D≧4) | | | | $a_p$ : All Flute<br>$a_e$ : 0.1D | | | |




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

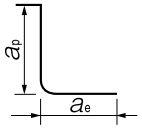
## Milling Conditions for CXERS

◆Side Milling

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | | STAINLESS STEELS SUS304 ※Use water soluble or oil coolant. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4100-02-250** | 10 | R0.2 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-03-250** | | R0.3 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-04-250** | | R0.4 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-05-250** | | R0.5 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-10-250** | | R1 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-12-250** | | R1.2 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-15-250** | | R1.5 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4100-20-250** | | R2 | 1,920 | 1,000 | 25 | 2 | 1,800 | 900 | 25 | 2 | 1,800 | 580 | 25 | 1 |
| **4120-02-300** | 12 | R0.2 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-03-300** | | R0.3 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-04-300** | | R0.4 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-05-300** | | R0.5 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-10-300** | | R1 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-12-300** | | R1.2 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-15-300** | | R1.5 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-20-300** | | R2 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| **4120-30-300** | | R3 | 1,440 | 800 | 30 | 2.4 | 1,440 | 750 | 30 | 2.4 | 1,440 | 540 | 30 | 1.2 |
| Milling Amount (mm) | | | $a_p$ : All Flute<br>$a_e$ : 0.2D(φD≧4) | | | | $a_p$ : All Flute<br>$a_e$ : 0.2D(φD≧4) | | | | $a_p$ : All Flute<br>$a_e$ : 0.1D | | | |

# Milling Conditions for CXERS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4100-02-250** | **10** | R0.2 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-03-250** | | R0.3 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-04-250** | | R0.4 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-05-250** | | R0.5 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-10-250** | | R1 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-12-250** | | R1.2 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-15-250** | | R1.5 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4100-20-250** | | R2 | 1,800 | 430 | 25 | 2 | 1,200 | 450 | 25 | 1 |
| **4120-02-300** | **12** | R0.2 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-03-300** | | R0.3 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-04-300** | | R0.4 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-05-300** | | R0.5 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-10-300** | | R1 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-12-300** | | R1.2 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-15-300** | | R1.5 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-20-300** | | R2 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| **4120-30-300** | | R3 | 1,200 | 320 | 30 | 2.4 | 960 | 420 | 30 | 1.2 |
| Milling Amount (mm) | | | $a_p$ : All Flute<br>$a_e$ : 0.2D($\phi$D≧4) | | | | $a_p$ : All Flute<br>$a_e$ : 0.1D | | | |




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

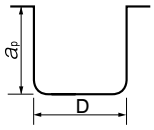
## Milling Conditions for CXERS

◆Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | STAINLESS STEELS SUS304 ※Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4010-01-025** | **1** | R0.1 | 21,600 | 160 | 1 | 21,600 | 160 | 1 | 17,400 | 170 | 0.5 |
| **4010-02-025** | | R0.2 | 21,600 | 160 | 1 | 21,600 | 160 | 1 | 17,400 | 170 | 0.5 |
| **4010-03-025** | | R0.3 | 21,600 | 160 | 1 | 21,600 | 160 | 1 | 17,400 | 170 | 0.5 |
| **4015-01-0375** | **1.5** | R0.1 | 16,200 | 250 | 1.5 | 16,200 | 220 | 1.5 | 15,960 | 190 | 0.75 |
| **4015-02-0375** | | R0.2 | 16,200 | 250 | 1.5 | 16,200 | 220 | 1.5 | 15,960 | 190 | 0.75 |
| **4015-03-0375** | | R0.3 | 16,200 | 250 | 1.5 | 16,200 | 220 | 1.5 | 15,960 | 190 | 0.75 |
| **4020-01-050** | **2** | R0.1 | 13,200 | 360 | 2 | 13,200 | 250 | 2 | 14,640 | 200 | 1 |
| **4020-02-050** | | R0.2 | 13,200 | 360 | 2 | 13,200 | 250 | 2 | 14,640 | 200 | 1 |
| **4020-03-050** | | R0.3 | 13,200 | 360 | 2 | 13,200 | 250 | 2 | 14,640 | 200 | 1 |
| **4020-05-050** | | R0.5 | 13,200 | 360 | 2 | 13,200 | 250 | 2 | 14,640 | 200 | 1 |
| **4025-03-0625** | **2.5** | R0.3 | 11,400 | 430 | 2.5 | 11,400 | 280 | 2.5 | 13,200 | 240 | 1.25 |
| **4025-05-0625** | | R0.5 | 11,400 | 430 | 2.5 | 11,400 | 280 | 2.5 | 13,200 | 240 | 1.25 |
| **4030-02-075** | **3** | R0.2 | 10,200 | 480 | 3 | 10,200 | 320 | 3 | 12,000 | 280 | 1.5 |
| **4030-03-075** | | R0.3 | 10,200 | 480 | 3 | 10,200 | 320 | 3 | 12,000 | 280 | 1.5 |
| **4030-05-075** | | R0.5 | 10,200 | 480 | 3 | 10,200 | 320 | 3 | 12,000 | 280 | 1.5 |
| **4040-02-100** | **4** | R0.2 | 8,640 | 650 | 4 | 8,040 | 450 | 4 | 9,000 | 400 | 2 |
| **4040-03-100** | | R0.3 | 8,640 | 650 | 4 | 8,040 | 450 | 4 | 9,000 | 400 | 2 |
| **4040-04-100** | | R0.4 | 8,640 | 650 | 4 | 8,040 | 450 | 4 | 9,000 | 400 | 2 |
| **4040-05-100** | | R0.5 | 8,640 | 650 | 4 | 8,040 | 450 | 4 | 9,000 | 400 | 2 |
| **4040-10-100** | | R1 | 8,640 | 650 | 4 | 8,040 | 450 | 4 | 9,000 | 400 | 2 |
| **4050-02-125** | **5** | R0.2 | 7,200 | 700 | 5 | 6,480 | 500 | 5 | 6,480 | 460 | 2.5 |
| **4050-03-125** | | R0.3 | 7,200 | 700 | 5 | 6,480 | 500 | 5 | 6,480 | 460 | 2.5 |
| **4050-04-125** | | R0.4 | 7,200 | 700 | 5 | 6,480 | 500 | 5 | 6,480 | 460 | 2.5 |
| **4050-05-125** | | R0.5 | 7,200 | 700 | 5 | 6,480 | 500 | 5 | 6,480 | 460 | 2.5 |
| **4050-10-125** | | R1 | 7,200 | 700 | 5 | 6,480 | 500 | 5 | 6,480 | 460 | 2.5 |
| **4060-02-150** | **6** | R0.2 | 6,000 | 700 | 6 | 5,400 | 500 | 6 | 5,400 | 460 | 3 |
| **4060-03-150** | | R0.3 | 6,000 | 700 | 6 | 5,400 | 500 | 6 | 5,400 | 460 | 3 |
| **4060-04-150** | | R0.4 | 6,000 | 700 | 6 | 5,400 | 500 | 6 | 5,400 | 460 | 3 |
| **4060-05-150** | | R0.5 | 6,000 | 700 | 6 | 5,400 | 500 | 6 | 5,400 | 460 | 3 |
| **4060-10-150** | | R1 | 6,000 | 700 | 6 | 5,400 | 500 | 6 | 5,400 | 460 | 3 |
| **4060-12-150** | | R1.2 | 6,000 | 700 | 6 | 5,400 | 500 | 6 | 5,400 | 460 | 3 |
| **4080-02-200** | **8** | R0.2 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-03-200** | | R0.3 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-04-200** | | R0.4 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-05-200** | | R0.5 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-10-200** | | R1 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-12-200** | | R1.2 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-15-200** | | R1.5 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| **4080-20-200** | | R2 | 3,600 | 500 | 8 | 3,480 | 360 | 8 | 3,480 | 340 | 4 |
| Milling Amount (mm) | | | $a_p$:1D | | | $a_p$:1D | | | $a_p$:0.5D | | |

# Milling Conditions for CXERS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4010-01-025** | **1** | R0.1 | 15,480 | 100 | 1 | 12,900 | 50 | 0.3 |
| **4010-02-025** | | R0.2 | 15,480 | 100 | 1 | 12,900 | 50 | 0.3 |
| **4010-03-025** | | R0.3 | 15,480 | 100 | 1 | 12,900 | 50 | 0.3 |
| **4015-01-0375** | **1.5** | R0.1 | 12,600 | 140 | 1.5 | 10,500 | 100 | 0.45 |
| **4015-02-0375** | | R0.2 | 12,600 | 140 | 1.5 | 10,500 | 100 | 0.45 |
| **4015-03-0375** | | R0.3 | 12,600 | 140 | 1.5 | 10,500 | 100 | 0.45 |
| **4020-01-050** | **2** | R0.1 | 11,220 | 170 | 2 | 9,350 | 150 | 0.6 |
| **4020-02-050** | | R0.2 | 11,220 | 170 | 2 | 9,350 | 150 | 0.6 |
| **4020-03-050** | | R0.3 | 11,220 | 170 | 2 | 9,350 | 150 | 0.6 |
| **4020-05-050** | | R0.5 | 11,220 | 170 | 2 | 9,350 | 150 | 0.6 |
| **4025-03-0625** | **2.5** | R0.3 | 9,960 | 210 | 2.5 | 8,300 | 240 | 0.75 |
| **4025-05-0625** | | R0.5 | 9,960 | 210 | 2.5 | 8,300 | 240 | 0.75 |
| **4030-02-075** | **3** | R0.2 | 8,880 | 250 | 3 | 7,400 | 360 | 1.5 |
| **4030-03-075** | | R0.3 | 8,880 | 250 | 3 | 7,400 | 360 | 1.5 |
| **4030-05-075** | | R0.5 | 8,880 | 250 | 3 | 7,400 | 360 | 1.5 |
| **4040-02-100** | **4** | R0.2 | 7,080 | 390 | 4 | 5,900 | 380 | 2 |
| **4040-03-100** | | R0.3 | 7,080 | 390 | 4 | 5,900 | 380 | 2 |
| **4040-04-100** | | R0.4 | 7,080 | 390 | 4 | 5,900 | 380 | 2 |
| **4040-05-100** | | R0.5 | 7,080 | 390 | 4 | 5,900 | 380 | 2 |
| **4040-10-100** | | R1 | 7,080 | 390 | 4 | 5,900 | 380 | 2 |
| **4050-02-125** | **5** | R0.2 | 5,760 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4050-03-125** | | R0.3 | 5,760 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4050-04-125** | | R0.4 | 5,760 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4050-05-125** | | R0.5 | 5,760 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4050-10-125** | | R1 | 5,760 | 440 | 5 | 4,800 | 410 | 2.5 |
| **4060-02-150** | **6** | R0.2 | 4,800 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-03-150** | | R0.3 | 4,800 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-04-150** | | R0.4 | 4,800 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-05-150** | | R0.5 | 4,800 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-10-150** | | R1 | 4,800 | 440 | 6 | 4,000 | 440 | 3 |
| **4060-12-150** | | R1.2 | 4,800 | 440 | 6 | 4,000 | 440 | 3 |
| **4080-02-200** | **8** | R0.2 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-03-200** | | R0.3 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-04-200** | | R0.4 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-05-200** | | R0.5 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-10-200** | | R1 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-12-200** | | R1.2 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-15-200** | | R1.5 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| **4080-20-200** | | R2 | 3,000 | 340 | 8 | 2,500 | 340 | 4 |
| Milling Amount (mm) | | | $a_p$ : 1D | | | $a_p$ : 0.5D | | |




Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

## Milling Conditions for CXERS

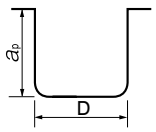
◆Slotting

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | STAINLESS STEELS SUS304 ※Use water soluble or oil coolant. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4100-02-250** | **10** | R0.2 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-03-250** | | R0.3 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-04-250** | | R0.4 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-05-250** | | R0.5 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-10-250** | | R1 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-12-250** | | R1.2 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-15-250** | | R1.5 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4100-20-250** | | R2 | 1,920 | 380 | 10 | 1,800 | 270 | 10 | 1,800 | 220 | 5 |
| **4120-02-300** | **12** | R0.2 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-03-300** | | R0.3 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-04-300** | | R0.4 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-05-300** | | R0.5 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-10-300** | | R1 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-12-300** | | R1.2 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-15-300** | | R1.5 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-20-300** | | R2 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| **4120-30-300** | | R3 | 1,440 | 300 | 12 | 1,440 | 210 | 12 | 1,440 | 180 | 6 |
| Milling Amount (mm) | | | $a_p$:1D | | | $a_p$:1D | | | $a_p$:0.5D | | |

Note:
- Decrease both spindle speed and feed rate proportionally in case of chattering.
- These milling parameters are calculated based on the shortest overhang length. Longer overhangs may require an adjustment to the milling parameters.
- Reduce the milling amount and feed rate in accordance with required milling precision.
- Every coolant offers stable milling.
- Recommend water soluble or oil coolant for Stainless Steels and Copper.

# Milling Conditions for CXERS

| WORK MATERIAL | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | |
|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **4100-02-250** | **10** | R0.2 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-03-250** | | R0.3 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-04-250** | | R0.4 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-05-250** | | R0.5 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-10-250** | | R1 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-12-250** | | R1.2 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-15-250** | | R1.5 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4100-20-250** | | R2 | 1,800 | 220 | 10 | 1,500 | 240 | 5 |
| **4120-02-300** | **12** | R0.2 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-03-300** | | R0.3 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-04-300** | | R0.4 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-05-300** | | R0.5 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-10-300** | | R1 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-12-300** | | R1.2 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-15-300** | | R1.5 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-20-300** | | R2 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| **4120-30-300** | | R3 | 1,200 | 180 | 12 | 1,200 | 220 | 6 |
| Milling Amount (mm) | | | $a_p$ : 1D | | | $a_p$ : 0.5D | | |




Slotting
$a_p$ : Axial Depth (mm)
D : Outside Diameter (mm)

**Size φ3～φ12**

# CXRS

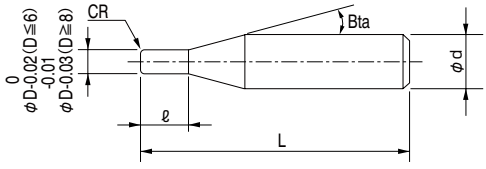
Super MG | UT COAT | 42°~45° | R | R ±0.01 (φ3～φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | |

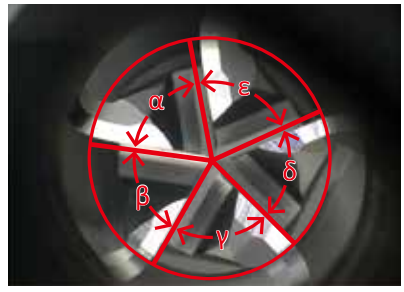
## Features

**Recommended on a wide range of materials – Carbon Steels and Hardened steels up to 55 HRC.**
**Variable pitch & helix design and positive rake angle offer highly efficient side milling.**
**Seamless corner radius design greatly reduces cutting force.**




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

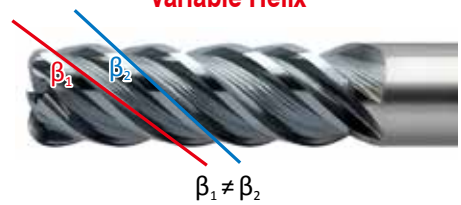
### Variable Pitch




$\alpha \neq \beta \neq \gamma \neq \delta \neq \varepsilon$

### Corner Radius Design

### Variable Helix




$\beta_1 \neq \beta_2$

Total 30 models

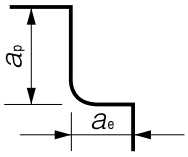
Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|
| CXRS 5030-05-0600 | 3 | R0.5 | 6 | 16° | 50 | 6 | 8,250 |
| CXRS 5030-05-0900 | | | 9 | | 50 | 6 | 8,250 |
| CXRS 5040-05-0800 | 4 | R0.5 | 8 | 16° | 60 | 6 | 8,900 |
| CXRS 5040-05-1200 | | | 12 | | 60 | 6 | 8,900 |
| CXRS 5040-10-0800 | | R1 | 8 | | 60 | 6 | 8,900 |
| CXRS 5040-10-1200 | | | 12 | | 60 | 6 | 8,900 |
| CXRS 5060-05-1200 | 6 | R0.5 | 12 | — | 70 | 6 | 9,600 |
| CXRS 5060-05-1800 | | | 18 | | 70 | 6 | 9,600 |
| CXRS 5060-10-1200 | | R1 | 12 | | 70 | 6 | 9,600 |
| CXRS 5060-10-1800 | | | 18 | | 70 | 6 | 9,600 |
| CXRS 5080-05-1600 | 8 | R0.5 | 16 | — | 70 | 8 | 13,800 |
| CXRS 5080-05-2400 | | | 24 | | 70 | 8 | 13,800 |
| CXRS 5080-10-1600 | | R1 | 16 | | 70 | 8 | 13,800 |
| CXRS 5080-10-2400 | | | 24 | | 70 | 8 | 13,800 |
| CXRS 5100-05-2000 | 10 | R0.5 | 20 | — | 80 | 10 | 16,800 |
| CXRS 5100-05-3000 | | | 30 | | 80 | 10 | 16,800 |
| CXRS 5100-10-2000 | | R1 | 20 | | 80 | 10 | 16,800 |
| CXRS 5100-10-3000 | | | 30 | | 80 | 10 | 16,800 |
| CXRS 5100-15-2000 | | R1.5 | 20 | | 80 | 10 | 16,800 |
| CXRS 5100-15-3000 | | | 30 | | 80 | 10 | 16,800 |
| CXRS 5100-20-2000 | | R2 | 20 | | 80 | 10 | 16,800 |
| CXRS 5100-20-3000 | | | 30 | | 80 | 10 | 16,800 |
| CXRS 5120-05-2400 | 12 | R0.5 | 24 | — | 80 | 12 | 22,000 |
| CXRS 5120-05-3600 | | | 36 | | 100 | 12 | 22,000 |
| CXRS 5120-10-2400 | | R1 | 24 | | 80 | 12 | 22,000 |
| CXRS 5120-10-3600 | | | 36 | | 100 | 12 | 22,000 |
| CXRS 5120-15-2400 | | R1.5 | 24 | | 80 | 12 | 22,000 |
| CXRS 5120-15-3600 | | | 36 | | 100 | 12 | 22,000 |
| CXRS 5120-20-2400 | | R2 | 24 | | 80 | 12 | 22,000 |
| CXRS 5120-20-3600 | | | 36 | | 100 | 12 | 22,000 |

## Milling Conditions for CXRS

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (~225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225~325HB) | | | | PREHARDENED STEELS HPM / NAK (30~45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | 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) |
| 5030 | 3 | 6 | 20,000 | 10,000 | 6 | 0.3 | 20,000 | 10,000 | 6 | 0.3 | 20,000 | 10,000 | 6 | 0.09 | 20,000 | 12,000 | 6 | 0.06 |
| | | 9 | 20,000 | 6,000 | 8 | 0.24 | 20,000 | 6,000 | 8 | 0.24 | 20,000 | 6,400 | 8 | 0.09 | 20,000 | 12,000 | 8 | 0.05 |
| 5040 | 4 | 8 | 18,200 | 9,100 | 8 | 0.4 | 18,200 | 9,100 | 8 | 0.4 | 19,800 | 9,900 | 8 | 0.12 | 15,000 | 11,500 | 8 | 0.08 |
| | | 12 | 18,200 | 5,460 | 10.8 | 0.32 | 18,200 | 5,460 | 10.8 | 0.32 | 15,900 | 4,770 | 10.8 | 0.12 | 15,000 | 11,500 | 10.8 | 0.05 |
| 5060 | 6 | 12 | 12,200 | 6,100 | 12 | 0.6 | 12,200 | 6,100 | 12 | 0.6 | 13,200 | 6,500 | 12 | 0.21 | 10,000 | 7,600 | 12 | 0.15 |
| | | 18 | 12,200 | 5,100 | 16 | 0.48 | 12,200 | 5,100 | 16 | 0.48 | 12,000 | 5,000 | 16 | 0.18 | 10,000 | 7,600 | 16 | 0.1 |
| 5080 | 8 | 16 | 9,100 | 4,550 | 16 | 0.8 | 9,100 | 4,550 | 16 | 0.8 | 9,900 | 4,950 | 16 | 0.4 | 7,600 | 5,600 | 16 | 0.2 |
| | | 24 | 9,100 | 4,550 | 21 | 0.64 | 9,100 | 4,550 | 21 | 0.64 | 9,000 | 4,500 | 21 | 0.32 | 7,600 | 5,600 | 21 | 0.15 |
| 5100 | 10 | 20 | 7,300 | 3,650 | 20 | 1 | 7,300 | 3,650 | 20 | 1 | 8,000 | 4,600 | 20 | 0.5 | 6,000 | 4,500 | 20 | 0.25 |
| | | 30 | 7,300 | 3,650 | 27 | 0.8 | 7,300 | 3,650 | 27 | 0.8 | 7,300 | 3,650 | 27 | 0.4 | 6,000 | 4,500 | 27 | 0.22 |
| 5120 | 12 | 24 | 6,100 | 3,050 | 24 | 1.2 | 6,100 | 3,050 | 24 | 1.2 | 6,600 | 3,960 | 24 | 0.6 | 5,000 | 3,800 | 24 | 0.3 |
| | | 36 | 6,100 | 3,050 | 32 | 0.96 | 6,100 | 3,050 | 32 | 0.96 | 6,100 | 3,050 | 32 | 0.48 | 5,000 | 3,800 | 32 | 0.25 |

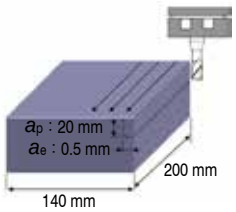
Note:
- Please be sure to use water soluble coolant.
- These milling parameters are for reference only.
- For best result, fine parameter adjustments may be required, depending on the milling shape / application / machine used and so on.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- WARNING: Because of high material removal rate, you must pay attention to your chip and coolant management.




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## 5 Flutes v.s. 4 Flutes　Comparison of Cutting Chips　　STAVAX（53HRC）

Size：140 x 200 mm
Coolant：Oil Mist
Milling Method：Side Milling
Spindle Speed：4,000 $min^{-1}$
Feed Rate：2,500 mm/min
$a_p$ Axial Depth：20 mm
$a_e$ Radial Depth：0.5 mm

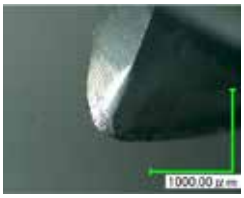



### ◆ 5 Flute Radius　φ10 × CR0.5× Length of Cut 20

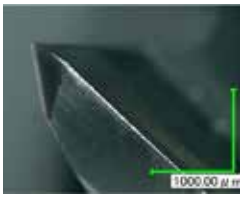
After 40 min

After 80 min

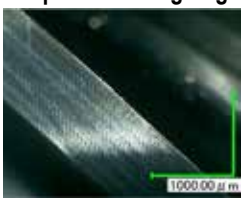
Rake Face

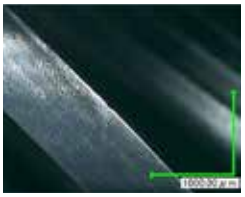


Relief Face



Peripheral Cutting Edge

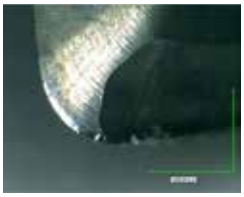




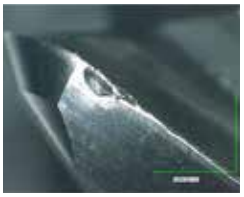
### ◆ 4 Flute Radius　φ10 × CR1× Length of Cut 26

After 40 min

Rake Face



Relief Face



Peripheral Cutting Edge

### ◆ Comparison of Cutting Chips

**5 Flutes**
Uniform cutting chips

**4 Flutes**
Irregular size cutting chips

5 flutes, variable pitch and variable helix design protect the tool from chattering and chipping under high-speed condition.

Size φ3～φ12

# HMERS

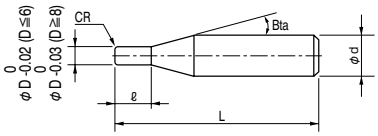
Super MG | HARD MAX | 45° | R | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ ～65HRC | | | | | | | | | | |

## Features

**Radius End Mills for Hard Materials.**
**4 and 6 Flutes have been applied to suitable sizes to offer outstandingly long tool life.**
**HARDMAX coat enables highly efficient milling for 65HRC High Speed Steels.**
**Various Corner Radius sizes available.**




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

Total 37 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Number of Flutes | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| HMERS 4030-01-075 | 3 | R0.1 | 7.5 | 16° | 60 | 6 | 4 | 15,000 |
| HMERS 4030-02-075 | | R0.2 | | | 60 | 6 | | 15,000 |
| HMERS 4030-03-075 | | R0.3 | | | 60 | 6 | | 15,000 |
| HMERS 4030-05-075 | | R0.5 | | | 60 | 6 | | 15,000 |
| HMERS 4040-01-100 | 4 | R0.1 | 10 | 16° | 60 | 6 | 4 | 16,200 |
| HMERS 4040-02-100 | | R0.2 | | | 60 | 6 | | 16,200 |
| HMERS 4040-03-100 | | R0.3 | | | 60 | 6 | | 16,200 |
| HMERS 4040-05-100 | | R0.5 | | | 60 | 6 | | 16,200 |
| HMERS 4040-10-100 | | R1 | | | 60 | 6 | | 16,200 |
| HMERS 4050-01-125 | 5 | R0.1 | 12.5 | 16° | 60 | 6 | 4 | 17,400 |
| HMERS 4050-02-125 | | R0.2 | | | 60 | 6 | | 17,400 |
| HMERS 4050-03-125 | | R0.3 | | | 60 | 6 | | 17,400 |
| HMERS 4050-05-125 | | R0.5 | | | 60 | 6 | | 17,400 |
| HMERS 4050-10-125 | | R1 | | | 60 | 6 | | 17,400 |

Next Page ➡

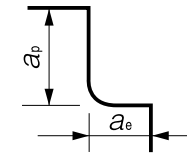
Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Number of Flutes | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| HMERS 6060-01-130 | 6 | R0.1 | 13 | — | 60 | 6 | 6 | 18,600 |
| HMERS 6060-02-130 | | R0.2 | | | 60 | 6 | | 18,600 |
| HMERS 6060-03-130 | | R0.3 | | | 60 | 6 | | 18,600 |
| HMERS 6060-05-130 | | R0.5 | | | 60 | 6 | | 18,600 |
| HMERS 6060-10-130 | | R1 | | | 60 | 6 | | 18,600 |
| HMERS 6060-15-130 | | R1.5 | | | 60 | 6 | | 18,600 |
| HMERS 6080-02-190 | 8 | R0.2 | 19 | — | 70 | 8 | 6 | 23,400 |
| HMERS 6080-03-190 | | R0.3 | | | 70 | 8 | | 23,400 |
| HMERS 6080-05-190 | | R0.5 | | | 70 | 8 | | 23,400 |
| HMERS 6080-10-190 | | R1 | | | 70 | 8 | | 23,400 |
| HMERS 6080-20-190 | | R2 | | | 70 | 8 | | 23,400 |
| HMERS 6100-02-220 | 10 | R0.2 | 22 | — | 80 | 10 | 6 | 31,800 |
| HMERS 6100-03-220 | | R0.3 | | | 80 | 10 | | 31,800 |
| HMERS 6100-05-220 | | R0.5 | | | 80 | 10 | | 31,800 |
| HMERS 6100-10-220 | | R1 | | | 80 | 10 | | 31,800 |
| HMERS 6100-15-220 | | R1.5 | | | 80 | 10 | | 31,800 |
| HMERS 6100-20-220 | | R2 | | | 80 | 10 | | 31,800 |
| HMERS 6120-02-260 | 12 | R0.2 | 26 | — | 100 | 12 | 6 | 38,400 |
| HMERS 6120-03-260 | | R0.3 | | | 100 | 12 | | 38,400 |
| HMERS 6120-05-260 | | R0.5 | | | 100 | 12 | | 38,400 |
| HMERS 6120-10-260 | | R1 | | | 100 | 12 | | 38,400 |
| HMERS 6120-15-260 | | R1.5 | | | 100 | 12 | | 38,400 |
| HMERS 6120-20-260 | | R2 | | | 100 | 12 | | 38,400 |

## Milling Conditions for HMERS

| WORK MATERIAL | | | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | | | | HARDENED STEELS (50～60HRC) | | | | HARDENED STEELS (60～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Number of Flutes | Outside Diameter (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4030** | **4** | 3 | 7.5 | 13,100 | 1,680 | 6 | 0.06 | 4,200 | 720 | 6 | 0.06 | 8,600 | 465 | 6 | 0.06 |
| **4040** | **4** | 4 | 10 | 11,300 | 1,950 | 8 | 0.08 | 3,150 | 540 | 8 | 0.08 | 6,450 | 350 | 8 | 0.08 |
| **4050** | **4** | 5 | 12.5 | 10,100 | 2,300 | 10 | 0.1 | 2,520 | 430 | 10 | 0.1 | 5,160 | 280 | 10 | 0.1 |
| **6060** | **6** | 6 | 13 | 8,900 | 2,930 | 12 | 0.12 | 4,300 | 1,200 | 9 | 0.12 | 4,300 | 1,200 | 9 | 0.12 |
| **6080** | **6** | 8 | 19 | 4,000 | 2,400 | 12 | 0.24 | 3,220 | 1,450 | 12 | 0.08 | 3,220 | 1,450 | 12 | 0.08 |
| **6100** | **6** | 10 | 22 | 3,200 | 2,000 | 15 | 0.3 | 2,580 | 1,160 | 15 | 0.1 | 2,580 | 1,160 | 15 | 0.1 |
| **6120** | **6** | 12 | 26 | 2,670 | 1,600 | 18 | 0.36 | 2,150 | 970 | 18 | 0.12 | 2,150 | 970 | 18 | 0.12 |

Note:
- Recommend down cut processing.
- Reduce cutting amount, feed rate, and apply zero-cut in accordance with required surface quality.
- Recommend air blow or oil mist.



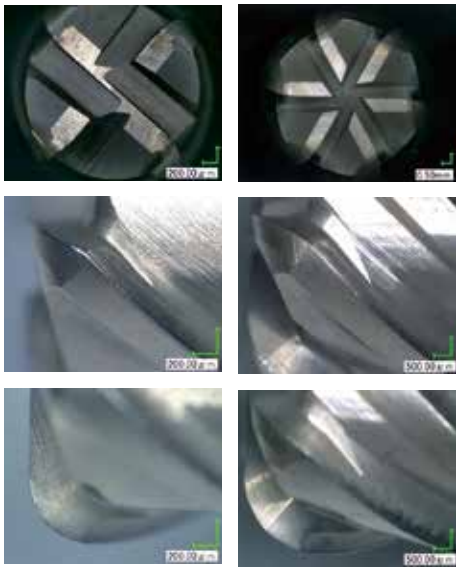

Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## Side Milling Example
## HMERS $\phi$ 3 × CR0.5 / $\phi$ 10 × CR2

SKH51 (63 HRC)

### Tools after Milling

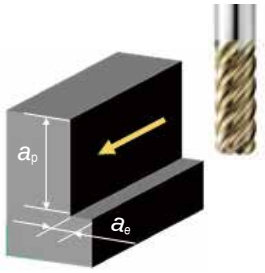
4030-05-075 | 6100-20-220



No chipping when milling Hard Materials.
More tool life left.

| Tool | HMERS 4030-05-075 ($\phi$ 3 × CR0.5) | HMERS 6100-20-220 ($\phi$ 10 × CR2) |
|---|---|---|
| Spindle Speed | 8,600 $min^{-1}$ | 2,580 $min^{-1}$ |
| Feed Rate | 465 mm/min | 1,160 mm/min |
| Axial Depth $a_p$ | 6 mm | 15 mm |
| Radial Depth $a_e$ | 0.06 mm | 0.1 mm |
| Milling Distance | 12.7 m | 28 m |
| Coolant | Air Blow (Through Spindle) | |

### Milling Image




Side Milling (Down-cut)

Size $\phi$0.2～$\phi$2

# UPDLRS

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | | | | ☆ | ◎ |

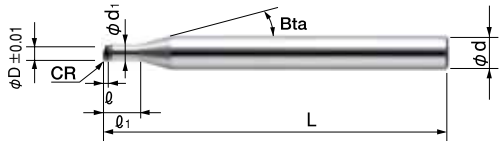
## Features

**Long Neck Radius End Mills for finishing of Cemented Carbide and Hard Brittle Materials.**
**Provides excellent machined surface quality due to the sharp cutting edge and optimized edge treatment.**
**Maintains excellent dimensional accuracy for a long time due to the high contour accuracy of the cutting edge and the excellent wear resistance of diamonds.**

Label Sample

#001 $\phi$D0.499 R0.049/0.048

Diameter and Ball R accuracy measurements are printed on the label to support high precision milling.




Be sure to confirm the interference between the inclined work piece and the shank part by actual measurement.

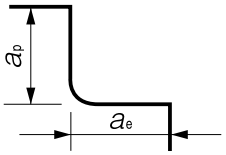
Total 12 models

Unit（mm）

| Model Number | Outside Diameter $\phi$D | Corner Radius CR | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi$d | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| **UPDLRS 1002-002-006** | 0.2 | R0.02 | 0.6 | 0.1 | 0.175 | 16° | 40 | 4 | Open price |
| **UPDLRS 1002-005-006** | | R0.05 | | | | | 40 | 4 | Open price |
| **UPDLRS 1003-002-010** | 0.3 | R0.02 | 1 | 0.15 | 0.27 | 16° | 40 | 4 | Open price |
| **UPDLRS 1003-005-010** | | R0.05 | | | | | 40 | 4 | Open price |
| **UPDLRS 1005-005-015** | 0.5 | R0.05 | 1.5 | 0.25 | 0.47 | 16° | 40 | 4 | Open price |
| **UPDLRS 1005-010-015** | | R0.1 | | | | | 40 | 4 | Open price |
| **UPDLRS 1010-005-030** | 1 | R0.05 | 3 | 0.55 | 0.95 | 16° | 40 | 4 | Open price |
| **UPDLRS 1010-010-030** | | R0.1 | | | | | 40 | 4 | Open price |
| **UPDLRS 1010-020-030** | | R0.2 | | | | | 40 | 4 | Open price |
| **UPDLRS 1020-005-040** | 2 | R0.05 | 4 | 0.55 | 1.95 | 16° | 40 | 4 | Open price |
| **UPDLRS 1020-010-040** | | R0.1 | | | | | 40 | 4 | Open price |
| **UPDLRS 1020-020-040** | | R0.2 | | | | | 40 | 4 | Open price |

## Milling Conditions for UPDLRS

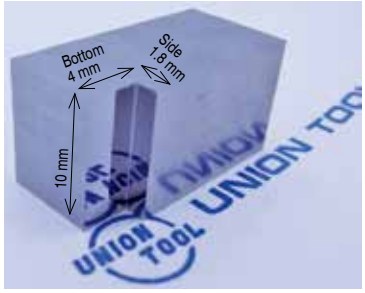
| WORK MATERIAL | | | CEMENTED CARBIDE | | | |
|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth (mm) | Radial Depth (mm) |
| **1002-002-006** | **0.2** | 0.6 | 40,000 | 100 | 0.001 | 0.001 |
| **1002-005-006** | | | 40,000 | 100 | 0.001 | 0.001 |
| **1003-002-010** | **0.3** | 1 | 40,000 | 150 | 0.002 | 0.001 |
| **1003-005-010** | | | 40,000 | 150 | 0.002 | 0.001 |
| **1005-005-015** | **0.5** | 1.5 | 40,000 | 200 | 0.003 | 0.001 |
| **1005-010-015** | | | 40,000 | 200 | 0.003 | 0.001 |
| **1010-005-030** | **1** | 3 | 40,000 | 400 | 0.005 | 0.003 |
| **1010-010-030** | | | 40,000 | 400 | 0.005 | 0.003 |
| **1010-020-030** | | | 40,000 | 400 | 0.005 | 0.003 |
| **1020-005-040** | **2** | 4 | 40,000 | 600 | 0.01 | 0.005 |
| **1020-010-040** | | | 40,000 | 600 | 0.01 | 0.005 |
| **1020-020-040** | | | 40,000 | 600 | 0.01 | 0.005 |




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
- Use a machine with high accuracy for stable cutting.
- Non-water soluble coolant recommended. Supply as a mist or external coolant. Take fire prevention precautions to avoid fire hazards caused by sparks igniting during machinig or tool breakage.
- Shorten overhang as much as possible.
- Adjust cutting conditions as necessary as machine spec and other conditions may vary.
- These cutting parameters show reference value. Adjust the cutting conditions to the desired machined surface finish.

## UPDLRS Milling Example for Finishing UDCLRSF / UPDLRS $\phi$2 Cemented Carbide VF-20 (92.5HRA)




Milling Area : 4 × 10 × Depth 1.8 mm
Work Size : 10 × 10 × 20 mm

After Finishing

| Milling Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Stock (mm) | Coolant | Cycle Time |
|---|---|---|---|---|---|---|---|---|
| Roughing | UDCLRSF 2020-005020 ($\phi$2 x CR0.05 x Effective Length 2 ) | 20,000 | 400 | 0.9 x 2 Times | 0.01 | 0.005 | Air Blow | 54 min |
| Finishing (Bottom) | UPDLRS 1020-005-040 ($\phi$2 x CR0.05 x Effective Length 4 ) | 40,000 | 600 | 0.01 | 0.005 | 0 | | 45 min |
| Finishing (Side) | | 40,000 | 400 | 0.002 | 0.01 | 0 | | 52 min |

Size $\phi$0.2～$\phi$6

# HLRS2000/HLRS2000E

Super MG | HARD MAX | 30° | R | ±0.005 R | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ○ ～65HRC | ○ | | | ◎ | | | ○ | ○ | | |

Total 353 models

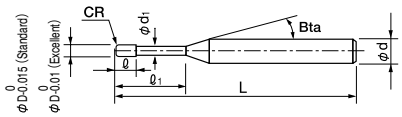
Unit（mm）

| Model Number | Excellent | Outside Diameter $\phi$D | Corner Radius CR | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi$d | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2002-005-005E | ○ | 0.2 | R0.05 | 0.5 | 0.2 | 0.17 | 16° | 50 | 4 | 12,320 |
| HLRS 2002-005-010E | ○ | | | 1 | | | | 50 | 4 | 12,320 |
| HLRS 2002-005-015E | ○ | | | 1.5 | | | | 50 | 4 | 12,320 |
| HLRS 2002-005-020E | ○ | | | 2 | | | | 50 | 4 | 12,320 |
| HLRS 2003-005-010E | ○ | 0.3 | R0.05 | 1 | 0.3 | 0.27 | 16° | 50 | 4 | 11,870 |
| HLRS 2003-005-015E | ○ | | | 1.5 | | | | 50 | 4 | 11,870 |
| HLRS 2003-005-020E | ○ | | | 2 | | | | 50 | 4 | 11,870 |
| HLRS 2003-005-025E | ○ | | | 2.5 | | | | 50 | 4 | 13,200 |
| HLRS 2003-005-030E | ○ | | | 3 | | | | 50 | 4 | 13,200 |
| HLRS 2004-005-010E | ○ | 0.4 | R0.05 | 1 | 0.4 | 0.38 | 16° | 50 | 4 | 7,910 |
| HLRS 2004-005-015E | ○ | | | 1.5 | | | | 50 | 4 | 7,910 |
| HLRS 2004-005-020E | ○ | | | 2 | | | | 50 | 4 | 7,910 |
| HLRS 2004-005-030E | ○ | | | 3 | | | | 50 | 4 | 7,910 |
| HLRS 2004-005-040E | ○ | | | 4 | | | | 50 | 4 | 7,910 |
| HLRS 2004-01-010 | | | R0.1 | 1 | | | | 50 | 4 | 7,910 |
| HLRS 2004-01-015 | | | | 1.5 | | | | 50 | 4 | 7,910 |
| HLRS 2004-01-020 | | | | 2 | | | | 50 | 4 | 7,910 |
| HLRS 2004-01-030 | | | | 3 | | | | 50 | 4 | 7,910 |
| HLRS 2004-01-040 | | | | 4 | | | | 50 | 4 | 7,910 |
| HLRS 2005-005-010 | | 0.5 | R0.05 | 1 | 0.5 | 0.48 | 16° | 50 | 4 | 6,440 |
| HLRS 2005-005-020 | | | | 2 | | | | 50 | 4 | 6,440 |
| HLRS 2005-005-030 | | | | 3 | | | | 50 | 4 | 6,440 |
| HLRS 2005-005-040 | | | | 4 | | | | 50 | 4 | 6,440 |
| HLRS 2005-005-050 | | | | 5 | | | | 50 | 4 | 6,440 |
| HLRS 2005-01-010 | | | R0.1 | 1 | | | | 50 | 4 | 6,440 |
| HLRS 2005-01-020 | | | | 2 | | | | 50 | 4 | 6,440 |
| HLRS 2005-01-030 | | | | 3 | | | | 50 | 4 | 6,440 |
| HLRS 2005-01-040 | | | | 4 | | | | 50 | 4 | 6,440 |
| HLRS 2005-01-050 | | | | 5 | | | | 50 | 4 | 6,440 |
| HLRS 2005-01-060 | | | | 6 | | | | 50 | 4 | 6,440 |

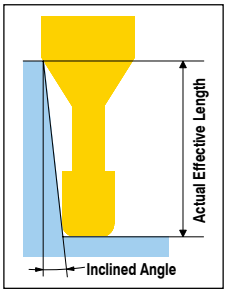
Next Page ➡

## Features

**Long Neck Radius design for high efficiency and high quality milling.**
**Recommended for various applications from Copper and Raw Materials to Hard Materials.**
**Both dry and wet coolant offer stable and long tool life.**
**Refer to page 338 for 4 flute HLRS.**




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




| | Diameter Tolerance | Corner Radius Tolerance |
|---|---|---|
| Standard Tolerance Type | 0/-0.015 | Nominal Radius ± 0.005 |
| Excellent Tolerance Type | 0/-0.01 | Nominal Radius ± 0.005 |

Unit (mm)

| Model Number | Excellent | Outside Diameter $\phi$D | Corner Radius CR | Effective Length $\ell_1$ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2002-005-005E | ○ | 0.2 | R0.05 | 0.5 | 0.67 | 0.71 | 0.75 | 0.78 | 0.85 |
| HLRS 2002-005-010E | ○ | | | 1 | 1.20 | 1.26 | 1.31 | 1.36 | 1.45 |
| HLRS 2002-005-015E | ○ | | | 1.5 | 1.72 | 1.80 | 1.87 | 1.92 | 2.03 |
| HLRS 2002-005-020E | ○ | | | 2 | 2.25 | 2.34 | 2.41 | 2.48 | 2.59 |
| HLRS 2003-005-010E | ○ | 0.3 | R0.05 | 1 | 1.24 | 1.31 | 1.38 | 1.44 | 1.55 |
| HLRS 2003-005-015E | ○ | | | 1.5 | 1.72 | 1.83 | 1.91 | 1.99 | 2.12 |
| HLRS 2003-005-020E | ○ | | | 2 | 2.26 | 2.37 | 2.47 | 2.55 | 2.70 |
| HLRS 2003-005-025E | ○ | | | 2.5 | 2.78 | 2.91 | 3.02 | 3.11 | 3.27 |
| HLRS 2003-005-030E | ○ | | | 3 | 3.31 | 3.45 | 3.57 | 3.66 | 3.83 |
| HLRS 2004-005-010E | ○ | 0.4 | R0.05 | 1 | 1.31 | 1.40 | 1.49 | 1.57 | 1.72 |
| HLRS 2004-005-015E | ○ | | | 1.5 | 1.79 | 1.92 | 2.03 | 2.13 | 2.31 |
| HLRS 2004-005-020E | ○ | | | 2 | 2.33 | 2.48 | 2.60 | 2.71 | 2.90 |
| HLRS 2004-005-030E | ○ | | | 3 | 3.40 | 3.58 | 3.72 | 3.85 | 4.07 |
| HLRS 2004-005-040E | ○ | | | 4 | 4.45 | 4.66 | 4.82 | 4.97 | 5.21 |
| HLRS 2004-01-010 | | | R0.1 | 1 | 1.28 | 1.38 | 1.46 | 1.55 | 1.69 |
| HLRS 2004-01-015 | | | | 1.5 | 1.76 | 1.90 | 2.01 | 2.11 | 2.28 |
| HLRS 2004-01-020 | | | | 2 | 2.30 | 2.46 | 2.58 | 2.69 | 2.89 |
| HLRS 2004-01-030 | | | | 3 | 3.38 | 3.56 | 3.71 | 3.83 | 4.06 |
| HLRS 2004-01-040 | | | | 4 | 4.44 | 4.64 | 4.81 | 4.95 | 5.20 |
| HLRS 2005-005-010 | | 0.5 | R0.05 | 1 | 1.34 | 1.46 | 1.57 | 1.67 | 1.86 |
| HLRS 2005-005-020 | | | | 2 | 2.37 | 2.55 | 2.71 | 2.84 | 3.08 |
| HLRS 2005-005-030 | | | | 3 | 3.45 | 3.67 | 3.85 | 4.00 | 4.27 |
| HLRS 2005-005-040 | | | | 4 | 4.52 | 4.77 | 4.97 | 5.14 | 5.44 |
| HLRS 2005-005-050 | | | | 5 | 5.58 | 5.85 | 6.07 | 6.26 | 6.58 |
| HLRS 2005-01-010 | | | R0.1 | 1 | 1.34 | 1.45 | 1.56 | 1.66 | 1.85 |
| HLRS 2005-01-020 | | | | 2 | 2.37 | 2.55 | 2.70 | 2.83 | 3.07 |
| HLRS 2005-01-030 | | | | 3 | 3.45 | 3.67 | 3.84 | 4.00 | 4.26 |
| HLRS 2005-01-040 | | | | 4 | 4.52 | 4.76 | 4.96 | 5.13 | 5.43 |
| HLRS 2005-01-050 | | | | 5 | 5.58 | 5.85 | 6.07 | 6.25 | 6.57 |
| HLRS 2005-01-060 | | | | 6 | 6.63 | 6.93 | 7.16 | 7.36 | 7.70 |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2006-005-020 | | 0.6 | R0.05 | 2 | 0.6 | 0.58 | 16° | 50 | 4 | 6,440 |
| HLRS 2006-005-030 | | | | 3 | | | | 50 | 4 | 6,440 |
| HLRS 2006-005-040 | | | | 4 | | | | 50 | 4 | 6,440 |
| HLRS 2006-005-060 | | | | 6 | | | | 50 | 4 | 6,440 |
| HLRS 2006-005-080 | | | | 8 | | | | 50 | 4 | 6,440 |
| HLRS 2006-01-020 | | | R0.1 | 2 | | | | 50 | 4 | 6,440 |
| HLRS 2006-01-020E | ○ | | | 2 | | | | 50 | 4 | 7,080 |
| HLRS 2006-01-030 | | | | 3 | | | | 50 | 4 | 6,440 |
| HLRS 2006-01-030E | ○ | | | 3 | | | | 50 | 4 | 7,080 |
| HLRS 2006-01-040 | | | | 4 | | | | 50 | 4 | 6,440 |
| HLRS 2006-01-040E | ○ | | | 4 | | | | 50 | 4 | 7,080 |
| HLRS 2006-01-060 | | | | 6 | | | | 50 | 4 | 6,440 |
| HLRS 2006-01-080 | | | | 8 | | | | 50 | 4 | 6,440 |
| HLRS 2006-02-020 | | | R0.2 | 2 | | | | 50 | 4 | 6,440 |
| HLRS 2006-02-030 | | | | 3 | | | | 50 | 4 | 6,440 |
| HLRS 2006-02-040 | | | | 4 | | | | 50 | 4 | 6,440 |
| HLRS 2006-02-060 | | | | 6 | | | | 50 | 4 | 6,440 |
| HLRS 2006-02-080 | | | | 8 | | | | 50 | 4 | 6,440 |
| HLRS 2007-01-040 | | 0.7 | R0.1 | 4 | 0.7 | 0.68 | 16° | 50 | 4 | 6,780 |
| HLRS 2007-01-060 | | | | 6 | | | | 50 | 4 | 6,780 |
| HLRS 2007-02-040 | | | R0.2 | 4 | | | | 50 | 4 | 6,780 |
| HLRS 2007-02-060 | | | | 6 | | | | 50 | 4 | 6,780 |
| HLRS 2008-005-040 | | 0.8 | R0.05 | 4 | 0.8 | 0.78 | 16° | 50 | 4 | 7,340 |
| HLRS 2008-005-060 | | | | 6 | | | | 50 | 4 | 7,340 |
| HLRS 2008-005-080 | | | | 8 | | | | 50 | 4 | 7,340 |
| HLRS 2008-01-040 | | | R0.1 | 4 | | | | 50 | 4 | 7,340 |
| HLRS 2008-01-060 | | | | 6 | | | | 50 | 4 | 7,340 |
| HLRS 2008-01-080 | | | | 8 | | | | 50 | 4 | 7,340 |
| HLRS 2008-02-040 | | | R0.2 | 4 | | | | 50 | 4 | 7,340 |
| HLRS 2008-02-060 | | | | 6 | | | | 50 | 4 | 7,340 |
| HLRS 2008-02-080 | | | | 8 | | | | 50 | 4 | 7,340 |
| HLRS 2010-005-020 | | 1 | R0.05 | 2 | 1 | 0.95 | 16° | 50 | 4 | 6,240 |
| HLRS 2010-005-030 | | | | 3 | | | | 50 | 4 | 6,240 |
| HLRS 2010-005-040 | | | | 4 | | | | 50 | 4 | 6,240 |
| HLRS 2010-005-050 | | | | 5 | | | | 50 | 4 | 6,240 |
| HLRS 2010-005-060 | | | | 6 | | | | 50 | 4 | 6,780 |
| HLRS 2010-005-080 | | | | 8 | | | | 50 | 4 | 6,780 |
| HLRS 2010-005-100 | | | | 10 | | | | 50 | 4 | 6,780 |
| HLRS 2010-005-120 | | | | 12 | | | | 55 | 4 | 6,780 |
| HLRS 2010-005-160 | | | | 16 | | | | 60 | 4 | 8,990 |
| HLRS 2010-005-200 | | | | 20 | | | | 60 | 4 | 9,980 |
| HLRS 2010-01-020 | | | R0.1 | 2 | | | | 50 | 4 | 6,240 |
| HLRS 2010-01-020E | ○ | | | 2 | | | | 50 | 4 | 6,860 |
| HLRS 2010-01-030 | | | | 3 | | | | 50 | 4 | 6,240 |
| HLRS 2010-01-040 | | | | 4 | | | | 50 | 4 | 6,240 |
| HLRS 2010-01-040E | ○ | | | 4 | | | | 50 | 4 | 6,860 |
| HLRS 2010-01-050 | | | | 5 | | | | 50 | 4 | 6,240 |
| HLRS 2010-01-060 | | | | 6 | | | | 50 | 4 | 6,780 |
| HLRS 2010-01-060E | ○ | | | 6 | | | | 50 | 4 | 7,460 |

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Ball
Long Neck Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2006-005-020 | | 0.6 | R0.05 | 2 | 2.38 | 2.61 | 2.79 | 2.95 | 3.22 |
| HLRS 2006-005-030 | | | | 3 | 3.48 | 3.74 | 3.95 | 4.13 | 4.30 |
| HLRS 2006-005-040 | | | | 4 | 4.56 | 4.85 | 5.08 | 5.28 | 5.67 |
| HLRS 2006-005-060 | | | | 6 | 6.68 | 7.03 | 7.30 | 7.55 | 8.12 |
| HLRS 2006-005-080 | | | | 8 | 8.79 | 9.18 | 9.50 | 9.83 | 10.56 |
| HLRS 2006-01-020 | | | R0.1 | 2 | 2.37 | 2.60 | 2.78 | 2.93 | 3.20 |
| HLRS 2006-01-020E | ○ | | | 2 | 2.37 | 2.60 | 2.78 | 2.93 | 3.20 |
| HLRS 2006-01-030 | | | | 3 | 3.47 | 3.73 | 3.94 | 4.11 | 4.28 |
| HLRS 2006-01-030E | ○ | | | 3 | 3.47 | 3.73 | 3.94 | 4.11 | 4.28 |
| HLRS 2006-01-040 | | | | 4 | 4.55 | 4.84 | 5.07 | 5.26 | 5.65 |
| HLRS 2006-01-040E | ○ | | | 4 | 4.55 | 4.84 | 5.07 | 5.26 | 5.65 |
| HLRS 2006-01-060 | | | | 6 | 6.68 | 7.03 | 7.30 | 7.54 | 8.10 |
| HLRS 2006-01-080 | | | | 8 | 8.79 | 9.18 | 9.50 | 9.82 | 10.55 |
| HLRS 2006-02-020 | | | R0.2 | 2 | 2.34 | 2.56 | 2.74 | 2.90 | 3.18 |
| HLRS 2006-02-030 | | | | 3 | 3.44 | 3.70 | 3.91 | 4.09 | 4.41 |
| HLRS 2006-02-040 | | | | 4 | 4.53 | 4.82 | 5.05 | 5.23 | 5.61 |
| HLRS 2006-02-060 | | | | 6 | 6.66 | 7.01 | 7.28 | 7.51 | 8.06 |
| HLRS 2006-02-080 | | | | 8 | 8.79 | 9.17 | 9.48 | 9.81 | 10.53 |
| HLRS 2007-01-040 | | 0.7 | R0.1 | 4 | 4.55 | 4.84 | 5.07 | 5.26 | 5.65 |
| HLRS 2007-01-060 | | | | 6 | 6.68 | 7.03 | 7.30 | 7.54 | 8.10 |
| HLRS 2007-02-040 | | | R0.2 | 4 | 4.53 | 4.82 | 5.05 | 5.23 | 5.61 |
| HLRS 2007-02-060 | | | | 6 | 6.66 | 7.01 | 7.28 | 7.51 | 8.06 |
| HLRS 2008-005-040 | | 0.8 | R0.05 | 4 | 4.56 | 4.85 | 5.08 | 5.28 | 5.67 |
| HLRS 2008-005-060 | | | | 6 | 6.68 | 7.03 | 7.30 | 7.55 | 8.12 |
| HLRS 2008-005-080 | | | | 8 | 8.79 | 9.18 | 9.50 | 9.83 | 10.56 |
| HLRS 2008-01-040 | | | R0.1 | 4 | 4.55 | 4.84 | 5.07 | 5.26 | 5.65 |
| HLRS 2008-01-060 | | | | 6 | 6.68 | 7.03 | 7.30 | 7.54 | 8.10 |
| HLRS 2008-01-080 | | | | 8 | 8.79 | 9.18 | 9.50 | 9.82 | 10.55 |
| HLRS 2008-02-040 | | | R0.2 | 4 | 4.53 | 4.82 | 5.05 | 5.23 | 5.61 |
| HLRS 2008-02-060 | | | | 6 | 6.66 | 7.01 | 7.28 | 7.51 | 8.06 |
| HLRS 2008-02-080 | | | | 8 | 8.79 | 9.17 | 9.48 | 9.81 | 10.53 |
| HLRS 2010-005-020 | | 1 | R0.05 | 2 | 2.51 | 2.86 | 2.70 | 3.01 | 3.28 |
| HLRS 2010-005-030 | | | | 3 | 3.59 | 3.82 | 4.01 | 4.18 | 4.51 |
| HLRS 2010-005-040 | | | | 4 | 4.72 | 4.92 | 5.14 | 5.33 | 5.73 |
| HLRS 2010-005-050 | | | | 5 | 5.72 | 6.01 | 6.25 | 6.47 | 6.95 |
| HLRS 2010-005-060 | | | | 6 | 6.77 | 7.09 | 7.35 | 7.61 | 8.18 |
| HLRS 2010-005-080 | | | | 8 | 8.87 | 9.24 | 9.55 | 9.88 | 10.62 |
| HLRS 2010-005-100 | | | | 10 | 10.97 | 11.37 | 11.75 | 12.16 | 13.07 |
| HLRS 2010-005-120 | | | | 12 | 13.05 | 13.50 | 13.96 | 14.44 | 15.52 |
| HLRS 2010-005-160 | | | | 16 | 17.20 | 17.76 | 18.36 | 18.99 | 20.41 |
| HLRS 2010-005-200 | | | | 20 | 21.33 | 22.02 | 22.76 | 23.55 | 25.31 |
| HLRS 2010-01-020 | | | R0.1 | 2 | 2.53 | 2.71 | 2.88 | 3.01 | 3.27 |
| HLRS 2010-01-020E | ○ | | | 2 | 2.53 | 2.71 | 2.88 | 3.01 | 3.27 |
| HLRS 2010-01-030 | | | | 3 | 3.58 | 3.81 | 4.00 | 4.18 | 4.49 |
| HLRS 2010-01-040 | | | | 4 | 4.67 | 4.93 | 5.14 | 5.33 | 5.72 |
| HLRS 2010-01-040E | ○ | | | 4 | 4.67 | 4.93 | 5.14 | 5.33 | 5.72 |
| HLRS 2010-01-050 | | | | 5 | 5.71 | 6.00 | 6.24 | 6.46 | 6.94 |
| HLRS 2010-01-060 | | | | 6 | 6.78 | 7.10 | 7.36 | 7.60 | 8.17 |
| HLRS 2010-01-060E | ○ | | | 6 | 6.78 | 7.10 | 7.36 | 7.60 | 8.17 |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2010-01-080 | | 1 | R0.1 | 8 | 1 | 0.95 | 16° | 50 | 4 | 6,780 |
| HLRS 2010-01-100 | | | | 10 | | | | 50 | 4 | 6,780 |
| HLRS 2010-01-120 | | | | 12 | | | | 55 | 4 | 6,780 |
| HLRS 2010-01-160 | | | | 16 | | | | 60 | 4 | 8,990 |
| HLRS 2010-01-200 | | | | 20 | | | | 60 | 4 | 9,980 |
| HLRS 2010-02-020 | | | R0.2 | 2 | | | | 50 | 4 | 6,240 |
| HLRS 2010-02-020E | ○ | | | 2 | | | | 50 | 4 | 6,860 |
| HLRS 2010-02-030 | | | | 3 | | | | 50 | 4 | 6,240 |
| HLRS 2010-02-040 | | | | 4 | | | | 50 | 4 | 6,240 |
| HLRS 2010-02-040E | ○ | | | 4 | | | | 50 | 4 | 6,860 |
| HLRS 2010-02-050 | | | | 5 | | | | 50 | 4 | 6,240 |
| HLRS 2010-02-060 | | | | 6 | | | | 50 | 4 | 6,780 |
| HLRS 2010-02-060E | ○ | | | 6 | | | | 50 | 4 | 7,460 |
| HLRS 2010-02-080 | | | | 8 | | | | 50 | 4 | 6,780 |
| HLRS 2010-02-100 | | | | 10 | | | | 50 | 4 | 6,780 |
| HLRS 2010-02-120 | | | | 12 | | | | 55 | 4 | 6,780 |
| HLRS 2010-02-160 | | | | 16 | | | | 60 | 4 | 8,990 |
| HLRS 2010-02-200 | | | | 20 | | | | 60 | 4 | 9,980 |
| HLRS 2010-03-020 | | | R0.3 | 2 | | | | 50 | 4 | 6,240 |
| HLRS 2010-03-020E | ○ | | | 2 | | | | 50 | 4 | 6,860 |
| HLRS 2010-03-030 | | | | 3 | | | | 50 | 4 | 6,240 |
| HLRS 2010-03-040 | | | | 4 | | | | 50 | 4 | 6,240 |
| HLRS 2010-03-040E | ○ | | | 4 | | | | 50 | 4 | 6,860 |
| HLRS 2010-03-050 | | | | 5 | | | | 50 | 4 | 6,240 |
| HLRS 2010-03-060 | | | | 6 | | | | 50 | 4 | 6,780 |
| HLRS 2010-03-060E | ○ | | | 6 | | | | 50 | 4 | 7,460 |
| HLRS 2010-03-080 | | | | 8 | | | | 50 | 4 | 6,780 |
| HLRS 2010-03-100 | | | | 10 | | | | 50 | 4 | 6,780 |
| HLRS 2010-03-120 | | | | 12 | | | | 55 | 4 | 6,780 |
| HLRS 2010-03-160 | | | | 16 | | | | 60 | 4 | 8,990 |
| HLRS 2010-03-200 | | | | 20 | | | | 60 | 4 | 9,980 |
| HLRS 2012-02-060 | | 1.2 | R0.2 | 6 | 1.2 | 1.14 | 16° | 50 | 4 | 7,000 |
| HLRS 2012-02-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2012-02-200 | | | | 20 | | | | 60 | 4 | 10,620 |
| HLRS 2012-03-060 | | | R0.3 | 6 | | | | 50 | 4 | 7,000 |
| HLRS 2012-03-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2012-03-200 | | | | 20 | | | | 60 | 4 | 10,620 |
| HLRS 2015-005-040 | | 1.5 | R0.05 | 4 | 1.5 | 1.45 | 16° | 50 | 4 | 6,650 |
| HLRS 2015-005-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2015-005-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2015-005-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2015-01-040 | | | R0.1 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2015-01-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2015-01-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2015-01-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2015-01-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2015-01-160 | | | | 16 | | | | 55 | 4 | 7,000 |
| HLRS 2015-01-200 | | | | 20 | | | | 60 | 4 | 7,000 |

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Ball
Long Neck Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2010-01-080 | | 1 | R0.1 | 8 | 8.88 | 9.24 | 9.56 | 9.88 | 10.61 |
| HLRS 2010-01-100 | | | | 10 | 10.97 | 11.37 | 11.76 | 12.16 | 13.06 |
| HLRS 2010-01-120 | | | | 12 | 13.05 | 13.50 | 13.96 | 14.44 | 15.51 |
| HLRS 2010-01-160 | | | | 16 | 17.20 | 17.76 | 18.36 | 18.99 | 20.40 |
| HLRS 2010-01-200 | | | | 20 | 21.33 | 22.02 | 22.76 | 23.54 | 25.30 |
| HLRS 2010-02-020 | | | R0.2 | 2 | 2.51 | 2.69 | 2.86 | 2.98 | 3.23 |
| HLRS 2010-02-020E | ○ | | | 2 | 2.51 | 2.69 | 2.86 | 2.98 | 3.23 |
| HLRS 2010-02-030 | | | | 3 | 3.58 | 3.80 | 3.99 | 4.16 | 4.47 |
| HLRS 2010-02-040 | | | | 4 | 4.65 | 4.91 | 5.12 | 5.30 | 5.68 |
| HLRS 2010-02-040E | ○ | | | 4 | 4.65 | 4.91 | 5.12 | 5.30 | 5.68 |
| HLRS 2010-02-050 | | | | 5 | 5.71 | 6.00 | 6.23 | 6.45 | 6.92 |
| HLRS 2010-02-060 | | | | 6 | 6.76 | 7.08 | 7.34 | 7.57 | 8.13 |
| HLRS 2010-02-060E | ○ | | | 6 | 6.76 | 7.08 | 7.34 | 7.57 | 8.13 |
| HLRS 2010-02-080 | | | | 8 | 8.86 | 9.22 | 9.54 | 9.85 | 10.57 |
| HLRS 2010-02-100 | | | | 10 | 10.95 | 11.35 | 11.74 | 12.13 | 13.02 |
| HLRS 2010-02-120 | | | | 12 | 13.03 | 13.48 | 13.94 | 14.41 | 15.47 |
| HLRS 2010-02-160 | | | | 16 | 17.18 | 17.74 | 18.34 | 18.96 | 20.36 |
| HLRS 2010-02-200 | | | | 20 | 21.31 | 22.00 | 22.74 | 23.51 | 25.26 |
| HLRS 2010-03-020 | | | R0.3 | 2 | 2.49 | 2.67 | 2.84 | 2.95 | 3.19 |
| HLRS 2010-03-020E | ○ | | | 2 | 2.49 | 2.67 | 2.84 | 2.95 | 3.19 |
| HLRS 2010-03-030 | | | | 3 | 3.57 | 3.79 | 3.98 | 4.14 | 4.45 |
| HLRS 2010-03-040 | | | | 4 | 4.63 | 4.89 | 5.10 | 5.27 | 5.64 |
| HLRS 2010-03-040E | ○ | | | 4 | 4.63 | 4.89 | 5.10 | 5.27 | 5.64 |
| HLRS 2010-03-050 | | | | 5 | 5.70 | 5.99 | 6.22 | 6.43 | 6.90 |
| HLRS 2010-03-060 | | | | 6 | 6.74 | 7.06 | 7.32 | 7.54 | 8.09 |
| HLRS 2010-03-060E | ○ | | | 6 | 6.74 | 7.06 | 7.32 | 7.54 | 8.09 |
| HLRS 2010-03-080 | | | | 8 | 8.84 | 9.20 | 9.52 | 9.82 | 10.53 |
| HLRS 2010-03-100 | | | | 10 | 10.93 | 11.33 | 11.72 | 12.10 | 12.98 |
| HLRS 2010-03-120 | | | | 12 | 13.01 | 13.46 | 13.92 | 14.38 | 15.43 |
| HLRS 2010-03-160 | | | | 16 | 17.16 | 17.72 | 18.32 | 18.93 | 20.32 |
| HLRS 2010-03-200 | | | | 20 | 21.29 | 21.98 | 22.72 | 23.48 | 25.22 |
| HLRS 2012-02-060 | | 1.2 | R0.2 | 6 | 6.18 | 6.38 | 6.59 | 6.82 | 7.33 |
| HLRS 2012-02-120 | | | | 12 | 12.37 | 12.77 | 13.19 | 13.65 | 14.67 |
| HLRS 2012-02-200 | | | | 20 | 20.62 | 21.29 | 22.00 | 22.76 | 24.46 |
| HLRS 2012-03-060 | | | R0.3 | 6 | 6.18 | 6.38 | 6.59 | 6.81 | 7.31 |
| HLRS 2012-03-120 | | | | 12 | 12.37 | 12.77 | 13.19 | 13.64 | 14.66 |
| HLRS 2012-03-200 | | | | 20 | 20.62 | 21.28 | 21.99 | 22.75 | 24.45 |
| HLRS 2015-005-040 | | 1.5 | R0.05 | 4 | 4.12 | 4.26 | 4.40 | 4.55 | 4.89 |
| HLRS 2015-005-060 | | | | 6 | 6.18 | 6.39 | 6.60 | 6.83 | 7.34 |
| HLRS 2015-005-080 | | | | 8 | 8.25 | 8.52 | 8.80 | 9.11 | 9.79 |
| HLRS 2015-005-100 | | | | 10 | 10.31 | 10.64 | 11.00 | 11.38 | 12.24 |
| HLRS 2015-01-040 | | | R0.1 | 4 | 4.12 | 4.25 | 4.40 | 4.55 | 4.89 |
| HLRS 2015-01-060 | | | | 6 | 6.18 | 6.38 | 6.60 | 6.83 | 7.34 |
| HLRS 2015-01-080 | | | | 8 | 8.24 | 8.51 | 8.80 | 9.10 | 9.78 |
| HLRS 2015-01-100 | | | | 10 | 10.31 | 10.64 | 11.00 | 11.38 | 12.23 |
| HLRS 2015-01-120 | | | | 12 | 12.37 | 12.77 | 13.20 | 13.66 | 14.68 |
| HLRS 2015-01-160 | | | | 16 | 16.50 | 17.03 | 17.60 | 18.21 | 19.57 |
| HLRS 2015-01-200 | | | | 20 | 20.62 | 21.29 | 22.00 | 22.77 | No Interference |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2015-02-040 | | 1.5 | R0.2 | 4 | 1.5 | 1.45 | 16° | 50 | 4 | 6,650 |
| HLRS 2015-02-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2015-02-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2015-02-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2015-02-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2015-02-160 | | | | 16 | | | | 55 | 4 | 7,000 |
| HLRS 2015-02-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2015-03-040 | | | R0.3 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2015-03-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2015-03-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2015-03-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2015-03-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2015-03-160 | | | | 16 | | | | 55 | 4 | 7,000 |
| HLRS 2015-03-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2015-05-040 | | | R0.5 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2015-05-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2015-05-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2015-05-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2015-05-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2015-05-160 | | | | 16 | | | | 55 | 4 | 7,000 |
| HLRS 2015-05-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2020-005-040 | | 2 | R0.05 | 4 | 2 | 1.92 | 16° | 50 | 4 | 6,650 |
| HLRS 2020-005-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2020-005-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2020-005-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2020-01-040 | | | R0.1 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2020-01-040E | ○ | | | 4 | | | | 50 | 4 | 7,320 |
| HLRS 2020-01-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2020-01-060E | ○ | | | 6 | | | | 50 | 4 | 7,320 |
| HLRS 2020-01-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2020-01-080E | ○ | | | 8 | | | | 50 | 4 | 7,700 |
| HLRS 2020-01-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2020-01-100E | ○ | | | 10 | | | | 50 | 4 | 7,700 |
| HLRS 2020-01-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2020-01-120E | ○ | | | 12 | | | | 55 | 4 | 7,700 |
| HLRS 2020-01-160 | | | | 16 | | | | 60 | 4 | 7,000 |
| HLRS 2020-01-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2020-01-260 | | | | 26 | | | | 70 | 4 | 7,000 |
| HLRS 2020-01-300 | | | | 30 | | | | 70 | 4 | 7,000 |
| HLRS 2020-02-040 | | | R0.2 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2020-02-040E | ○ | | | 4 | | | | 50 | 4 | 7,320 |
| HLRS 2020-02-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2020-02-060E | ○ | | | 6 | | | | 50 | 4 | 7,320 |
| HLRS 2020-02-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2020-02-080E | ○ | | | 8 | | | | 50 | 4 | 7,700 |
| HLRS 2020-02-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2020-02-100E | ○ | | | 10 | | | | 50 | 4 | 7,700 |





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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2015-02-040 | | 1.5 | R0.2 | 4 | 4.12 | 4.25 | 4.39 | 4.54 | 4.88 |
| HLRS 2015-02-060 | | | | 6 | 6.18 | 6.38 | 6.59 | 6.82 | 7.33 |
| HLRS 2015-02-080 | | | | 8 | 8.24 | 8.51 | 8.79 | 9.10 | 9.77 |
| HLRS 2015-02-100 | | | | 10 | 10.31 | 10.64 | 10.99 | 11.37 | 12.22 |
| HLRS 2015-02-120 | | | | 12 | 12.37 | 12.77 | 13.19 | 13.65 | 14.67 |
| HLRS 2015-02-160 | | | | 16 | 16.49 | 17.03 | 17.60 | 18.21 | 19.56 |
| HLRS 2015-02-200 | | | | 20 | 20.62 | 21.29 | 22.00 | 22.76 | No Interference |
| HLRS 2015-03-040 | | | R0.3 | 4 | 4.12 | 4.25 | 4.39 | 4.54 | 4.87 |
| HLRS 2015-03-060 | | | | 6 | 6.18 | 6.38 | 6.59 | 6.81 | 7.31 |
| HLRS 2015-03-080 | | | | 8 | 8.24 | 8.51 | 8.79 | 9.09 | 9.76 |
| HLRS 2015-03-100 | | | | 10 | 10.30 | 10.64 | 10.99 | 11.37 | 12.21 |
| HLRS 2015-03-120 | | | | 12 | 12.37 | 12.77 | 13.19 | 13.64 | 14.66 |
| HLRS 2015-03-160 | | | | 16 | 16.49 | 17.02 | 17.59 | 18.20 | 19.55 |
| HLRS 2015-03-200 | | | | 20 | 20.62 | 21.28 | 21.99 | 22.75 | No Interference |
| HLRS 2015-05-040 | | | R0.5 | 4 | 4.11 | 4.24 | 4.38 | 4.52 | 4.85 |
| HLRS 2015-05-060 | | | | 6 | 6.18 | 6.37 | 6.58 | 6.80 | 7.29 |
| HLRS 2015-05-080 | | | | 8 | 8.24 | 8.50 | 8.78 | 9.08 | 9.74 |
| HLRS 2015-05-100 | | | | 10 | 10.30 | 10.63 | 10.98 | 11.35 | 12.19 |
| HLRS 2015-05-120 | | | | 12 | 12.36 | 12.76 | 13.18 | 13.63 | 14.64 |
| HLRS 2015-05-160 | | | | 16 | 16.49 | 17.02 | 17.58 | 18.19 | 19.53 |
| HLRS 2015-05-200 | | | | 20 | 20.62 | 21.28 | 21.98 | 22.74 | 24.42 |
| HLRS 2020-005-040 | | 2 | R0.05 | 4 | 4.16 | 4.29 | 4.44 | 4.59 | 4.94 |
| HLRS 2020-005-060 | | | | 6 | 6.22 | 6.42 | 6.64 | 6.87 | 7.38 |
| HLRS 2020-005-080 | | | | 8 | 8.28 | 8.55 | 8.84 | 9.15 | 9.83 |
| HLRS 2020-005-100 | | | | 10 | 10.35 | 10.68 | 11.04 | 11.42 | 12.28 |
| HLRS 2020-01-040 | | | R0.1 | 4 | 4.16 | 4.29 | 4.43 | 4.59 | 4.93 |
| HLRS 2020-01-040E | ○ | | | 4 | 4.16 | 4.29 | 4.43 | 4.59 | 4.93 |
| HLRS 2020-01-060 | | | | 6 | 6.22 | 6.42 | 6.64 | 6.87 | 7.38 |
| HLRS 2020-01-060E | ○ | | | 6 | 6.22 | 6.42 | 6.64 | 6.87 | 7.38 |
| HLRS 2020-01-080 | | | | 8 | 8.28 | 8.55 | 8.84 | 9.14 | 9.83 |
| HLRS 2020-01-080E | ○ | | | 8 | 8.28 | 8.55 | 8.84 | 9.14 | 9.83 |
| HLRS 2020-01-100 | | | | 10 | 10.34 | 10.68 | 11.04 | 11.42 | 12.27 |
| HLRS 2020-01-100E | ○ | | | 10 | 10.34 | 10.68 | 11.04 | 11.42 | 12.27 |
| HLRS 2020-01-120 | | | | 12 | 12.41 | 12.81 | 13.24 | 13.70 | 14.72 |
| HLRS 2020-01-120E | ○ | | | 12 | 12.41 | 12.81 | 13.24 | 13.70 | 14.72 |
| HLRS 2020-01-160 | | | | 16 | 16.53 | 17.07 | 17.64 | 18.25 | No Interference |
| HLRS 2020-01-200 | | | | 20 | 20.66 | 21.33 | 22.04 | 22.81 | No Interference |
| HLRS 2020-01-260 | | | | 26 | 26.85 | 27.72 | 28.65 | No Interference | No Interference |
| HLRS 2020-01-300 | | | | 30 | 30.97 | 31.98 | 33.05 | No Interference | No Interference |
| HLRS 2020-02-040 | | | R0.2 | 4 | 4.15 | 4.29 | 4.43 | 4.58 | 4.92 |
| HLRS 2020-02-040E | ○ | | | 4 | 4.15 | 4.29 | 4.43 | 4.58 | 4.92 |
| HLRS 2020-02-060 | | | | 6 | 6.22 | 6.42 | 6.63 | 6.86 | 7.37 |
| HLRS 2020-02-060E | ○ | | | 6 | 6.22 | 6.42 | 6.63 | 6.86 | 7.37 |
| HLRS 2020-02-080 | | | | 8 | 8.28 | 8.55 | 8.83 | 9.14 | 9.82 |
| HLRS 2020-02-080E | ○ | | | 8 | 8.28 | 8.55 | 8.83 | 9.14 | 9.82 |
| HLRS 2020-02-100 | | | | 10 | 10.34 | 10.68 | 11.03 | 11.41 | 12.26 |
| HLRS 2020-02-100E | ○ | | | 10 | 10.34 | 10.68 | 11.03 | 11.41 | 12.26 |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2020-02-120 | | 2 | R0.2 | 12 | 2 | 1.92 | 16° | 55 | 4 | 7,000 |
| HLRS 2020-02-120E | ○ | | | 12 | | | | 55 | 4 | 7,700 |
| HLRS 2020-02-160 | | | | 16 | | | | 60 | 4 | 7,000 |
| HLRS 2020-02-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2020-02-260 | | | | 26 | | | | 70 | 4 | 7,000 |
| HLRS 2020-02-300 | | | | 30 | | | | 70 | 4 | 7,000 |
| HLRS 2020-03-040 | | | R0.3 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2020-03-040E | ○ | | | 4 | | | | 50 | 4 | 7,320 |
| HLRS 2020-03-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2020-03-060E | ○ | | | 6 | | | | 50 | 4 | 7,320 |
| HLRS 2020-03-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2020-03-080E | ○ | | | 8 | | | | 50 | 4 | 7,700 |
| HLRS 2020-03-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2020-03-100E | ○ | | | 10 | | | | 50 | 4 | 7,700 |
| HLRS 2020-03-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2020-03-120E | ○ | | | 12 | | | | 55 | 4 | 7,700 |
| HLRS 2020-03-160 | | | | 16 | | | | 60 | 4 | 7,000 |
| HLRS 2020-03-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2020-03-260 | | | | 26 | | | | 70 | 4 | 7,000 |
| HLRS 2020-03-300 | | | | 30 | | | | 70 | 4 | 7,000 |
| HLRS 2020-05-040 | | | R0.5 | 4 | | | | 50 | 4 | 6,650 |
| HLRS 2020-05-040E | ○ | | | 4 | | | | 50 | 4 | 7,320 |
| HLRS 2020-05-060 | | | | 6 | | | | 50 | 4 | 6,650 |
| HLRS 2020-05-060E | ○ | | | 6 | | | | 50 | 4 | 7,320 |
| HLRS 2020-05-080 | | | | 8 | | | | 50 | 4 | 7,000 |
| HLRS 2020-05-080E | ○ | | | 8 | | | | 50 | 4 | 7,700 |
| HLRS 2020-05-100 | | | | 10 | | | | 50 | 4 | 7,000 |
| HLRS 2020-05-100E | ○ | | | 10 | | | | 50 | 4 | 7,700 |
| HLRS 2020-05-120 | | | | 12 | | | | 55 | 4 | 7,000 |
| HLRS 2020-05-120E | ○ | | | 12 | | | | 55 | 4 | 7,700 |
| HLRS 2020-05-160 | | | | 16 | | | | 60 | 4 | 7,000 |
| HLRS 2020-05-200 | | | | 20 | | | | 60 | 4 | 7,000 |
| HLRS 2020-05-260 | | | | 26 | | | | 70 | 4 | 7,000 |
| HLRS 2020-05-300 | | | | 30 | | | | 70 | 4 | 7,000 |
| HLRS 2025-01-100 | | 2.5 | R0.1 | 10 | 2.5 | 2.42 | 16° | 50 | 4 | 7,340 |
| HLRS 2025-01-200 | | | | 20 | | | | 60 | 4 | 7,570 |
| HLRS 2025-01-300 | | | | 30 | | | | 70 | 4 | 7,800 |
| HLRS 2025-02-100 | | | R0.2 | 10 | | | | 50 | 4 | 7,340 |
| HLRS 2025-02-200 | | | | 20 | | | | 60 | 4 | 7,570 |
| HLRS 2025-02-300 | | | | 30 | | | | 70 | 4 | 7,800 |
| HLRS 2025-03-100 | | | R0.3 | 10 | | | | 50 | 4 | 7,340 |
| HLRS 2025-03-200 | | | | 20 | | | | 60 | 4 | 7,570 |
| HLRS 2025-03-300 | | | | 30 | | | | 70 | 4 | 7,800 |
| HLRS 2025-05-100 | | | R0.5 | 10 | | | | 50 | 4 | 7,340 |
| HLRS 2025-05-200 | | | | 20 | | | | 60 | 4 | 7,570 |
| HLRS 2025-05-300 | | | | 30 | | | | 70 | 4 | 7,800 |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2020-02-120 | | 2 | R0.2 | 12 | 12.40 | 12.81 | 13.23 | 13.69 | 14.71 |
| HLRS 2020-02-120E | ○ | | | 12 | 12.40 | 12.81 | 13.23 | 13.69 | 14.71 |
| HLRS 2020-02-160 | | | | 16 | 16.53 | 17.06 | 17.64 | 18.25 | No Interference |
| HLRS 2020-02-200 | | | | 20 | 20.66 | 21.32 | 22.04 | 22.80 | No Interference |
| HLRS 2020-02-260 | | | | 26 | 26.84 | 27.71 | 28.64 | No Interference | No Interference |
| HLRS 2020-02-300 | | | | 30 | 30.97 | 31.97 | 33.04 | No Interference | No Interference |
| HLRS 2020-03-040 | | | R0.3 | 4 | 4.15 | 4.28 | 4.42 | 4.57 | 4.91 |
| HLRS 2020-03-040E | ○ | | | 4 | 4.15 | 4.28 | 4.42 | 4.57 | 4.91 |
| HLRS 2020-03-060 | | | | 6 | 6.21 | 6.41 | 6.63 | 6.85 | 7.36 |
| HLRS 2020-03-060E | ○ | | | 6 | 6.21 | 6.41 | 6.63 | 6.85 | 7.36 |
| HLRS 2020-03-080 | | | | 8 | 8.28 | 8.54 | 8.83 | 9.13 | 9.80 |
| HLRS 2020-03-080E | ○ | | | 8 | 8.28 | 8.54 | 8.83 | 9.13 | 9.80 |
| HLRS 2020-03-100 | | | | 10 | 10.34 | 10.67 | 11.03 | 11.41 | 12.25 |
| HLRS 2020-03-100E | ○ | | | 10 | 10.34 | 10.67 | 11.03 | 11.41 | 12.25 |
| HLRS 2020-03-120 | | | | 12 | 12.40 | 12.80 | 13.23 | 13.68 | 14.70 |
| HLRS 2020-03-120E | ○ | | | 12 | 12.40 | 12.80 | 13.23 | 13.68 | 14.70 |
| HLRS 2020-03-160 | | | | 16 | 16.53 | 17.06 | 17.63 | 18.24 | 19.59 |
| HLRS 2020-03-200 | | | | 20 | 20.65 | 21.32 | 22.03 | 22.79 | No Interference |
| HLRS 2020-03-260 | | | | 26 | 26.84 | 27.71 | 28.64 | No Interference | No Interference |
| HLRS 2020-03-300 | | | | 30 | 30.97 | 31.97 | 33.04 | No Interference | No Interference |
| HLRS 2020-05-040 | | | R0.5 | 4 | 4.15 | 4.28 | 4.41 | 4.56 | 4.89 |
| HLRS 2020-05-040E | ○ | | | 4 | 4.15 | 4.28 | 4.41 | 4.56 | 4.89 |
| HLRS 2020-05-060 | | | | 6 | 6.21 | 6.41 | 6.62 | 6.84 | 7.34 |
| HLRS 2020-05-060E | ○ | | | 6 | 6.21 | 6.41 | 6.62 | 6.84 | 7.34 |
| HLRS 2020-05-080 | | | | 8 | 8.27 | 8.54 | 8.82 | 9.12 | 9.78 |
| HLRS 2020-05-080E | ○ | | | 8 | 8.27 | 8.54 | 8.82 | 9.12 | 9.78 |
| HLRS 2020-05-100 | | | | 10 | 10.34 | 10.67 | 11.02 | 11.39 | 12.23 |
| HLRS 2020-05-100E | ○ | | | 10 | 10.34 | 10.67 | 11.02 | 11.39 | 12.23 |
| HLRS 2020-05-120 | | | | 12 | 12.40 | 12.80 | 13.22 | 13.67 | 14.68 |
| HLRS 2020-05-120E | ○ | | | 12 | 12.40 | 12.80 | 13.22 | 13.67 | 14.68 |
| HLRS 2020-05-160 | | | | 16 | 16.53 | 17.06 | 17.62 | 18.23 | 19.57 |
| HLRS 2020-05-200 | | | | 20 | 20.65 | 21.31 | 22.02 | 22.78 | No Interference |
| HLRS 2020-05-260 | | | | 26 | 26.84 | 27.70 | 28.63 | No Interference | No Interference |
| HLRS 2020-05-300 | | | | 30 | 30.97 | 31.96 | 33.03 | No Interference | No Interference |
| HLRS 2025-01-100 | | 2.5 | R0.1 | 10 | 10.34 | 10.68 | 11.04 | 11.42 | 12.27 |
| HLRS 2025-01-200 | | | | 20 | 20.66 | 21.33 | 22.04 | No Interference | No Interference |
| HLRS 2025-01-300 | | | | 30 | 30.97 | 31.98 | No Interference | No Interference | No Interference |
| HLRS 2025-02-100 | | | R0.2 | 10 | 10.34 | 10.68 | 11.03 | 11.41 | 12.26 |
| HLRS 2025-02-200 | | | | 20 | 20.66 | 21.32 | 22.04 | No Interference | No Interference |
| HLRS 2025-02-300 | | | | 30 | 30.97 | 31.97 | No Interference | No Interference | No Interference |
| HLRS 2025-03-100 | | | R0.3 | 10 | 10.34 | 10.67 | 11.03 | 11.41 | 12.25 |
| HLRS 2025-03-200 | | | | 20 | 20.65 | 21.32 | 22.03 | No Interference | No Interference |
| HLRS 2025-03-300 | | | | 30 | 30.97 | 31.97 | No Interference | No Interference | No Interference |
| HLRS 2025-05-100 | | | R0.5 | 10 | 10.34 | 10.67 | 11.02 | 11.39 | 12.23 |
| HLRS 2025-05-200 | | | | 20 | 20.65 | 21.31 | 22.02 | No Interference | No Interference |
| HLRS 2025-05-300 | | | | 30 | 30.97 | 31.96 | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2030-01-060 | | 3 | R0.1 | 6 | 3 | 2.92 | 16° | 55 | 6 | 6,000 |
| HLRS 2030-01-060E | ○ | | | 6 | | | | 55 | 6 | 6,600 |
| HLRS 2030-01-120 | | | | 12 | | | | 55 | 6 | 7,800 |
| HLRS 2030-01-160 | | | | 16 | | | | 60 | 6 | 9,100 |
| HLRS 2030-01-160E | ○ | | | 16 | | | | 60 | 6 | 10,010 |
| HLRS 2030-01-180 | | | | 18 | | | | 60 | 6 | 9,100 |
| HLRS 2030-01-200 | | | | 20 | | | | 60 | 6 | 9,100 |
| HLRS 2030-01-260 | | | | 26 | | | | 70 | 6 | 9,100 |
| HLRS 2030-01-300 | | | | 30 | | | | 70 | 6 | 9,100 |
| HLRS 2030-01-360 | | | | 36 | | | | 80 | 6 | 11,200 |
| HLRS 2030-02-060 | | | R0.2 | 6 | | | | 55 | 6 | 6,000 |
| HLRS 2030-02-060E | ○ | | | 6 | | | | 55 | 6 | 6,600 |
| HLRS 2030-02-120 | | | | 12 | | | | 55 | 6 | 7,800 |
| HLRS 2030-02-160 | | | | 16 | | | | 60 | 6 | 9,100 |
| HLRS 2030-02-160E | ○ | | | 16 | | | | 60 | 6 | 10,010 |
| HLRS 2030-02-180 | | | | 18 | | | | 60 | 6 | 9,100 |
| HLRS 2030-02-200 | | | | 20 | | | | 60 | 6 | 9,100 |
| HLRS 2030-02-260 | | | | 26 | | | | 70 | 6 | 9,100 |
| HLRS 2030-02-300 | | | | 30 | | | | 70 | 6 | 9,100 |
| HLRS 2030-02-360 | | | | 36 | | | | 80 | 6 | 11,200 |
| HLRS 2030-03-060 | | | R0.3 | 6 | | | | 55 | 6 | 6,000 |
| HLRS 2030-03-060E | ○ | | | 6 | | | | 55 | 6 | 6,600 |
| HLRS 2030-03-120 | | | | 12 | | | | 55 | 6 | 7,800 |
| HLRS 2030-03-160 | | | | 16 | | | | 60 | 6 | 9,100 |
| HLRS 2030-03-160E | ○ | | | 16 | | | | 60 | 6 | 10,010 |
| HLRS 2030-03-180 | | | | 18 | | | | 60 | 6 | 9,100 |
| HLRS 2030-03-200 | | | | 20 | | | | 60 | 6 | 9,100 |
| HLRS 2030-03-260 | | | | 26 | | | | 70 | 6 | 9,100 |
| HLRS 2030-03-300 | | | | 30 | | | | 70 | 6 | 9,100 |
| HLRS 2030-03-360 | | | | 36 | | | | 80 | 6 | 11,200 |
| HLRS 2030-05-060 | | | R0.5 | 6 | | | | 55 | 6 | 6,000 |
| HLRS 2030-05-060E | ○ | | | 6 | | | | 55 | 6 | 6,600 |
| HLRS 2030-05-120 | | | | 12 | | | | 55 | 6 | 7,800 |
| HLRS 2030-05-160 | | | | 16 | | | | 60 | 6 | 9,100 |
| HLRS 2030-05-160E | ○ | | | 16 | | | | 60 | 6 | 10,010 |
| HLRS 2030-05-180 | | | | 18 | | | | 60 | 6 | 9,100 |
| HLRS 2030-05-200 | | | | 20 | | | | 60 | 6 | 9,100 |
| HLRS 2030-05-260 | | | | 26 | | | | 70 | 6 | 9,100 |
| HLRS 2030-05-300 | | | | 30 | | | | 70 | 6 | 9,100 |
| HLRS 2030-05-360 | | | | 36 | | | | 80 | 6 | 11,200 |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2030-01-060 | | 3 | R0.1 | 6 | 6.21 | 6.42 | 6.63 | 6.86 | 7.37 |
| HLRS 2030-01-060E | ○ | | | 6 | 6.21 | 6.42 | 6.63 | 6.86 | 7.37 |
| HLRS 2030-01-120 | | | | 12 | 12.40 | 12.81 | 13.23 | 13.69 | 14.72 |
| HLRS 2030-01-160 | | | | 16 | 16.53 | 17.06 | 17.64 | 18.25 | 19.61 |
| HLRS 2030-01-160E | ○ | | | 16 | 16.53 | 17.06 | 17.64 | 18.25 | 19.61 |
| HLRS 2030-01-180 | | | | 18 | 18.59 | 19.19 | 19.84 | 20.53 | 22.06 |
| HLRS 2030-01-200 | | | | 20 | 20.65 | 21.32 | 22.04 | 22.80 | 24.51 |
| HLRS 2030-01-260 | | | | 26 | 26.84 | 27.71 | 28.64 | 29.64 | No Interference |
| HLRS 2030-01-300 | | | | 30 | 30.97 | 31.97 | 33.04 | 34.19 | No Interference |
| HLRS 2030-01-360 | | | | 36 | 37.16 | 38.36 | 39.65 | 41.02 | No Interference |
| HLRS 2030-02-060 | | | R0.2 | 6 | 6.21 | 6.41 | 6.63 | 6.85 | 7.36 |
| HLRS 2030-02-060E | ○ | | | 6 | 6.21 | 6.41 | 6.63 | 6.85 | 7.36 |
| HLRS 2030-02-120 | | | | 12 | 12.40 | 12.80 | 13.23 | 13.69 | 14.71 |
| HLRS 2030-02-160 | | | | 16 | 16.53 | 17.06 | 17.63 | 18.24 | 19.60 |
| HLRS 2030-02-160E | ○ | | | 16 | 16.53 | 17.06 | 17.63 | 18.24 | 19.60 |
| HLRS 2030-02-180 | | | | 18 | 18.59 | 19.19 | 19.83 | 20.52 | 22.05 |
| HLRS 2030-02-200 | | | | 20 | 20.65 | 21.32 | 22.03 | 22.80 | 24.49 |
| HLRS 2030-02-260 | | | | 26 | 26.84 | 27.71 | 28.64 | 29.63 | No Interference |
| HLRS 2030-02-300 | | | | 30 | 30.97 | 31.97 | 33.04 | 34.18 | No Interference |
| HLRS 2030-02-360 | | | | 36 | 37.15 | 38.36 | 39.64 | 41.02 | No Interference |
| HLRS 2030-03-060 | | | R0.3 | 6 | 6.21 | 6.41 | 6.62 | 6.85 | 7.35 |
| HLRS 2030-03-060E | ○ | | | 6 | 6.21 | 6.41 | 6.62 | 6.85 | 7.35 |
| HLRS 2030-03-120 | | | | 12 | 12.40 | 12.80 | 13.22 | 13.68 | 14.70 |
| HLRS 2030-03-160 | | | | 16 | 16.53 | 17.06 | 17.63 | 18.23 | 19.59 |
| HLRS 2030-03-160E | ○ | | | 16 | 16.53 | 17.06 | 17.63 | 18.23 | 19.59 |
| HLRS 2030-03-180 | | | | 18 | 18.59 | 19.19 | 19.83 | 20.51 | 22.04 |
| HLRS 2030-03-200 | | | | 20 | 20.65 | 21.32 | 22.03 | 22.79 | 24.48 |
| HLRS 2030-03-260 | | | | 26 | 26.84 | 27.71 | 28.63 | 29.62 | No Interference |
| HLRS 2030-03-300 | | | | 30 | 30.96 | 31.97 | 33.03 | 34.18 | No Interference |
| HLRS 2030-03-360 | | | | 36 | 37.15 | 38.35 | 39.64 | 41.01 | No Interference |
| HLRS 2030-05-060 | | | R0.5 | 6 | 6.21 | 6.40 | 6.61 | 6.83 | 7.33 |
| HLRS 2030-05-060E | ○ | | | 6 | 6.21 | 6.40 | 6.61 | 6.83 | 7.33 |
| HLRS 2030-05-120 | | | | 12 | 12.40 | 12.79 | 13.21 | 13.67 | 14.67 |
| HLRS 2030-05-160 | | | | 16 | 16.52 | 17.05 | 17.62 | 18.22 | 19.57 |
| HLRS 2030-05-160E | ○ | | | 16 | 16.52 | 17.05 | 17.62 | 18.22 | 19.57 |
| HLRS 2030-05-180 | | | | 18 | 18.58 | 19.18 | 19.82 | 20.50 | 22.02 |
| HLRS 2030-05-200 | | | | 20 | 20.65 | 21.31 | 22.02 | 22.78 | 24.46 |
| HLRS 2030-05-260 | | | | 26 | 26.84 | 27.70 | 28.62 | 29.61 | No Interference |
| HLRS 2030-05-300 | | | | 30 | 30.96 | 31.96 | 33.02 | 34.16 | No Interference |
| HLRS 2030-05-360 | | | | 36 | 37.15 | 38.35 | 39.63 | 41.00 | No Interference |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2030-10-060 | | 3 | R1 | 6 | 3 | 2.92 | 16° | 55 | 6 | 6,000 |
| HLRS 2030-10-060E | ○ | | | 6 | | | | 55 | 6 | 6,600 |
| HLRS 2030-10-120 | | | | 12 | | | | 55 | 6 | 7,800 |
| HLRS 2030-10-160 | | | | 16 | | | | 60 | 6 | 9,100 |
| HLRS 2030-10-160E | ○ | | | 16 | | | | 60 | 6 | 10,010 |
| HLRS 2030-10-180 | | | | 18 | | | | 60 | 6 | 9,100 |
| HLRS 2030-10-200 | | | | 20 | | | | 60 | 6 | 9,100 |
| HLRS 2030-10-260 | | | | 26 | | | | 70 | 6 | 9,100 |
| HLRS 2030-10-300 | | | | 30 | | | | 70 | 6 | 9,100 |
| HLRS 2030-10-360 | | | | 36 | | | | 80 | 6 | 11,200 |
| HLRS 2040-01-080 | | 4 | R0.1 | 8 | 4 | 3.82 | 16° | 65 | 6 | 7,800 |
| HLRS 2040-01-080E | ○ | | | 8 | | | | 65 | 6 | 8,580 |
| HLRS 2040-01-120 | | | | 12 | | | | 65 | 6 | 8,000 |
| HLRS 2040-01-160 | | | | 16 | | | | 65 | 6 | 9,400 |
| HLRS 2040-01-200 | | | | 20 | | | | 65 | 6 | 10,130 |
| HLRS 2040-01-200E | ○ | | | 20 | | | | 65 | 6 | 11,140 |
| HLRS 2040-01-240 | | | | 24 | | | | 70 | 6 | 10,130 |
| HLRS 2040-01-320 | | | | 32 | | | | 80 | 6 | 10,130 |
| HLRS 2040-01-480 | | | | 48 | | | | 100 | 6 | 16,200 |
| HLRS 2040-02-080 | | | R0.2 | 8 | | | | 65 | 6 | 7,800 |
| HLRS 2040-02-080E | ○ | | | 8 | | | | 65 | 6 | 8,580 |
| HLRS 2040-02-120 | | | | 12 | | | | 65 | 6 | 8,000 |
| HLRS 2040-02-160 | | | | 16 | | | | 65 | 6 | 9,400 |
| HLRS 2040-02-200 | | | | 20 | | | | 65 | 6 | 10,130 |
| HLRS 2040-02-200E | ○ | | | 20 | | | | 65 | 6 | 11,140 |
| HLRS 2040-02-240 | | | | 24 | | | | 70 | 6 | 10,130 |
| HLRS 2040-02-320 | | | | 32 | | | | 80 | 6 | 10,130 |
| HLRS 2040-02-480 | | | | 48 | | | | 100 | 6 | 16,200 |
| HLRS 2040-03-080 | | | R0.3 | 8 | | | | 65 | 6 | 7,800 |
| HLRS 2040-03-080E | ○ | | | 8 | | | | 65 | 6 | 8,580 |
| HLRS 2040-03-120 | | | | 12 | | | | 65 | 6 | 8,000 |
| HLRS 2040-03-160 | | | | 16 | | | | 65 | 6 | 9,400 |
| HLRS 2040-03-200 | | | | 20 | | | | 65 | 6 | 10,130 |
| HLRS 2040-03-200E | ○ | | | 20 | | | | 65 | 6 | 11,140 |
| HLRS 2040-03-240 | | | | 24 | | | | 70 | 6 | 10,130 |
| HLRS 2040-03-320 | | | | 32 | | | | 80 | 6 | 10,130 |
| HLRS 2040-03-480 | | | | 48 | | | | 100 | 6 | 16,200 |
| HLRS 2040-05-080 | | | R0.5 | 8 | | | | 65 | 6 | 7,800 |
| HLRS 2040-05-080E | ○ | | | 8 | | | | 65 | 6 | 8,580 |
| HLRS 2040-05-120 | | | | 12 | | | | 65 | 6 | 8,000 |
| HLRS 2040-05-160 | | | | 16 | | | | 65 | 6 | 9,400 |
| HLRS 2040-05-200 | | | | 20 | | | | 65 | 6 | 10,130 |
| HLRS 2040-05-200E | ○ | | | 20 | | | | 65 | 6 | 11,140 |
| HLRS 2040-05-240 | | | | 24 | | | | 70 | 6 | 10,130 |
| HLRS 2040-05-320 | | | | 32 | | | | 80 | 6 | 10,130 |
| HLRS 2040-05-480 | | | | 48 | | | | 100 | 6 | 16,200 |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2030-10-060 | | 3 | R1 | 6 | 6.20 | 6.39 | 6.59 | 6.80 | 7.28 |
| HLRS 2030-10-060E | ○ | | | 6 | 6.20 | 6.39 | 6.59 | 6.80 | 7.28 |
| HLRS 2030-10-120 | | | | 12 | 12.39 | 12.78 | 13.19 | 13.63 | 14.62 |
| HLRS 2030-10-160 | | | | 16 | 16.51 | 17.04 | 17.59 | 18.19 | 19.52 |
| HLRS 2030-10-160E | ○ | | | 16 | 16.51 | 17.04 | 17.59 | 18.19 | 19.52 |
| HLRS 2030-10-180 | | | | 18 | 18.58 | 19.17 | 19.79 | 20.47 | 21.96 |
| HLRS 2030-10-200 | | | | 20 | 20.64 | 21.29 | 21.99 | 22.74 | 24.41 |
| HLRS 2030-10-260 | | | | 26 | 26.83 | 27.68 | 28.60 | 29.57 | No Interference |
| HLRS 2030-10-300 | | | | 30 | 30.95 | 31.94 | 33.00 | 34.13 | No Interference |
| HLRS 2030-10-360 | | | | 36 | 37.14 | 38.33 | 39.60 | 40.96 | No Interference |
| HLRS 2040-01-080 | | 4 | R0.1 | 8 | 8.45 | 8.73 | 9.02 | 9.33 | 10.03 |
| HLRS 2040-01-080E | ○ | | | 8 | 8.45 | 8.73 | 9.02 | 9.33 | 10.03 |
| HLRS 2040-01-120 | | | | 12 | 12.58 | 12.99 | 13.42 | 13.89 | 14.92 |
| HLRS 2040-01-160 | | | | 16 | 16.70 | 17.25 | 17.82 | 18.44 | No Interference |
| HLRS 2040-01-200 | | | | 20 | 20.83 | 21.50 | 22.23 | 23.00 | No Interference |
| HLRS 2040-01-200E | ○ | | | 20 | 20.83 | 21.50 | 22.23 | 23.00 | No Interference |
| HLRS 2040-01-240 | | | | 24 | 24.95 | 25.76 | 26.63 | 27.55 | No Interference |
| HLRS 2040-01-320 | | | | 32 | 33.21 | 34.28 | 35.43 | No Interference | No Interference |
| HLRS 2040-01-480 | | | | 48 | 49.71 | 51.32 | No Interference | No Interference | No Interference |
| HLRS 2040-02-080 | | | R0.2 | 8 | 8.45 | 8.72 | 9.01 | 9.33 | 10.02 |
| HLRS 2040-02-080E | ○ | | | 8 | 8.45 | 8.72 | 9.01 | 9.33 | 10.02 |
| HLRS 2040-02-120 | | | | 12 | 12.58 | 12.98 | 13.42 | 13.88 | 14.91 |
| HLRS 2040-02-160 | | | | 16 | 16.70 | 17.24 | 17.82 | 18.44 | No Interference |
| HLRS 2040-02-200 | | | | 20 | 20.83 | 21.50 | 22.22 | 22.99 | No Interference |
| HLRS 2040-02-200E | ○ | | | 20 | 20.83 | 21.50 | 22.22 | 22.99 | No Interference |
| HLRS 2040-02-240 | | | | 24 | 24.95 | 25.76 | 26.62 | 27.54 | No Interference |
| HLRS 2040-02-320 | | | | 32 | 33.20 | 34.28 | 35.43 | No Interference | No Interference |
| HLRS 2040-02-480 | | | | 48 | 49.71 | 51.32 | No Interference | No Interference | No Interference |
| HLRS 2040-03-080 | | | R0.3 | 8 | 8.45 | 8.72 | 9.01 | 9.32 | 10.01 |
| HLRS 2040-03-080E | ○ | | | 8 | 8.45 | 8.72 | 9.01 | 9.32 | 10.01 |
| HLRS 2040-03-120 | | | | 12 | 12.58 | 12.98 | 13.41 | 13.87 | 14.69 |
| HLRS 2040-03-160 | | | | 16 | 16.70 | 17.24 | 17.81 | 18.43 | No Interference |
| HLRS 2040-03-200 | | | | 20 | 20.83 | 21.50 | 22.22 | 22.98 | No Interference |
| HLRS 2040-03-200E | ○ | | | 20 | 20.83 | 21.50 | 22.22 | 22.98 | No Interference |
| HLRS 2040-03-240 | | | | 24 | 24.95 | 25.76 | 26.62 | 27.54 | No Interference |
| HLRS 2040-03-320 | | | | 32 | 33.20 | 34.28 | 35.42 | No Interference | No Interference |
| HLRS 2040-03-480 | | | | 48 | 49.71 | 51.31 | No Interference | No Interference | No Interference |
| HLRS 2040-05-080 | | | R0.5 | 8 | 8.45 | 8.71 | 9.00 | 9.31 | 9.99 |
| HLRS 2040-05-080E | ○ | | | 8 | 8.45 | 8.71 | 9.00 | 9.31 | 9.99 |
| HLRS 2040-05-120 | | | | 12 | 12.57 | 12.97 | 13.40 | 13.86 | 14.88 |
| HLRS 2040-05-160 | | | | 16 | 16.70 | 17.23 | 17.80 | 18.42 | No Interference |
| HLRS 2040-05-200 | | | | 20 | 20.82 | 21.49 | 22.21 | 22.97 | No Interference |
| HLRS 2040-05-200E | ○ | | | 20 | 20.82 | 21.49 | 22.21 | 22.97 | No Interference |
| HLRS 2040-05-240 | | | | 24 | 24.95 | 25.75 | 26.61 | 27.52 | No Interference |
| HLRS 2040-05-320 | | | | 32 | 33.20 | 34.27 | 35.41 | No Interference | No Interference |
| HLRS 2040-05-480 | | | | 48 | 49.70 | 51.31 | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| HLRS 2040-10-080 | | 4 | R1 | 8 | 4 | 3.82 | 16° | 65 | 6 | 7,800 |
| HLRS 2040-10-080E | ○ | | | 8 | | | | 65 | 6 | 8,580 |
| HLRS 2040-10-120 | | | | 12 | | | | 65 | 6 | 8,000 |
| HLRS 2040-10-160 | | | | 16 | | | | 65 | 6 | 9,400 |
| HLRS 2040-10-200 | | | | 20 | | | | 65 | 6 | 10,130 |
| HLRS 2040-10-200E | ○ | | | 20 | | | | 65 | 6 | 11,140 |
| HLRS 2040-10-240 | | | | 24 | | | | 70 | 6 | 10,130 |
| HLRS 2040-10-320 | | | | 32 | | | | 80 | 6 | 10,130 |
| HLRS 2040-10-480 | | | | 48 | | | | 100 | 6 | 16,200 |
| HLRS 2050-02-200 | | 5 | R0.2 | 20 | 5 | 4.82 | 16° | 70 | 6 | 12,900 |
| HLRS 2050-02-400 | | | | 40 | | | | 90 | 6 | 16,200 |
| HLRS 2050-03-200 | | | R0.3 | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2050-03-400 | | | | 40 | | | | 90 | 6 | 16,200 |
| HLRS 2050-05-200 | | | R0.5 | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2050-05-400 | | | | 40 | | | | 90 | 6 | 16,200 |
| HLRS 2050-10-200 | | | R1 | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2050-10-400 | | | | 40 | | | | 90 | 6 | 16,200 |
| HLRS 2060-01-120 | | 6 | R0.1 | 12 | 6 | 5.82 | – | 65 | 6 | 12,900 |
| HLRS 2060-01-120E | ○ | | | 12 | | | | 65 | 6 | 14,190 |
| HLRS 2060-01-200 | | | | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2060-01-300 | | | | 30 | | | | 100 | 6 | 16,700 |
| HLRS 2060-01-300E | ○ | | | 30 | | | | 100 | 6 | 18,370 |
| HLRS 2060-01-600 | | | | 60 | | | | 120 | 6 | 20,300 |
| HLRS 2060-02-120 | | | R0.2 | 12 | | | | 65 | 6 | 12,900 |
| HLRS 2060-02-120E | ○ | | | 12 | | | | 65 | 6 | 14,190 |
| HLRS 2060-02-200 | | | | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2060-02-300 | | | | 30 | | | | 100 | 6 | 16,700 |
| HLRS 2060-02-300E | ○ | | | 30 | | | | 100 | 6 | 18,370 |
| HLRS 2060-02-600 | | | | 60 | | | | 120 | 6 | 20,300 |
| HLRS 2060-03-120 | | | R0.3 | 12 | | | | 65 | 6 | 12,900 |
| HLRS 2060-03-120E | ○ | | | 12 | | | | 65 | 6 | 14,190 |
| HLRS 2060-03-200 | | | | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2060-03-300 | | | | 30 | | | | 100 | 6 | 16,700 |
| HLRS 2060-03-300E | ○ | | | 30 | | | | 100 | 6 | 18,370 |
| HLRS 2060-03-600 | | | | 60 | | | | 120 | 6 | 20,300 |
| HLRS 2060-05-120 | | | R0.5 | 12 | | | | 65 | 6 | 12,900 |
| HLRS 2060-05-120E | ○ | | | 12 | | | | 65 | 6 | 14,190 |
| HLRS 2060-05-200 | | | | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2060-05-300 | | | | 30 | | | | 100 | 6 | 16,700 |
| HLRS 2060-05-300E | ○ | | | 30 | | | | 100 | 6 | 18,370 |
| HLRS 2060-05-600 | | | | 60 | | | | 120 | 6 | 20,300 |
| HLRS 2060-10-120 | | | R1 | 12 | | | | 65 | 6 | 12,900 |
| HLRS 2060-10-120E | ○ | | | 12 | | | | 65 | 6 | 14,190 |
| HLRS 2060-10-200 | | | | 20 | | | | 70 | 6 | 12,900 |
| HLRS 2060-10-300 | | | | 30 | | | | 100 | 6 | 16,700 |
| HLRS 2060-10-300E | ○ | | | 30 | | | | 100 | 6 | 18,370 |
| HLRS 2060-10-600 | | | | 60 | | | | 120 | 6 | 20,300 |





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Unit (mm)

| Model Number | Excellent | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 2040-10-080 | | 4 | R1 | 8 | 8.44 | 8.70 | 8.98 | 9.27 | 9.93 |
| HLRS 2040-10-080E | ○ | | | 8 | 8.44 | 8.70 | 8.98 | 9.27 | 9.93 |
| HLRS 2040-10-120 | | | | 12 | 12.56 | 12.96 | 13.38 | 13.83 | 14.83 |
| HLRS 2040-10-160 | | | | 16 | 16.69 | 17.22 | 17.78 | 18.38 | 19.72 |
| HLRS 2040-10-200 | | | | 20 | 20.82 | 21.48 | 22.18 | 22.94 | No Interference |
| HLRS 2040-10-200E | ○ | | | 20 | 20.82 | 21.48 | 22.18 | 22.94 | No Interference |
| HLRS 2040-10-240 | | | | 24 | 24.94 | 25.74 | 26.58 | 27.49 | No Interference |
| HLRS 2040-10-320 | | | | 32 | 33.19 | 34.25 | 35.39 | No Interference | No Interference |
| HLRS 2040-10-480 | | | | 48 | 49.69 | 51.29 | No Interference | No Interference | No Interference |
| HLRS 2050-02-200 | | 5 | R0.2 | 20 | 20.83 | 21.50 | No Interference | No Interference | No Interference |
| HLRS 2050-02-400 | | | | 40 | 41.46 | No Interference | No Interference | No Interference | No Interference |
| HLRS 2050-03-200 | | | R0.3 | 20 | 20.83 | 21.50 | No Interference | No Interference | No Interference |
| HLRS 2050-03-400 | | | | 40 | 41.45 | No Interference | No Interference | No Interference | No Interference |
| HLRS 2050-05-200 | | | R0.5 | 20 | 20.82 | 21.49 | No Interference | No Interference | No Interference |
| HLRS 2050-05-400 | | | | 40 | 41.45 | No Interference | No Interference | No Interference | No Interference |
| HLRS 2050-10-200 | | | R1 | 20 | 20.82 | 21.48 | No Interference | No Interference | No Interference |
| HLRS 2050-10-400 | | | | 40 | 41.44 | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-01-120 | | 6 | R0.1 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-01-120E | ○ | | | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-01-200 | | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-01-300 | | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-01-300E | ○ | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-01-600 | | | | 60 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-02-120 | | | R0.2 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-02-120E | ○ | | | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-02-200 | | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-02-300 | | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-02-300E | ○ | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-02-600 | | | | 60 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-03-120 | | | R0.3 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-03-120E | ○ | | | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-03-200 | | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-03-300 | | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-03-300E | ○ | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-03-600 | | | | 60 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-05-120 | | | R0.5 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-05-120E | ○ | | | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-05-200 | | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-05-300 | | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-05-300E | ○ | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-05-600 | | | | 60 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-10-120 | | | R1 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-10-120E | ○ | | | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-10-200 | | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-10-300 | | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-10-300E | ○ | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 2060-10-600 | | | | 60 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for HLRS（2 Flutes）

| WORK MATERIAL | | | Copper OFC / TPC | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **2002** | **0.2** | 0.5 | 55,000 | 230 | 0.027 | 0.02 | 55,000 | 230 | 0.006 | 0.02 | 44,800 | 236 | 0.005 | 0.02 | 19,000 | 30 | 0.002 | 0.015 |
| | | 1 | 55,000 | 200 | 0.027 | 0.02 | 55,000 | 200 | 0.006 | 0.02 | 35,000 | 150 | 0.004 | 0.02 | 15,000 | 25 | 0.0015 | 0.015 |
| | | 1.5 | 55,000 | 180 | 0.017 | 0.01 | 55,000 | 180 | 0.005 | 0.01 | 27,000 | 100 | 0.003 | 0.01 | 12,000 | 20 | 0.001 | 0.007 |
| | | 2 | 55,000 | 170 | 0.007 | 0.005 | 55,000 | 170 | 0.003 | 0.005 | 20,000 | 60 | 0.002 | 0.005 | 10,500 | 15 | 0.001 | 0.003 |
| **2003** | **0.3** | 1 | 60,000 | 500 | 0.03 | 0.02 | 60,000 | 500 | 0.007 | 0.02 | 35,000 | 350 | 0.005 | 0.02 | 22,000 | 35 | 0.004 | 0.015 |
| | | 1.5 | 60,000 | 470 | 0.03 | 0.02 | 60,000 | 470 | 0.007 | 0.02 | 35,000 | 310 | 0.005 | 0.018 | 22,000 | 33 | 0.004 | 0.015 |
| | | 2 | 60,000 | 400 | 0.03 | 0.02 | 60,000 | 400 | 0.007 | 0.02 | 33,200 | 250 | 0.005 | 0.015 | 20,000 | 32 | 0.004 | 0.015 |
| | | 2.5 | 57,000 | 330 | 0.03 | 0.017 | 57,000 | 330 | 0.007 | 0.017 | 30,000 | 180 | 0.003 | 0.012 | 18,000 | 30 | 0.002 | 0.012 |
| | | 3 | 52,000 | 220 | 0.03 | 0.015 | 52,000 | 220 | 0.006 | 0.015 | 25,000 | 80 | 0.003 | 0.01 | 15,000 | 20 | 0.002 | 0.01 |
| **2004** | **0.4** | 1 | 50,900 | 610 | 0.048 | 0.063 | 50,900 | 510 | 0.013 | 0.072 | 40,700 | 370 | 0.011 | 0.072 | 24,200 | 40 | 0.004 | 0.072 |
| | | 1.5 | 45,200 | 580 | 0.045 | 0.063 | 45,200 | 480 | 0.012 | 0.054 | 36,200 | 360 | 0.01 | 0.054 | 21,500 | 38 | 0.004 | 0.054 |
| | | 2 | 40,400 | 540 | 0.042 | 0.054 | 40,400 | 450 | 0.011 | 0.045 | 32,300 | 330 | 0.009 | 0.045 | 19,200 | 35 | 0.004 | 0.045 |
| | | 3 | 33,900 | 460 | 0.027 | 0.054 | 33,900 | 390 | 0.008 | 0.027 | 27,100 | 280 | 0.007 | 0.027 | 16,100 | 30 | 0.003 | 0.027 |
| | | 4 | 30,000 | 220 | 0.01 | 0.045 | 30,000 | 340 | 0.006 | 0.014 | 24,000 | 250 | 0.005 | 0.014 | 14,300 | 27 | 0.002 | 0.014 |
| **2005** | **0.5** | 1 | 49,200 | 1,370 | 0.081 | 0.117 | 49,200 | 1,140 | 0.034 | 0.122 | 40,000 | 860 | 0.03 | 0.122 | 24,800 | 94 | 0.013 | 0.122 |
| | | 2 | 39,900 | 1,000 | 0.075 | 0.108 | 39,900 | 830 | 0.029 | 0.117 | 32,500 | 630 | 0.026 | 0.117 | 20,100 | 68 | 0.011 | 0.117 |
| | | 3 | 31,900 | 770 | 0.057 | 0.09 | 31,900 | 640 | 0.023 | 0.113 | 26,000 | 480 | 0.02 | 0.113 | 16,100 | 52 | 0.008 | 0.113 |
| | | 4 | 29,100 | 660 | 0.039 | 0.072 | 29,100 | 550 | 0.016 | 0.108 | 23,700 | 410 | 0.014 | 0.108 | 14,600 | 45 | 0.006 | 0.108 |
| | | 5 | 26,400 | 570 | 0.027 | 0.045 | 26,400 | 470 | 0.011 | 0.099 | 21,500 | 360 | 0.01 | 0.099 | 13,300 | 39 | 0.004 | 0.099 |
| | | 6 | 24,200 | 480 | 0.021 | 0.018 | 24,200 | 400 | 0.007 | 0.09 | 19,700 | 300 | 0.006 | 0.09 | 12,200 | 33 | 0.003 | 0.09 |
| **2006** | **0.6** | 2 | 28,600 | 610 | 0.114 | 0.162 | 28,600 | 510 | 0.01 | 0.219 | 23,700 | 390 | 0.01 | 0.219 | 15,200 | 43 | 0.004 | 0.219 |
| | | 3 | 23,800 | 480 | 0.09 | 0.135 | 23,800 | 400 | 0.008 | 0.108 | 19,700 | 300 | 0.007 | 0.108 | 12,600 | 33 | 0.003 | 0.108 |
| | | 4 | 20,400 | 400 | 0.063 | 0.108 | 20,400 | 330 | 0.005 | 0.104 | 16,800 | 250 | 0.005 | 0.104 | 10,800 | 28 | 0.002 | 0.104 |
| | | 6 | 16,800 | 300 | 0.036 | 0.045 | 16,800 | 250 | 0.003 | 0.099 | 13,900 | 190 | 0.003 | 0.099 | 8,900 | 21 | 0.001 | 0.099 |
| | | 8 | 14,600 | 240 | 0.021 | 0.027 | 14,600 | 200 | 0.002 | 0.072 | 12,100 | 150 | 0.002 | 0.072 | 7,700 | 16 | 0.001 | 0.072 |
| **2007** | **0.7** | 4 | 18,400 | 480 | 0.087 | 0.162 | 18,400 | 400 | 0.008 | 0.117 | 15,500 | 310 | 0.008 | 0.117 | 10,200 | 35 | 0.004 | 0.117 |
| | | 6 | 15,400 | 360 | 0.051 | 0.108 | 15,400 | 300 | 0.005 | 0.108 | 13,000 | 230 | 0.005 | 0.108 | 8,600 | 26 | 0.002 | 0.108 |
| **2008** | **0.8** | 4 | 17,500 | 540 | 0.132 | 0.198 | 17,500 | 450 | 0.014 | 0.117 | 15,000 | 360 | 0.015 | 0.117 | 10,200 | 41 | 0.007 | 0.117 |
| | | 6 | 14,600 | 410 | 0.075 | 0.144 | 14,600 | 340 | 0.008 | 0.108 | 12,500 | 270 | 0.008 | 0.108 | 8,500 | 30 | 0.004 | 0.108 |
| | | 8 | 12,800 | 310 | 0.03 | 0.1 | 12,800 | 270 | 0.005 | 0.09 | 11,000 | 185 | 0.004 | 0.09 | 7,600 | 20 | 0.002 | 0.09 |
| **2010** | **1** | 2 | 17,600 | 1,100 | 0.21 | 0.45 | 17,600 | 920 | 0.035 | 0.27 | 15,300 | 750 | 0.04 | 0.27 | 10,900 | 89 | 0.02 | 0.27 |
| | | 3 | 15,500 | 1,050 | 0.205 | 0.425 | 15,500 | 870 | 0.031 | 0.27 | 13,200 | 720 | 0.037 | 0.27 | 9,400 | 86 | 0.018 | 0.27 |
| | | 4 | 13,800 | 980 | 0.201 | 0.405 | 13,800 | 820 | 0.03 | 0.27 | 12,000 | 670 | 0.035 | 0.27 | 8,500 | 80 | 0.017 | 0.27 |
| | | 5 | 12,500 | 900 | 0.16 | 0.4 | 12,500 | 720 | 0.025 | 0.24 | 11,000 | 600 | 0.03 | 0.24 | 7,800 | 72 | 0.015 | 0.24 |
| | | 6 | 11,300 | 790 | 0.117 | 0.387 | 11,300 | 650 | 0.021 | 0.216 | 9,800 | 540 | 0.024 | 0.216 | 7,000 | 64 | 0.012 | 0.216 |
| | | 8 | 9,800 | 590 | 0.072 | 0.36 | 9,800 | 490 | 0.016 | 0.189 | 8,500 | 400 | 0.018 | 0.189 | 6,100 | 48 | 0.009 | 0.189 |
| | | 10 | 8,800 | 390 | 0.048 | 0.315 | 8,800 | 320 | 0.011 | 0.126 | 7,600 | 270 | 0.013 | 0.126 | 5,400 | 32 | 0.006 | 0.126 |
| | | 12 | 8,100 | 260 | 0.033 | 0.27 | 8,100 | 210 | 0.008 | 0.072 | 7,000 | 180 | 0.009 | 0.072 | 5,000 | 21 | 0.004 | 0.072 |
| | | 16 | 7,000 | 230 | 0.018 | 0.225 | 7,000 | 190 | 0.004 | 0.027 | 6,100 | 160 | 0.005 | 0.027 | 4,300 | 19 | 0.002 | 0.027 |
| | | 20 | 6,300 | 160 | 0.015 | 0.18 | 6,300 | 130 | 0.003 | 0.018 | 5,500 | 110 | 0.003 | 0.018 | 3,900 | 13 | 0.001 | 0.018 |

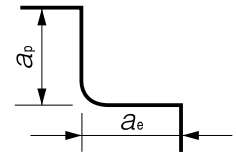
## Milling Conditions for HLRS（2 Flutes）

| WORK MATERIAL | | | Copper OFC / TPC | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| 2012 | 1.2 | 6 | 9,400 | 700 | 0.186 | 0.468 | 9,400 | 580 | 0.018 | 0.09 | 8,400 | 490 | 0.022 | 0.09 | 6,200 | 60 | 0.011 | 0.09 |
| | | 12 | 6,800 | 440 | 0.054 | 0.405 | 6,800 | 370 | 0.007 | 0.072 | 6,100 | 310 | 0.008 | 0.072 | 4,500 | 38 | 0.004 | 0.072 |
| | | 20 | 5,400 | 250 | 0.021 | 0.24 | 5,400 | 210 | 0.003 | 0.018 | 4,800 | 180 | 0.003 | 0.018 | 3,500 | 22 | 0.002 | 0.018 |
| 2015 | 1.5 | 4 | 13,200 | 1,310 | 0.3 | 0.675 | 13,200 | 1,090 | 0.045 | 0.45 | 12,000 | 950 | 0.06 | 0.45 | 9,200 | 124 | 0.033 | 0.45 |
| | | 6 | 10,600 | 1,240 | 0.282 | 0.63 | 10,600 | 1,030 | 0.041 | 0.405 | 9,700 | 900 | 0.055 | 0.405 | 7,400 | 117 | 0.03 | 0.405 |
| | | 8 | 9,300 | 1,050 | 0.204 | 0.612 | 9,300 | 870 | 0.034 | 0.315 | 8,500 | 760 | 0.045 | 0.315 | 6,500 | 99 | 0.025 | 0.315 |
| | | 10 | 8,500 | 900 | 0.15 | 0.567 | 8,500 | 750 | 0.032 | 0.288 | 7,800 | 650 | 0.042 | 0.288 | 6,000 | 85 | 0.023 | 0.288 |
| | | 12 | 7,800 | 800 | 0.114 | 0.54 | 7,800 | 670 | 0.029 | 0.27 | 7,100 | 580 | 0.038 | 0.27 | 5,400 | 76 | 0.021 | 0.27 |
| | | 16 | 6,800 | 620 | 0.066 | 0.45 | 6,800 | 510 | 0.015 | 0.18 | 6,200 | 450 | 0.02 | 0.18 | 4,700 | 58 | 0.011 | 0.18 |
| | | 20 | 6,000 | 490 | 0.042 | 0.36 | 6,000 | 410 | 0.005 | 0.108 | 5,500 | 360 | 0.006 | 0.108 | 4,200 | 46 | 0.003 | 0.108 |
| 2020 | 2 | 4 | 15,300 | 1,500 | 0.33 | 0.9 | 15,300 | 1,250 | 0.046 | 0.9 | 14,300 | 1,130 | 0.065 | 0.9 | 11,500 | 162 | 0.039 | 0.9 |
| | | 6 | 12,800 | 1,220 | 0.321 | 0.855 | 12,800 | 1,020 | 0.043 | 0.81 | 12,000 | 930 | 0.06 | 0.81 | 9,700 | 133 | 0.036 | 0.81 |
| | | 8 | 11,200 | 1,120 | 0.267 | 0.81 | 11,200 | 930 | 0.039 | 0.72 | 10,400 | 850 | 0.055 | 0.72 | 8,400 | 121 | 0.033 | 0.72 |
| | | 10 | 10,000 | 1,050 | 0.225 | 0.765 | 10,000 | 870 | 0.033 | 0.585 | 9,300 | 790 | 0.047 | 0.585 | 7,600 | 113 | 0.028 | 0.585 |
| | | 12 | 9,100 | 980 | 0.186 | 0.72 | 9,100 | 820 | 0.031 | 0.45 | 8,500 | 740 | 0.044 | 0.45 | 6,900 | 107 | 0.026 | 0.45 |
| | | 16 | 7,800 | 830 | 0.132 | 0.702 | 7,800 | 690 | 0.028 | 0.315 | 7,300 | 630 | 0.039 | 0.315 | 5,900 | 90 | 0.023 | 0.315 |
| | | 20 | 7,000 | 770 | 0.093 | 0.666 | 7,000 | 640 | 0.017 | 0.198 | 6,600 | 580 | 0.024 | 0.198 | 5,300 | 84 | 0.014 | 0.198 |
| | | 26 | 6,200 | 700 | 0.06 | 0.54 | 6,200 | 580 | 0.006 | 0.144 | 5,800 | 530 | 0.008 | 0.144 | 4,600 | 75 | 0.005 | 0.144 |
| | | 30 | 6,000 | 670 | 0.05 | 0.45 | 6,000 | 550 | 0.005 | 0.135 | 5,500 | 500 | 0.005 | 0.135 | 4,400 | 70 | 0.002 | 0.135 |
| 2025 | 2.5 | 10 | 10,500 | 1,220 | 0.339 | 0.855 | 10,500 | 1,020 | 0.052 | 0.54 | 10,000 | 960 | 0.075 | 0.54 | 8,400 | 154 | 0.048 | 0.54 |
| | | 20 | 7,800 | 720 | 0.165 | 0.756 | 7,800 | 600 | 0.024 | 0.225 | 7,500 | 560 | 0.035 | 0.225 | 6,300 | 91 | 0.022 | 0.225 |
| | | 30 | 6,300 | 540 | 0.069 | 0.63 | 6,300 | 450 | 0.011 | 0.18 | 6,000 | 420 | 0.016 | 0.18 | 5,000 | 67 | 0.01 | 0.18 |
| 2030 | 3 | 6 | 14,000 | 2,700 | 0.5 | 0.9 | 14,000 | 1,510 | 0.15 | 0.72 | 13,300 | 1,140 | 0.15 | 0.72 | 12,000 | 270 | 0.1 | 0.72 |
| | | 12 | 10,500 | 1,600 | 0.39 | 0.85 | 10,500 | 1,150 | 0.105 | 0.67 | 10,000 | 890 | 0.105 | 0.67 | 9,000 | 200 | 0.075 | 0.67 |
| | | 16 | 9,200 | 1,160 | 0.321 | 0.81 | 9,200 | 960 | 0.081 | 0.63 | 8,800 | 730 | 0.081 | 0.63 | 7,900 | 173 | 0.054 | 0.63 |
| | | 18 | 8,800 | 1,100 | 0.29 | 0.79 | 8,800 | 900 | 0.078 | 0.6 | 8,300 | 700 | 0.078 | 0.6 | 7,500 | 160 | 0.048 | 0.6 |
| | | 20 | 8,400 | 1,050 | 0.26 | 0.78 | 8,400 | 880 | 0.073 | 0.58 | 7,900 | 680 | 0.073 | 0.58 | 7,100 | 150 | 0.044 | 0.58 |
| | | 26 | 7,500 | 980 | 0.18 | 0.72 | 7,500 | 820 | 0.065 | 0.495 | 7,100 | 620 | 0.065 | 0.495 | 6,400 | 146 | 0.043 | 0.495 |
| | | 30 | 7,000 | 870 | 0.14 | 0.69 | 7,000 | 720 | 0.05 | 0.38 | 6,500 | 560 | 0.05 | 0.38 | 6,000 | 118 | 0.029 | 0.36 |
| | | 36 | 6,400 | 710 | 0.09 | 0.63 | 6,400 | 590 | 0.022 | 0.18 | 6,100 | 440 | 0.022 | 0.18 | 5,500 | 105 | 0.014 | 0.18 |
| 2040 | 4 | 8 | 10,200 | 1,340 | 0.42 | 1.62 | 10,200 | 1,110 | 0.095 | 1.35 | 8,500 | 970 | 0.14 | 1.35 | 7,300 | 223 | 0.101 | 1.35 |
| | | 12 | 8,900 | 1,300 | 0.41 | 1.56 | 8,900 | 1,080 | 0.083 | 1.15 | 7,600 | 950 | 0.12 | 1.15 | 6,400 | 215 | 0.085 | 1.15 |
| | | 16 | 7,900 | 1,250 | 0.4 | 1.5 | 7,900 | 1,030 | 0.065 | 1 | 6,600 | 910 | 0.1 | 1 | 5,600 | 205 | 0.065 | 1 |
| | | 20 | 6,900 | 1,190 | 0.384 | 1.44 | 6,900 | 990 | 0.054 | 0.9 | 5,800 | 860 | 0.08 | 0.9 | 4,900 | 198 | 0.058 | 0.9 |
| | | 24 | 6,200 | 1,100 | 0.31 | 1.38 | 6,200 | 900 | 0.043 | 0.8 | 5,200 | 770 | 0.065 | 0.8 | 4,500 | 175 | 0.043 | 0.8 |
| | | 32 | 5,500 | 860 | 0.189 | 1.26 | 5,500 | 720 | 0.027 | 0.648 | 4,600 | 630 | 0.04 | 0.648 | 3,900 | 144 | 0.029 | 0.648 |
| | | 48 | 4,600 | 430 | 0.093 | 1.08 | 4,600 | 360 | 0.007 | 0.315 | 3,900 | 310 | 0.01 | 0.315 | 3,300 | 72 | 0.007 | 0.315 |

## Milling Conditions for HLRS（2 Flutes）

| WORK MATERIAL | | | Copper OFC / TPC | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **2050** | **5** | 20 | 6,700 | 1,780 | 0.606 | 1.98 | 6,700 | 1,480 | 0.092 | 1.17 | 4,800 | 990 | 0.13 | 1.17 | 4,000 | 297 | 0.096 | 1.17 |
| | | 40 | 4,600 | 850 | 0.297 | 1.53 | 4,600 | 710 | 0.046 | 0.9 | 3,300 | 470 | 0.065 | 0.9 | 2,800 | 143 | 0.048 | 0.9 |
| **2060** | **6** | 12 | 8,000 | 1,800 | 0.6 | 2.25 | 8,000 | 1,620 | 0.5 | 1.35 | 4,700 | 1,360 | 0.2 | 1.35 | 4,000 | 540 | 0.15 | 1.35 |
| | | 20 | 5,800 | 1,350 | 0.58 | 2.12 | 5,800 | 1,180 | 0.46 | 1.31 | 3,500 | 1,000 | 0.18 | 1.31 | 3,000 | 380 | 0.14 | 1.31 |
| | | 30 | 4,500 | 1,060 | 0.546 | 1.98 | 4,500 | 880 | 0.396 | 1.26 | 2,600 | 740 | 0.158 | 1.26 | 2,200 | 294 | 0.119 | 1.26 |
| | | 60 | 2,800 | 530 | 0.156 | 1.62 | 2,800 | 440 | 0.113 | 0.99 | 1,600 | 370 | 0.045 | 0.99 | 1,400 | 147 | 0.034 | 0.99 |

Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

Size $\phi$0.2～$\phi$6

# HLRS4000

Additional 42 models

Super MG | HARD MAX | 30° | R | ±0.005 | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ○ ～65HRC | ○ | | | ○ | | | ○ | ○ | | |

Total 381 models

Unit（mm）

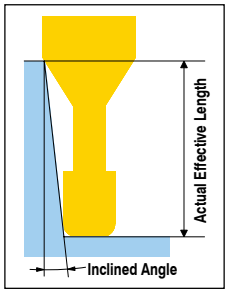
| | Model Number | Outside Diameter $\phi$D | Corner Radius CR | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi$d | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4002-002-003 | 0.2 | R0.02 | 0.3 | 0.12 | 0.185 | 16° | 50 | 4 | 14,100 |
| | HLRS 4002-002-005 | | | 0.5 | | | | 50 | 4 | 14,100 |
| | HLRS 4002-002-010 | | | 1 | | | | 50 | 4 | 14,100 |
| ※ | HLRS 4002-002-015 | | | 1.5 | | | | 50 | 4 | 16,590 |
| ※ | HLRS 4002-002-020 | | | 2 | | | | 50 | 4 | 18,150 |
| ※ | HLRS 4002-005-003 | | R0.05 | 0.3 | | | | 50 | 4 | 14,100 |
| ※ | HLRS 4003-002-003 | 0.3 | R0.02 | 0.3 | 0.18 | 0.28 | 16° | 50 | 4 | 14,100 |
| | HLRS 4003-002-005 | | | 0.5 | | | | 50 | 4 | 14,100 |
| | HLRS 4003-002-010 | | | 1 | | | | 50 | 4 | 14,100 |
| ※ | HLRS 4003-002-015 | | | 1.5 | | | | 50 | 4 | 14,100 |
| ※ | HLRS 4003-002-020 | | | 2 | | | | 50 | 4 | 14,100 |
| ※ | HLRS 4003-005-003 | | R0.05 | 0.3 | | | | 50 | 4 | 14,100 |
| | HLRS 4003-005-005 | | | 0.5 | | | | 50 | 4 | 14,100 |
| | HLRS 4004-002-005 | 0.4 | R0.02 | 0.5 | 0.24 | 0.385 | 16° | 50 | 4 | 9,050 |
| | HLRS 4004-002-010 | | | 1 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-002-020 | | | 2 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-005-005 | | R0.05 | 0.5 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-005-010 | | | 1 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-005-015 | | | 1.5 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-005-020 | | | 2 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-01-010 | | R0.1 | 1 | | | | 50 | 4 | 9,050 |
| | HLRS 4004-01-020 | | | 2 | | | | 50 | 4 | 9,050 |

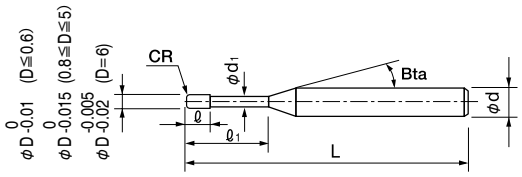
※Additional model

Next Page ➡

## Features

**Long Neck Radius design for high efficiency and high quality milling.**
**The rigid tool geometry offers longer tool life when milling Hard Materials.**
**HARDMAX coat is adopted which maintains heat resistance, toughness and lubricity at a high level.**
**Both dry and wet coolant offer stable and long tool life.**
**Refer to page 318 for 2 flute HLRS.**




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

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4002-002-003 | 0.2 | R0.02 | 0.3 | 0.39 | 0.41 | 0.44 | 0.46 | 0.51 |
| HLRS 4002-002-005 | | | 0.5 | 0.60 | 0.63 | 0.67 | 0.70 | 0.75 |
| HLRS 4002-002-010 | | | 1 | 1.13 | 1.18 | 1.22 | 1.27 | 1.36 |
| HLRS 4002-002-015 | | | 1.5 | 1.65 | 1.71 | 1.77 | 1.84 | 1.98 |
| HLRS 4002-002-020 | | | 2 | 2.17 | 2.25 | 2.32 | 2.41 | 2.59 |
| HLRS 4002-005-003 | | R0.05 | 0.3 | 0.39 | 0.41 | 0.43 | 0.46 | 0.50 |
| HLRS 4003-002-003 | 0.3 | R0.02 | 0.3 | 0.41 | 0.43 | 0.46 | 0.48 | 0.52 |
| HLRS 4003-002-005 | | | 0.5 | 0.62 | 0.65 | 0.68 | 0.71 | 0.77 |
| HLRS 4003-002-010 | | | 1 | 1.15 | 1.19 | 1.24 | 1.28 | 1.38 |
| HLRS 4003-002-015 | | | 1.5 | 1.67 | 1.73 | 1.79 | 1.85 | 1.99 |
| HLRS 4003-002-020 | | | 2 | 2.19 | 2.26 | 2.34 | 2.42 | 2.60 |
| HLRS 4003-005-003 | | R0.05 | 0.3 | 0.41 | 0.43 | 0.45 | 0.47 | 0.52 |
| HLRS 4003-005-005 | | | 0.5 | 0.62 | 0.65 | 0.68 | 0.71 | 0.76 |
| HLRS 4004-002-005 | 0.4 | R0.02 | 0.5 | 0.62 | 0.65 | 0.68 | 0.71 | 0.77 |
| HLRS 4004-002-010 | | | 1 | 1.15 | 1.19 | 1.24 | 1.28 | 1.38 |
| HLRS 4004-002-020 | | | 2 | 2.17 | 2.25 | 2.33 | 2.41 | 2.59 |
| HLRS 4004-005-005 | | R0.05 | 0.5 | 0.62 | 0.65 | 0.68 | 0.71 | 0.76 |
| HLRS 4004-005-010 | | | 1 | 1.14 | 1.19 | 1.23 | 1.28 | 1.37 |
| HLRS 4004-005-015 | | | 1.5 | 1.65 | 1.72 | 1.77 | 1.84 | 1.97 |
| HLRS 4004-005-020 | | | 2 | 2.17 | 2.25 | 2.32 | 2.41 | 2.59 |
| HLRS 4004-01-010 | | R0.1 | 1 | 1.14 | 1.19 | 1.23 | 1.27 | 1.36 |
| HLRS 4004-01-020 | | | 2 | 2.17 | 2.25 | 2.32 | 2.40 | 2.57 |

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| HLRS 4005-002-010 | 0.5 | R0.02 | 1 | 0.3 | 0.485 | 16° | 50 | 4 | 7,370 |
| HLRS 4005-002-020 | | | 2 | | | | 50 | 4 | 7,370 |
| HLRS 4005-005-010 | | R0.05 | 1 | | | | 50 | 4 | 7,370 |
| HLRS 4005-005-020 | | | 2 | | | | 50 | 4 | 7,370 |
| HLRS 4005-01-010 | | R0.1 | 1 | | | | 50 | 4 | 7,370 |
| HLRS 4005-01-020 | | | 2 | | | | 50 | 4 | 7,370 |
| HLRS 4006-005-020 | 0.6 | R0.05 | 2 | 0.36 | 0.585 | 16° | 50 | 4 | 7,370 |
| HLRS 4006-005-040 | | | 4 | | | | 50 | 4 | 7,370 |
| HLRS 4006-01-020 | | R0.1 | 2 | | | | 50 | 4 | 7,370 |
| HLRS 4006-01-040 | | | 4 | | | | 50 | 4 | 7,370 |
| HLRS 4008-002-020 | 0.8 | R0.02 | 2 | 0.48 | 0.78 | 16° | 50 | 4 | 8,100 |
| HLRS 4008-002-030 | | | 3 | | | | 50 | 4 | 8,100 |
| HLRS 4008-002-040 | | | 4 | | | | 50 | 4 | 8,400 |
| HLRS 4008-002-060 | | | 6 | | | | 50 | 4 | 8,400 |
| HLRS 4008-002-080 | | | 8 | | | | 50 | 4 | 8,400 |
| HLRS 4008-005-020 | | R0.05 | 2 | | | | 50 | 4 | 8,100 |
| HLRS 4008-005-030 | | | 3 | | | | 50 | 4 | 8,100 |
| HLRS 4008-005-040 | | | 4 | | | | 50 | 4 | 8,400 |
| HLRS 4008-005-060 | | | 6 | | | | 50 | 4 | 8,400 |
| HLRS 4008-01-020 | | R0.1 | 2 | | | | 50 | 4 | 8,100 |
| HLRS 4008-01-030 | | | 3 | | | | 50 | 4 | 8,100 |
| HLRS 4008-01-040 | | | 4 | | | | 50 | 4 | 8,400 |
| HLRS 4008-01-060 | | | 6 | | | | 50 | 4 | 8,400 |
| HLRS 4008-02-020 | | R0.2 | 2 | | | | 50 | 4 | 8,100 |
| HLRS 4008-02-030 | | | 3 | | | | 50 | 4 | 8,100 |
| HLRS 4008-02-040 | | | 4 | | | | 50 | 4 | 8,400 |
| HLRS 4008-02-060 | | | 6 | | | | 50 | 4 | 8,400 |
| HLRS 4010-002-020 | 1 | R0.02 | 2 | 0.8 | 0.95 | 16° | 50 | 4 | 7,400 |
| HLRS 4010-002-030 | | | 3 | | | | 50 | 4 | 7,400 |
| HLRS 4010-002-040 | | | 4 | | | | 50 | 4 | 7,400 |
| HLRS 4010-002-050 | | | 5 | | | | 50 | 4 | 8,100 |
| HLRS 4010-002-060 | | | 6 | | | | 50 | 4 | 8,100 |
| HLRS 4010-002-080 | | | 8 | | | | 50 | 4 | 8,100 |
| HLRS 4010-002-100 | | | 10 | | | | 50 | 4 | 8,100 |
| ※ HLRS 4010-002-120 | | | 12 | | | | 55 | 4 | 8,100 |
| HLRS 4010-005-020 | | R0.05 | 2 | | | | 50 | 4 | 7,400 |
| HLRS 4010-005-030 | | | 3 | | | | 50 | 4 | 7,400 |
| HLRS 4010-005-040 | | | 4 | | | | 50 | 4 | 7,400 |





※Additional model

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4005-002-010 | 0.5 | R0.02 | 1 | 1.15 | 1.19 | 1.24 | 1.28 | 1.38 |
| HLRS 4005-002-020 | | | 2 | 2.17 | 2.25 | 2.33 | 2.41 | 2.59 |
| HLRS 4005-005-010 | | R0.05 | 1 | 1.14 | 1.19 | 1.23 | 1.28 | 1.37 |
| HLRS 4005-005-020 | | | 2 | 2.17 | 2.25 | 2.32 | 2.41 | 2.59 |
| HLRS 4005-01-010 | | R0.1 | 1 | 1.14 | 1.19 | 1.23 | 1.27 | 1.36 |
| HLRS 4005-01-020 | | | 2 | 2.17 | 2.25 | 2.32 | 2.40 | 2.57 |
| HLRS 4006-005-020 | 0.6 | R0.05 | 2 | 2.17 | 2.25 | 2.32 | 2.41 | 2.59 |
| HLRS 4006-005-040 | | | 4 | 4.24 | 4.38 | 4.53 | 4.68 | 5.03 |
| HLRS 4006-01-020 | | R0.1 | 2 | 2.17 | 2.25 | 2.32 | 2.40 | 2.57 |
| HLRS 4006-01-040 | | | 4 | 4.24 | 4.38 | 4.52 | 4.68 | 5.02 |
| HLRS 4008-002-020 | 0.8 | R0.02 | 2 | 2.51 | 2.70 | 2.87 | 3.02 | 3.29 |
| HLRS 4008-002-030 | | | 3 | 3.59 | 3.82 | 4.02 | 4.19 | 4.51 |
| HLRS 4008-002-040 | | | 4 | 4.66 | 4.92 | 5.14 | 5.34 | 5.74 |
| HLRS 4008-002-060 | | | 6 | 6.78 | 7.10 | 7.36 | 7.61 | 8.19 |
| HLRS 4008-002-080 | | | 8 | 8.88 | 9.25 | 9.56 | 9.89 | 10.63 |
| HLRS 4008-005-020 | | R0.05 | 2 | 2.51 | 2.70 | 2.86 | 3.01 | 3.28 |
| HLRS 4008-005-030 | | | 3 | 3.59 | 3.82 | 4.01 | 4.19 | 4.51 |
| HLRS 4008-005-040 | | | 4 | 4.66 | 4.92 | 5.14 | 5.33 | 5.73 |
| HLRS 4008-005-060 | | | 6 | 6.77 | 7.09 | 7.35 | 7.61 | 8.18 |
| HLRS 4008-01-020 | | R0.1 | 2 | 2.51 | 2.69 | 2.86 | 3.00 | 3.27 |
| HLRS 4008-01-030 | | | 3 | 3.58 | 3.81 | 4.01 | 4.18 | 4.50 |
| HLRS 4008-01-040 | | | 4 | 4.65 | 4.92 | 5.13 | 5.33 | 5.72 |
| HLRS 4008-01-060 | | | 6 | 6.77 | 7.09 | 7.35 | 7.60 | 8.17 |
| HLRS 4008-02-020 | | R0.2 | 2 | 2.49 | 2.68 | 2.84 | 2.98 | 3.25 |
| HLRS 4008-02-030 | | | 3 | 3.57 | 3.80 | 3.99 | 4.16 | 4.47 |
| HLRS 4008-02-040 | | | 4 | 4.64 | 4.90 | 5.12 | 5.31 | 5.70 |
| HLRS 4008-02-060 | | | 6 | 6.76 | 7.08 | 7.34 | 7.59 | 8.14 |
| HLRS 4010-002-020 | 1 | R0.02 | 2 | 2.57 | 2.75 | 2.90 | 3.05 | 3.32 |
| HLRS 4010-002-030 | | | 3 | 3.64 | 3.86 | 4.05 | 4.22 | 4.54 |
| HLRS 4010-002-040 | | | 4 | 4.70 | 4.96 | 5.17 | 5.36 | 5.76 |
| HLRS 4010-002-050 | | | 5 | 5.76 | 6.04 | 6.28 | 6.50 | 6.99 |
| HLRS 4010-002-060 | | | 6 | 6.81 | 7.12 | 7.38 | 7.64 | 8.21 |
| HLRS 4010-002-080 | | | 8 | 8.91 | 9.27 | 9.58 | 9.92 | 10.66 |
| HLRS 4010-002-100 | | | 10 | 11.00 | 11.40 | 11.78 | 12.19 | 13.11 |
| HLRS 4010-002-120 | | | 12 | 13.08 | 13.53 | 13.98 | 14.47 | 15.55 |
| HLRS 4010-005-020 | | R0.05 | 2 | 2.56 | 2.74 | 2.90 | 3.05 | 3.31 |
| HLRS 4010-005-030 | | | 3 | 3.63 | 3.85 | 4.04 | 4.21 | 4.53 |
| HLRS 4010-005-040 | | | 4 | 4.70 | 4.95 | 5.17 | 5.36 | 5.76 |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4010-005-050 | 1 | R0.05 | 5 | 0.8 | 0.95 | 16° | 50 | 4 | 8,100 |
| | HLRS 4010-005-060 | | | 6 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-005-080 | | | 8 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-005-100 | | | 10 | | | | 50 | 4 | 8,100 |
| ※ | HLRS 4010-005-120 | | | 12 | | | | 55 | 4 | 8,100 |
| | HLRS 4010-01-020 | | R0.1 | 2 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-01-030 | | | 3 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-01-040 | | | 4 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-01-050 | | | 5 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-01-060 | | | 6 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-01-080 | | | 8 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-01-100 | | | 10 | | | | 50 | 4 | 8,100 |
| ※ | HLRS 4010-01-120 | | | 12 | | | | 55 | 4 | 8,100 |
| | HLRS 4010-02-020 | | R0.2 | 2 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-02-030 | | | 3 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-02-040 | | | 4 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-02-050 | | | 5 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-02-060 | | | 6 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-02-080 | | | 8 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-02-100 | | | 10 | | | | 50 | 4 | 8,100 |
| ※ | HLRS 4010-02-120 | | | 12 | | | | 55 | 4 | 8,100 |
| | HLRS 4010-03-020 | | R0.3 | 2 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-03-030 | | | 3 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-03-040 | | | 4 | | | | 50 | 4 | 7,400 |
| | HLRS 4010-03-050 | | | 5 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-03-060 | | | 6 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-03-080 | | | 8 | | | | 50 | 4 | 8,100 |
| | HLRS 4010-03-100 | | | 10 | | | | 50 | 4 | 8,100 |
| ※ | HLRS 4010-03-120 | | | 12 | | | | 55 | 4 | 8,100 |
| ※ | HLRS 4010-03-160 | | | 16 | | | | 60 | 4 | 10,740 |
| | HLRS 4012-01-040 | 1.2 | R0.1 | 4 | 0.96 | 1.14 | 16° | 50 | 4 | 8,400 |
| | HLRS 4012-01-060 | | | 6 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-01-100 | | | 10 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-02-040 | | R0.2 | 4 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-02-060 | | | 6 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-02-100 | | | 10 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-03-040 | | R0.3 | 4 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-03-060 | | | 6 | | | | 50 | 4 | 8,400 |
| | HLRS 4012-03-100 | | | 10 | | | | 50 | 4 | 8,400 |





※Additional model

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4010-005-050 | 1 | R0.05 | 5 | 5.76 | 6.04 | 6.28 | 6.50 | 6.98 |
| HLRS 4010-005-060 | | | 6 | 6.81 | 7.12 | 7.38 | 7.63 | 8.20 |
| HLRS 4010-005-080 | | | 8 | 8.91 | 9.27 | 9.58 | 9.91 | 10.65 |
| HLRS 4010-005-100 | | | 10 | 11.00 | 11.40 | 11.78 | 12.19 | 13.10 |
| HLRS 4010-005-120 | | | 12 | 13.08 | 13.53 | 13.98 | 14.47 | 15.55 |
| HLRS 4010-01-020 | | R0.1 | 2 | 2.56 | 2.74 | 2.89 | 3.04 | 3.30 |
| HLRS 4010-01-030 | | | 3 | 3.63 | 3.85 | 4.04 | 4.20 | 4.52 |
| HLRS 4010-01-040 | | | 4 | 4.70 | 4.95 | 5.16 | 5.35 | 5.75 |
| HLRS 4010-01-050 | | | 5 | 5.75 | 6.04 | 6.27 | 6.49 | 6.97 |
| HLRS 4010-01-060 | | | 6 | 6.81 | 7.12 | 7.37 | 7.63 | 8.19 |
| HLRS 4010-01-080 | | | 8 | 8.91 | 9.26 | 9.57 | 9.90 | 10.64 |
| HLRS 4010-01-100 | | | 10 | 11.00 | 11.39 | 11.77 | 12.18 | 13.09 |
| HLRS 4010-01-120 | | | 12 | 13.08 | 13.52 | 13.98 | 14.46 | 15.54 |
| HLRS 4010-02-020 | | R0.2 | 2 | 2.55 | 2.72 | 2.88 | 3.02 | 3.28 |
| HLRS 4010-02-030 | | | 3 | 3.62 | 3.84 | 4.02 | 4.19 | 4.50 |
| HLRS 4010-02-040 | | | 4 | 4.69 | 4.94 | 5.15 | 5.34 | 5.72 |
| HLRS 4010-02-050 | | | 5 | 5.75 | 6.03 | 6.26 | 6.47 | 6.95 |
| HLRS 4010-02-060 | | | 6 | 6.80 | 7.11 | 7.36 | 7.61 | 8.17 |
| HLRS 4010-02-080 | | | 8 | 8.90 | 9.26 | 9.56 | 9.89 | 10.62 |
| HLRS 4010-02-100 | | | 10 | 10.99 | 11.39 | 11.76 | 12.17 | 13.07 |
| HLRS 4010-02-120 | | | 12 | 13.07 | 13.52 | 13.97 | 14.45 | 15.51 |
| HLRS 4010-03-020 | | R0.3 | 2 | 2.54 | 2.71 | 2.86 | 3.00 | 3.25 |
| HLRS 4010-03-030 | | | 3 | 3.62 | 3.83 | 4.01 | 4.17 | 4.48 |
| HLRS 4010-03-040 | | | 4 | 4.68 | 4.93 | 5.14 | 5.32 | 5.70 |
| HLRS 4010-03-050 | | | 5 | 5.74 | 6.02 | 6.25 | 6.46 | 6.93 |
| HLRS 4010-03-060 | | | 6 | 6.80 | 7.10 | 7.35 | 7.60 | 8.15 |
| HLRS 4010-03-080 | | | 8 | 8.90 | 9.25 | 9.55 | 9.88 | 10.60 |
| HLRS 4010-03-100 | | | 10 | 10.99 | 11.38 | 11.75 | 12.15 | 13.04 |
| HLRS 4010-03-120 | | | 12 | 13.07 | 13.51 | 13.96 | 14.43 | 15.49 |
| HLRS 4010-03-160 | | | 16 | 17.22 | 17.77 | 18.36 | 18.99 | 20.39 |
| HLRS 4012-01-040 | 1.2 | R0.1 | 4 | 4.13 | 4.27 | 4.41 | 4.56 | 4.90 |
| HLRS 4012-01-060 | | | 6 | 6.20 | 6.40 | 6.61 | 6.84 | 7.34 |
| HLRS 4012-01-100 | | | 10 | 10.32 | 10.66 | 11.01 | 11.39 | 12.24 |
| HLRS 4012-02-040 | | R0.2 | 4 | 4.13 | 4.26 | 4.40 | 4.55 | 4.87 |
| HLRS 4012-02-060 | | | 6 | 6.19 | 6.39 | 6.60 | 6.82 | 7.32 |
| HLRS 4012-02-100 | | | 10 | 10.32 | 10.65 | 11.00 | 11.38 | 12.22 |
| HLRS 4012-03-040 | | R0.3 | 4 | 4.13 | 4.25 | 4.39 | 4.53 | 4.85 |
| HLRS 4012-03-060 | | | 6 | 6.19 | 6.38 | 6.59 | 6.81 | 7.30 |
| HLRS 4012-03-100 | | | 10 | 10.32 | 10.64 | 10.99 | 11.36 | 12.20 |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4015-005-030 | 1.5 | R0.05 | 3 | 1.2 | 1.45 | 16° | 50 | 4 | 7,900 |
| | HLRS 4015-005-040 | | | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-005-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-005-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-005-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4015-005-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4015-01-030 | | R0.1 | 3 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-01-040 | | | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-01-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-01-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-01-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-01-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4015-01-160 | | | 16 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4015-01-180 | | | 18 | | | | 60 | 4 | 8,200 |
| | HLRS 4015-02-030 | | R0.2 | 3 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-02-040 | | | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-02-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-02-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-02-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-02-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4015-02-160 | | | 16 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4015-02-180 | | | 18 | | | | 60 | 4 | 8,200 |
| | HLRS 4015-03-030 | | R0.3 | 3 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-03-040 | | | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-03-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-03-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-03-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-03-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4015-03-160 | | | 16 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4015-03-180 | | | 18 | | | | 60 | 4 | 8,200 |
| | HLRS 4015-05-030 | | R0.5 | 3 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-05-040 | | | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-05-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4015-05-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-05-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4015-05-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4015-05-160 | | | 16 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4015-05-180 | | | 18 | | | | 60 | 4 | 8,200 |





※Additional model

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4015-005-030 | 1.5 | R0.05 | 3 | 3.10 | 3.20 | 3.31 | 3.43 | 3.68 |
| HLRS 4015-005-040 | | | 4 | 4.14 | 4.27 | 4.41 | 4.57 | 4.91 |
| HLRS 4015-005-060 | | | 6 | 6.20 | 6.40 | 6.61 | 6.84 | 7.35 |
| HLRS 4015-005-080 | | | 8 | 8.26 | 8.53 | 8.82 | 9.12 | 9.80 |
| HLRS 4015-005-120 | | | 12 | 12.39 | 12.79 | 13.22 | 13.68 | 14.70 |
| HLRS 4015-005-160 | | | 16 | 16.51 | 17.05 | 17.62 | 18.23 | 19.59 |
| HLRS 4015-01-030 | | R0.1 | 3 | 3.10 | 3.20 | 3.31 | 3.42 | 3.67 |
| HLRS 4015-01-040 | | | 4 | 4.13 | 4.27 | 4.41 | 4.56 | 4.90 |
| HLRS 4015-01-060 | | | 6 | 6.20 | 6.40 | 6.61 | 6.84 | 7.34 |
| HLRS 4015-01-080 | | | 8 | 8.26 | 8.53 | 8.81 | 9.11 | 9.79 |
| HLRS 4015-01-100 | | | 10 | 10.32 | 10.66 | 11.01 | 11.39 | 12.24 |
| HLRS 4015-01-120 | | | 12 | 12.39 | 12.79 | 13.21 | 13.67 | 14.69 |
| HLRS 4015-01-160 | | | 16 | 16.51 | 17.04 | 17.61 | 18.22 | 19.58 |
| HLRS 4015-01-180 | | | 18 | 18.57 | 19.17 | 19.82 | 20.50 | 22.03 |
| HLRS 4015-02-030 | | R0.2 | 3 | 3.10 | 3.20 | 3.30 | 3.41 | 3.65 |
| HLRS 4015-02-040 | | | 4 | 4.13 | 4.26 | 4.40 | 4.55 | 4.87 |
| HLRS 4015-02-060 | | | 6 | 6.19 | 6.39 | 6.60 | 6.82 | 7.32 |
| HLRS 4015-02-080 | | | 8 | 8.26 | 8.52 | 8.80 | 9.10 | 9.77 |
| HLRS 4015-02-100 | | | 10 | 10.32 | 10.65 | 11.00 | 11.38 | 12.22 |
| HLRS 4015-02-120 | | | 12 | 12.38 | 12.78 | 13.20 | 13.66 | 14.66 |
| HLRS 4015-02-160 | | | 16 | 16.51 | 17.04 | 17.60 | 18.21 | 19.56 |
| HLRS 4015-02-180 | | | 18 | 18.57 | 19.17 | 19.81 | 20.49 | 22.01 |
| HLRS 4015-03-030 | | R0.3 | 3 | 3.10 | 3.19 | 3.29 | 3.39 | 3.63 |
| HLRS 4015-03-040 | | | 4 | 4.13 | 4.25 | 4.39 | 4.53 | 4.85 |
| HLRS 4015-03-060 | | | 6 | 6.19 | 6.38 | 6.59 | 6.81 | 7.30 |
| HLRS 4015-03-080 | | | 8 | 8.25 | 8.51 | 8.79 | 9.09 | 9.75 |
| HLRS 4015-03-100 | | | 10 | 10.32 | 10.64 | 10.99 | 11.36 | 12.20 |
| HLRS 4015-03-120 | | | 12 | 12.38 | 12.77 | 13.19 | 13.64 | 14.64 |
| HLRS 4015-03-160 | | | 16 | 16.50 | 17.03 | 17.59 | 18.20 | 19.54 |
| HLRS 4015-03-180 | | | 18 | 18.57 | 19.16 | 19.80 | 20.47 | 21.98 |
| HLRS 4015-05-030 | | R0.5 | 3 | 3.09 | 3.17 | 3.27 | 3.36 | 3.58 |
| HLRS 4015-05-040 | | | 4 | 4.12 | 4.24 | 4.37 | 4.50 | 4.81 |
| HLRS 4015-05-060 | | | 6 | 6.18 | 6.37 | 6.57 | 6.78 | 7.25 |
| HLRS 4015-05-080 | | | 8 | 8.25 | 8.50 | 8.77 | 9.06 | 9.70 |
| HLRS 4015-05-100 | | | 10 | 10.31 | 10.63 | 10.97 | 11.34 | 12.15 |
| HLRS 4015-05-120 | | | 12 | 12.37 | 12.76 | 13.17 | 13.61 | 14.60 |
| HLRS 4015-05-160 | | | 16 | 16.50 | 17.02 | 17.57 | 18.17 | 19.49 |
| HLRS 4015-05-180 | | | 18 | 18.56 | 19.15 | 19.77 | 20.44 | 21.94 |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4018-02-080 | 1.8 | R0.2 | 8 | 1.44 | 1.72 | 16° | 50 | 4 | 8,200 |
| | HLRS 4018-02-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4018-02-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4018-02-140 | | | 14 | | | | 55 | 4 | 8,200 |
| | HLRS 4018-02-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-002-040 | 2 | R0.02 | 4 | 1.6 | 1.92 | 16° | 50 | 4 | 7,900 |
| | HLRS 4020-002-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-002-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-002-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-002-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4020-002-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-002-200 | | | 20 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-005-040 | | R0.05 | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-005-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-005-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-005-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-005-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4020-005-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-005-200 | | | 20 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-01-040 | | R0.1 | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-01-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-01-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-01-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-01-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4020-01-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-01-200 | | | 20 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4020-01-240 | | | 24 | | | | 70 | 4 | 8,200 |
| | HLRS 4020-02-040 | | R0.2 | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-02-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-02-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-02-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-02-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4020-02-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-02-200 | | | 20 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4020-02-240 | | | 24 | | | | 70 | 4 | 8,200 |
| | HLRS 4020-03-040 | | R0.3 | 4 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-03-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-03-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-03-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-03-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4020-03-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-03-200 | | | 20 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4020-03-240 | | | 24 | | | | 70 | 4 | 8,200 |





※Additional model

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4018-02-080 | 1.8 | R0.2 | 8 | 8.29 | 8.56 | 8.84 | 9.14 | 9.81 |
| HLRS 4018-02-100 | | | 10 | 10.36 | 10.69 | 11.04 | 11.42 | 12.26 |
| HLRS 4018-02-120 | | | 12 | 12.42 | 12.82 | 13.24 | 13.69 | 14.71 |
| HLRS 4018-02-140 | | | 14 | 14.48 | 14.95 | 15.44 | 15.97 | 17.15 |
| HLRS 4018-02-160 | | | 16 | 16.54 | 17.08 | 17.64 | 18.25 | 19.60 |
| HLRS 4020-002-040 | 2 | R0.02 | 4 | 4.17 | 4.31 | 4.45 | 4.61 | 4.96 |
| HLRS 4020-002-060 | | | 6 | 6.24 | 6.44 | 6.66 | 6.89 | 7.40 |
| HLRS 4020-002-080 | | | 8 | 8.30 | 8.57 | 8.86 | 9.16 | 9.85 |
| HLRS 4020-002-100 | | | 10 | 10.36 | 10.70 | 11.06 | 11.44 | 12.30 |
| HLRS 4020-002-120 | | | 12 | 12.42 | 12.83 | 13.26 | 13.72 | 14.75 |
| HLRS 4020-002-160 | | | 16 | 16.55 | 17.09 | 17.66 | 18.27 | No Interference |
| HLRS 4020-002-200 | | | 20 | 20.67 | 21.35 | 22.06 | 22.83 | No Interference |
| HLRS 4020-005-040 | | R0.05 | 4 | 4.17 | 4.31 | 4.45 | 4.61 | 4.95 |
| HLRS 4020-005-060 | | | 6 | 6.23 | 6.44 | 6.65 | 6.88 | 7.40 |
| HLRS 4020-005-080 | | | 8 | 8.30 | 8.57 | 8.85 | 9.16 | 9.84 |
| HLRS 4020-005-100 | | | 10 | 10.36 | 10.70 | 11.05 | 11.44 | 12.29 |
| HLRS 4020-005-120 | | | 12 | 12.42 | 12.83 | 13.26 | 13.72 | 14.74 |
| HLRS 4020-005-160 | | | 16 | 16.55 | 17.08 | 17.66 | 18.27 | No Interference |
| HLRS 4020-005-200 | | | 20 | 20.67 | 21.34 | 22.06 | 22.82 | No Interference |
| HLRS 4020-01-040 | | R0.1 | 4 | 4.17 | 4.30 | 4.45 | 4.60 | 4.94 |
| HLRS 4020-01-060 | | | 6 | 6.23 | 6.43 | 6.65 | 6.88 | 7.39 |
| HLRS 4020-01-080 | | | 8 | 8.30 | 8.56 | 8.85 | 9.15 | 9.83 |
| HLRS 4020-01-100 | | | 10 | 10.36 | 10.69 | 11.05 | 11.43 | 12.28 |
| HLRS 4020-01-120 | | | 12 | 12.42 | 12.82 | 13.25 | 13.71 | 14.73 |
| HLRS 4020-01-160 | | | 16 | 16.55 | 17.08 | 17.65 | 18.26 | No Interference |
| HLRS 4020-01-200 | | | 20 | 20.67 | 21.34 | 22.05 | 22.82 | No Interference |
| HLRS 4020-01-240 | | | 24 | 24.80 | 25.60 | 26.46 | 27.37 | No Interference |
| HLRS 4020-02-040 | | R0.2 | 4 | 4.17 | 4.30 | 4.44 | 4.59 | 4.92 |
| HLRS 4020-02-060 | | | 6 | 6.23 | 6.43 | 6.64 | 6.86 | 7.36 |
| HLRS 4020-02-080 | | | 8 | 8.29 | 8.56 | 8.84 | 9.14 | 9.81 |
| HLRS 4020-02-100 | | | 10 | 10.36 | 10.69 | 11.04 | 11.42 | 12.26 |
| HLRS 4020-02-120 | | | 12 | 12.42 | 12.82 | 13.24 | 13.69 | 14.71 |
| HLRS 4020-02-160 | | | 16 | 16.54 | 17.08 | 17.64 | 18.25 | 19.60 |
| HLRS 4020-02-200 | | | 20 | 20.67 | 21.33 | 22.04 | 22.80 | No Interference |
| HLRS 4020-02-240 | | | 24 | 24.79 | 25.59 | 26.45 | 27.36 | No Interference |
| HLRS 4020-03-040 | | R0.3 | 4 | 4.16 | 4.29 | 4.43 | 4.57 | 4.90 |
| HLRS 4020-03-060 | | | 6 | 6.23 | 6.42 | 6.63 | 6.85 | 7.34 |
| HLRS 4020-03-080 | | | 8 | 8.29 | 8.55 | 8.83 | 9.13 | 9.79 |
| HLRS 4020-03-100 | | | 10 | 10.35 | 10.68 | 11.03 | 11.40 | 12.24 |
| HLRS 4020-03-120 | | | 12 | 12.41 | 12.81 | 13.23 | 13.68 | 14.68 |
| HLRS 4020-03-160 | | | 16 | 16.54 | 17.07 | 17.63 | 18.24 | 19.58 |
| HLRS 4020-03-200 | | | 20 | 20.67 | 21.33 | 22.03 | 22.79 | No Interference |
| HLRS 4020-03-240 | | | 24 | 24.79 | 25.59 | 26.44 | 27.35 | No Interference |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4020-05-040 | 2 | R0.5 | 4 | 1.6 | 1.92 | 16° | 50 | 4 | 7,900 |
| | HLRS 4020-05-060 | | | 6 | | | | 50 | 4 | 7,900 |
| | HLRS 4020-05-080 | | | 8 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-05-100 | | | 10 | | | | 50 | 4 | 8,200 |
| | HLRS 4020-05-120 | | | 12 | | | | 55 | 4 | 8,200 |
| | HLRS 4020-05-160 | | | 16 | | | | 60 | 4 | 8,200 |
| | HLRS 4020-05-200 | | | 20 | | | | 60 | 4 | 8,200 |
| ※ | HLRS 4020-05-240 | | | 24 | | | | 70 | 4 | 8,200 |
| ※ | HLRS 4020-05-260 | | | 26 | | | | 70 | 4 | 8,200 |
| ※ | HLRS 4020-05-300 | | | 30 | | | | 70 | 4 | 8,200 |
| | HLRS 4025-01-060 | 2.5 | R0.1 | 6 | 2 | 2.42 | 16° | 50 | 4 | 8,600 |
| | HLRS 4025-01-080 | | | 8 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-01-100 | | | 10 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-01-160 | | | 16 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-01-200 | | | 20 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-01-300 | | | 30 | | | | 70 | 4 | 9,200 |
| | HLRS 4025-02-060 | | R0.2 | 6 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-02-080 | | | 8 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-02-100 | | | 10 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-02-160 | | | 16 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-02-200 | | | 20 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-02-300 | | | 30 | | | | 70 | 4 | 9,200 |
| | HLRS 4025-03-060 | | R0.3 | 6 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-03-080 | | | 8 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-03-100 | | | 10 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-03-160 | | | 16 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-03-200 | | | 20 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-03-300 | | | 30 | | | | 70 | 4 | 9,200 |
| | HLRS 4025-05-060 | | R0.5 | 6 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-05-080 | | | 8 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-05-100 | | | 10 | | | | 50 | 4 | 8,600 |
| | HLRS 4025-05-160 | | | 16 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-05-200 | | | 20 | | | | 60 | 4 | 8,900 |
| | HLRS 4025-05-300 | | | 30 | | | | 70 | 4 | 9,200 |



※Additional model



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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4020-05-040 | 2 | R0.5 | 4 | 4.16 | 4.28 | 4.40 | 4.54 | 4.85 |
| HLRS 4020-05-060 | | | 6 | 6.22 | 6.41 | 6.61 | 6.82 | 7.30 |
| HLRS 4020-05-080 | | | 8 | 8.28 | 8.54 | 8.81 | 9.10 | 9.74 |
| HLRS 4020-05-100 | | | 10 | 10.34 | 10.67 | 11.01 | 11.37 | 12.19 |
| HLRS 4020-05-120 | | | 12 | 12.41 | 12.79 | 13.21 | 13.65 | 14.64 |
| HLRS 4020-05-160 | | | 16 | 16.53 | 17.05 | 17.61 | 18.21 | 19.53 |
| HLRS 4020-05-200 | | | 20 | 20.66 | 21.31 | 22.01 | 22.76 | No Interference |
| HLRS 4020-05-240 | | | 24 | 24.78 | 25.57 | 26.41 | 27.32 | No Interference |
| HLRS 4020-05-260 | | | 26 | 26.85 | 27.70 | 28.62 | 29.59 | No Interference |
| HLRS 4020-05-300 | | | 30 | 30.97 | 31.96 | 33.02 | No Interference | No Interference |
| HLRS 4025-01-060 | 2.5 | R0.1 | 6 | 6.23 | 6.43 | 6.65 | 6.88 | 7.39 |
| HLRS 4025-01-080 | | | 8 | 8.30 | 8.56 | 8.85 | 9.15 | 9.83 |
| HLRS 4025-01-100 | | | 10 | 10.36 | 10.69 | 11.05 | 11.43 | 12.28 |
| HLRS 4025-01-160 | | | 16 | 16.55 | 17.08 | 17.65 | 18.26 | No Interference |
| HLRS 4025-01-200 | | | 20 | 20.67 | 21.34 | 22.05 | No Interference | No Interference |
| HLRS 4025-01-300 | | | 30 | 30.99 | 31.99 | No Interference | No Interference | No Interference |
| HLRS 4025-02-060 | | R0.2 | 6 | 6.23 | 6.43 | 6.64 | 6.86 | 7.36 |
| HLRS 4025-02-080 | | | 8 | 8.29 | 8.56 | 8.84 | 9.14 | 9.81 |
| HLRS 4025-02-100 | | | 10 | 10.36 | 10.69 | 11.04 | 11.42 | 12.26 |
| HLRS 4025-02-160 | | | 16 | 16.54 | 17.08 | 17.64 | 18.25 | No Interference |
| HLRS 4025-02-200 | | | 20 | 20.67 | 21.33 | 22.04 | No Interference | No Interference |
| HLRS 4025-02-300 | | | 30 | 30.98 | 31.98 | No Interference | No Interference | No Interference |
| HLRS 4025-03-060 | | R0.3 | 6 | 6.23 | 6.42 | 6.63 | 6.85 | 7.34 |
| HLRS 4025-03-080 | | | 8 | 8.29 | 8.55 | 8.83 | 9.13 | 9.79 |
| HLRS 4025-03-100 | | | 10 | 10.35 | 10.68 | 11.03 | 11.40 | 12.24 |
| HLRS 4025-03-160 | | | 16 | 16.54 | 17.07 | 17.63 | 18.24 | No Interference |
| HLRS 4025-03-200 | | | 20 | 20.67 | 21.33 | 22.03 | No Interference | No Interference |
| HLRS 4025-03-300 | | | 30 | 30.98 | 31.98 | No Interference | No Interference | No Interference |
| HLRS 4025-05-060 | | R0.5 | 6 | 6.22 | 6.41 | 6.61 | 6.82 | 7.30 |
| HLRS 4025-05-080 | | | 8 | 8.28 | 8.54 | 8.81 | 9.10 | 9.74 |
| HLRS 4025-05-100 | | | 10 | 10.34 | 10.67 | 11.01 | 11.37 | 12.19 |
| HLRS 4025-05-160 | | | 16 | 16.53 | 17.05 | 17.61 | 18.21 | No Interference |
| HLRS 4025-05-200 | | | 20 | 20.66 | 21.31 | 22.01 | No Interference | No Interference |
| HLRS 4025-05-300 | | | 30 | 30.97 | 31.96 | No Interference | No Interference | No Interference |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4030-005-040 | 3 | R0.05 | 4 | 2.4 | 2.92 | 16° | 55 | 6 | 7,100 |
| | HLRS 4030-005-060 | | | 6 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-005-080 | | | 8 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-005-100 | | | 10 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-005-120 | | | 12 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-005-160 | | | 16 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-005-200 | | | 20 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-01-040 | | R0.1 | 4 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-01-060 | | | 6 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-01-080 | | | 8 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-01-100 | | | 10 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-01-120 | | | 12 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-01-160 | | | 16 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-01-180 | | | 18 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-01-200 | | | 20 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-01-240 | | | 24 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-01-260 | | | 26 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-01-300 | | | 30 | | | | 70 | 6 | 12,000 |
| | HLRS 4030-02-040 | | R0.2 | 4 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-02-060 | | | 6 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-02-080 | | | 8 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-02-100 | | | 10 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-02-120 | | | 12 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-02-160 | | | 16 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-02-180 | | | 18 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-02-200 | | | 20 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-02-240 | | | 24 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-02-260 | | | 26 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-02-300 | | | 30 | | | | 70 | 6 | 12,000 |
| ※ | HLRS 4030-02-360 | | | 36 | | | | 80 | 6 | 12,000 |
| | HLRS 4030-03-040 | | R0.3 | 4 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-03-060 | | | 6 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-03-080 | | | 8 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-03-100 | | | 10 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-03-120 | | | 12 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-03-140 | | | 14 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-03-160 | | | 16 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-03-200 | | | 20 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-03-240 | | | 24 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-03-260 | | | 26 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-03-300 | | | 30 | | | | 70 | 6 | 12,000 |
| ※ | HLRS 4030-03-360 | | | 36 | | | | 80 | 6 | 12,000 |

※Additional model

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4030-005-040 | 3 | R0.05 | 4 | 4.17 | 4.31 | 4.45 | 4.60 | 4.95 |
| HLRS 4030-005-060 | | | 6 | 6.23 | 6.43 | 6.65 | 6.88 | 7.40 |
| HLRS 4030-005-080 | | | 8 | 8.30 | 8.56 | 8.85 | 9.16 | 9.84 |
| HLRS 4030-005-100 | | | 10 | 10.36 | 10.69 | 11.05 | 11.44 | 12.29 |
| HLRS 4030-005-120 | | | 12 | 12.42 | 12.82 | 13.25 | 13.71 | 14.74 |
| HLRS 4030-005-160 | | | 16 | 16.55 | 17.08 | 17.66 | 18.27 | 19.63 |
| HLRS 4030-005-200 | | | 20 | 20.67 | 21.34 | 22.06 | 22.82 | 24.53 |
| HLRS 4030-01-040 | | R0.1 | 4 | 4.17 | 4.30 | 4.44 | 4.60 | 4.94 |
| HLRS 4030-01-060 | | | 6 | 6.23 | 6.43 | 6.65 | 6.87 | 7.38 |
| HLRS 4030-01-080 | | | 8 | 8.29 | 8.56 | 8.85 | 9.15 | 9.83 |
| HLRS 4030-01-100 | | | 10 | 10.36 | 10.69 | 11.05 | 11.43 | 12.28 |
| HLRS 4030-01-120 | | | 12 | 12.42 | 12.82 | 13.25 | 13.71 | 14.73 |
| HLRS 4030-01-160 | | | 16 | 16.54 | 17.08 | 17.65 | 18.26 | 19.62 |
| HLRS 4030-01-180 | | | 18 | 18.61 | 19.21 | 19.85 | 20.54 | 22.07 |
| HLRS 4030-01-200 | | | 20 | 20.67 | 21.34 | 22.05 | 22.82 | 24.52 |
| HLRS 4030-01-240 | | | 24 | 24.80 | 25.60 | 26.45 | 27.37 | No Interference |
| HLRS 4030-01-260 | | | 26 | 26.86 | 27.73 | 28.66 | 29.65 | No Interference |
| HLRS 4030-01-300 | | | 30 | 30.98 | 31.99 | 33.06 | 34.20 | No Interference |
| HLRS 4030-02-040 | | R0.2 | 4 | 4.17 | 4.30 | 4.43 | 4.58 | 4.92 |
| HLRS 4030-02-060 | | | 6 | 6.23 | 6.43 | 6.64 | 6.86 | 7.36 |
| HLRS 4030-02-080 | | | 8 | 8.29 | 8.55 | 8.84 | 9.14 | 9.81 |
| HLRS 4030-02-100 | | | 10 | 10.35 | 10.68 | 11.04 | 11.42 | 12.26 |
| HLRS 4030-02-120 | | | 12 | 12.42 | 12.81 | 13.24 | 13.69 | 14.70 |
| HLRS 4030-02-160 | | | 16 | 16.54 | 17.07 | 17.64 | 18.25 | 19.60 |
| HLRS 4030-02-180 | | | 18 | 18.60 | 19.20 | 19.84 | 20.53 | 22.05 |
| HLRS 4030-02-200 | | | 20 | 20.67 | 21.33 | 22.04 | 22.80 | 24.49 |
| HLRS 4030-02-240 | | | 24 | 24.79 | 25.59 | 26.44 | 27.36 | No Interference |
| HLRS 4030-02-260 | | | 26 | 26.86 | 27.72 | 28.65 | 29.63 | No Interference |
| HLRS 4030-02-300 | | | 30 | 30.98 | 31.98 | 33.05 | 34.19 | No Interference |
| HLRS 4030-02-360 | | | 36 | 37.17 | 38.37 | 39.65 | 41.02 | No Interference |
| HLRS 4030-03-040 | | R0.3 | 4 | 4.16 | 4.29 | 4.42 | 4.57 | 4.89 |
| HLRS 4030-03-060 | | | 6 | 6.22 | 6.42 | 6.63 | 6.85 | 7.34 |
| HLRS 4030-03-080 | | | 8 | 8.29 | 8.55 | 8.83 | 9.12 | 9.79 |
| HLRS 4030-03-100 | | | 10 | 10.35 | 10.68 | 11.03 | 11.40 | 12.24 |
| HLRS 4030-03-120 | | | 12 | 12.41 | 12.81 | 13.23 | 13.68 | 14.68 |
| HLRS 4030-03-140 | | | 14 | 14.48 | 14.94 | 15.43 | 15.96 | 17.13 |
| HLRS 4030-03-160 | | | 16 | 16.54 | 17.07 | 17.63 | 18.23 | 19.58 |
| HLRS 4030-03-200 | | | 20 | 20.66 | 21.33 | 22.03 | 22.79 | 24.47 |
| HLRS 4030-03-240 | | | 24 | 24.79 | 25.59 | 26.43 | 27.34 | No Interference |
| HLRS 4030-03-260 | | | 26 | 26.85 | 27.71 | 28.64 | 29.62 | No Interference |
| HLRS 4030-03-300 | | | 30 | 30.98 | 31.97 | 33.04 | 34.18 | No Interference |
| HLRS 4030-03-360 | | | 36 | 37.17 | 38.36 | 39.64 | 41.01 | No Interference |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4030-05-040 | 3 | R0.5 | 4 | 2.4 | 2.92 | 16° | 55 | 6 | 7,100 |
| | HLRS 4030-05-060 | | | 6 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-05-080 | | | 8 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-05-100 | | | 10 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-05-120 | | | 12 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-05-160 | | | 16 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-05-200 | | | 20 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-05-240 | | | 24 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-05-260 | | | 26 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-05-300 | | | 30 | | | | 70 | 6 | 12,000 |
| ※ | HLRS 4030-05-360 | | | 36 | | | | 80 | 6 | 12,000 |
| | HLRS 4030-10-060 | | R1 | 6 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-10-080 | | | 8 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-10-100 | | | 10 | | | | 55 | 6 | 7,100 |
| | HLRS 4030-10-120 | | | 12 | | | | 55 | 6 | 8,600 |
| | HLRS 4030-10-160 | | | 16 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-10-200 | | | 20 | | | | 60 | 6 | 10,600 |
| | HLRS 4030-10-240 | | | 24 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-10-260 | | | 26 | | | | 70 | 6 | 10,600 |
| | HLRS 4030-10-300 | | | 30 | | | | 70 | 6 | 12,000 |
| ※ | HLRS 4030-10-360 | | | 36 | | | | 80 | 6 | 12,000 |
| | HLRS 4040-005-080 | 4 | R0.05 | 8 | 3.2 | 3.82 | 16° | 65 | 6 | 10,600 |
| | HLRS 4040-005-120 | | | 12 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-005-160 | | | 16 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-005-200 | | | 20 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-005-240 | | | 24 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-005-320 | | | 32 | | | | 80 | 6 | 11,800 |
| | HLRS 4040-01-080 | | R0.1 | 8 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-01-120 | | | 12 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-01-160 | | | 16 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-01-200 | | | 20 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-01-240 | | | 24 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-01-320 | | | 32 | | | | 80 | 6 | 11,800 |
| ※ | HLRS 4040-01-480 | | | 48 | | | | 100 | 6 | 18,800 |
| | HLRS 4040-02-080 | | R0.2 | 8 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-02-120 | | | 12 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-02-160 | | | 16 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-02-200 | | | 20 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-02-240 | | | 24 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-02-320 | | | 32 | | | | 80 | 6 | 11,800 |
| ※ | HLRS 4040-02-480 | | | 48 | | | | 100 | 6 | 18,800 |





※Additional model

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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4030-05-040 | 3 | R0.5 | 4 | 4.15 | 4.27 | 4.40 | 4.54 | 4.85 |
| HLRS 4030-05-060 | | | 6 | 6.22 | 6.40 | 6.60 | 6.82 | 7.30 |
| HLRS 4030-05-080 | | | 8 | 8.28 | 8.53 | 8.80 | 9.10 | 9.74 |
| HLRS 4030-05-100 | | | 10 | 10.34 | 10.66 | 11.01 | 11.37 | 12.19 |
| HLRS 4030-05-120 | | | 12 | 12.40 | 12.79 | 13.21 | 13.65 | 14.64 |
| HLRS 4030-05-160 | | | 16 | 16.53 | 17.05 | 17.61 | 18.20 | 19.53 |
| HLRS 4030-05-200 | | | 20 | 20.66 | 21.31 | 22.01 | 22.76 | 24.43 |
| HLRS 4030-05-240 | | | 24 | 24.78 | 25.57 | 26.41 | 27.31 | 29.32 |
| HLRS 4030-05-260 | | | 26 | 26.84 | 27.70 | 28.61 | 29.59 | No Interference |
| HLRS 4030-05-300 | | | 30 | 30.97 | 31.96 | 33.02 | 34.15 | No Interference |
| HLRS 4030-05-360 | | | 36 | 37.16 | 38.35 | 39.62 | 40.98 | No Interference |
| HLRS 4030-10-060 | | R1 | 6 | 6.20 | 6.37 | 6.55 | 6.75 | 7.18 |
| HLRS 4030-10-080 | | | 8 | 8.26 | 8.50 | 8.75 | 9.03 | 9.63 |
| HLRS 4030-10-100 | | | 10 | 10.32 | 10.63 | 10.95 | 11.30 | 12.08 |
| HLRS 4030-10-120 | | | 12 | 12.39 | 12.76 | 13.16 | 13.58 | 14.53 |
| HLRS 4030-10-160 | | | 16 | 16.51 | 17.02 | 17.56 | 18.13 | 19.42 |
| HLRS 4030-10-200 | | | 20 | 20.64 | 21.28 | 21.96 | 22.69 | 24.32 |
| HLRS 4030-10-240 | | | 24 | 24.76 | 25.54 | 26.36 | 27.24 | 29.21 |
| HLRS 4030-10-260 | | | 26 | 26.83 | 27.67 | 28.56 | 29.52 | No Interference |
| HLRS 4030-10-300 | | | 30 | 30.95 | 31.93 | 32.96 | 34.08 | No Interference |
| HLRS 4030-10-360 | | | 36 | 37.14 | 38.31 | 39.57 | 40.91 | No Interference |
| HLRS 4040-005-080 | 4 | R0.05 | 8 | 8.48 | 8.75 | 9.04 | 9.36 | 10.06 |
| HLRS 4040-005-120 | | | 12 | 12.60 | 13.01 | 13.45 | 13.91 | 14.95 |
| HLRS 4040-005-160 | | | 16 | 16.73 | 17.27 | 17.85 | 18.47 | No Interference |
| HLRS 4040-005-200 | | | 20 | 20.85 | 21.53 | 22.25 | 23.02 | No Interference |
| HLRS 4040-005-240 | | | 24 | 24.98 | 25.79 | 26.65 | 27.58 | No Interference |
| HLRS 4040-005-320 | | | 32 | 33.23 | 34.31 | 35.46 | No Interference | No Interference |
| HLRS 4040-01-080 | | R0.1 | 8 | 8.47 | 8.75 | 9.04 | 9.35 | 10.05 |
| HLRS 4040-01-120 | | | 12 | 12.60 | 13.01 | 13.44 | 13.91 | 14.94 |
| HLRS 4040-01-160 | | | 16 | 16.72 | 17.27 | 17.84 | 18.46 | No Interference |
| HLRS 4040-01-200 | | | 20 | 20.85 | 21.52 | 22.24 | 23.01 | No Interference |
| HLRS 4040-01-240 | | | 24 | 24.98 | 25.78 | 26.65 | 27.57 | No Interference |
| HLRS 4040-01-320 | | | 32 | 33.23 | 34.30 | 35.45 | No Interference | No Interference |
| HLRS 4040-01-480 | | | 48 | 49.73 | 51.34 | No Interference | No Interference | No Interference |
| HLRS 4040-02-080 | | R0.2 | 8 | 8.47 | 8.74 | 9.03 | 9.34 | 10.02 |
| HLRS 4040-02-120 | | | 12 | 12.60 | 13.00 | 13.43 | 13.89 | 14.92 |
| HLRS 4040-02-160 | | | 16 | 16.72 | 17.26 | 17.83 | 18.45 | No Interference |
| HLRS 4040-02-200 | | | 20 | 20.85 | 21.52 | 22.23 | 23.00 | No Interference |
| HLRS 4040-02-240 | | | 24 | 24.97 | 25.78 | 26.64 | 27.56 | No Interference |
| HLRS 4040-02-320 | | | 32 | 33.22 | 34.30 | 35.44 | No Interference | No Interference |
| HLRS 4040-02-480 | | | 48 | 49.73 | 51.33 | No Interference | No Interference | No Interference |



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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| | HLRS 4040-03-080 | 4 | R0.3 | 8 | 3.2 | 3.82 | 16° | 65 | 6 | 10,600 |
| | HLRS 4040-03-120 | | | 12 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-03-140 | | | 14 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-03-160 | | | 16 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-03-200 | | | 20 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-03-240 | | | 24 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-03-320 | | | 32 | | | | 80 | 6 | 11,800 |
| ※ | HLRS 4040-03-480 | | | 48 | | | | 100 | 6 | 18,800 |
| | HLRS 4040-05-080 | | R0.5 | 8 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-05-120 | | | 12 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-05-160 | | | 16 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-05-200 | | | 20 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-05-240 | | | 24 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-05-320 | | | 32 | | | | 80 | 6 | 11,800 |
| ※ | HLRS 4040-05-400 | | | 40 | | | | 100 | 6 | 17,500 |
| ※ | HLRS 4040-05-480 | | | 48 | | | | 100 | 6 | 18,800 |
| | HLRS 4040-10-080 | | R1 | 8 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-10-120 | | | 12 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-10-160 | | | 16 | | | | 65 | 6 | 10,600 |
| | HLRS 4040-10-200 | | | 20 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-10-240 | | | 24 | | | | 70 | 6 | 11,800 |
| | HLRS 4040-10-320 | | | 32 | | | | 80 | 6 | 11,800 |
| ※ | HLRS 4040-10-480 | | | 48 | | | | 100 | 6 | 18,800 |
| ※ | HLRS 4050-005-160 | 5 | R0.05 | 16 | 4 | 4.82 | 16° | 65 | 6 | 14,300 |
| ※ | HLRS 4050-005-200 | | | 20 | | | | 70 | 6 | 14,000 |
| ※ | HLRS 4050-005-400 | | | 40 | | | | 100 | 6 | 17,500 |
| | HLRS 4050-01-160 | | R0.1 | 16 | | | | 65 | 6 | 14,300 |
| | HLRS 4050-01-200 | | | 20 | | | | 70 | 6 | 14,000 |
| | HLRS 4050-01-400 | | | 40 | | | | 100 | 6 | 17,500 |
| | HLRS 4050-02-160 | | R0.2 | 16 | | | | 65 | 6 | 14,000 |
| | HLRS 4050-02-200 | | | 20 | | | | 70 | 6 | 14,000 |
| | HLRS 4050-02-400 | | | 40 | | | | 100 | 6 | 17,500 |
| | HLRS 4050-03-160 | | R0.3 | 16 | | | | 65 | 6 | 14,000 |
| | HLRS 4050-03-200 | | | 20 | | | | 70 | 6 | 14,000 |
| | HLRS 4050-03-400 | | | 40 | | | | 100 | 6 | 17,500 |
| | HLRS 4050-05-160 | | R0.5 | 16 | | | | 65 | 6 | 14,000 |
| | HLRS 4050-05-200 | | | 20 | | | | 70 | 6 | 14,000 |
| | HLRS 4050-05-400 | | | 40 | | | | 100 | 6 | 17,500 |
| | HLRS 4050-10-160 | | R1 | 16 | | | | 65 | 6 | 14,000 |
| | HLRS 4050-10-200 | | | 20 | | | | 70 | 6 | 14,000 |
| | HLRS 4050-10-400 | | | 40 | | | | 100 | 6 | 17,500 |



※Additional model



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Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4040-03-080 | 4 | R0.3 | 8 | 8.47 | 8.73 | 9.02 | 9.32 | 10.00 |
| HLRS 4040-03-120 | | | 12 | 12.59 | 12.99 | 13.42 | 13.88 | 14.90 |
| HLRS 4040-03-140 | | | 14 | 14.66 | 15.12 | 15.62 | 16.16 | 17.34 |
| HLRS 4040-03-160 | | | 16 | 16.72 | 17.25 | 17.82 | 18.43 | No Interference |
| HLRS 4040-03-200 | | | 20 | 20.84 | 21.51 | 22.22 | 22.99 | No Interference |
| HLRS 4040-03-240 | | | 24 | 24.97 | 25.77 | 26.63 | 27.54 | No Interference |
| HLRS 4040-03-320 | | | 32 | 33.22 | 34.29 | 35.43 | No Interference | No Interference |
| HLRS 4040-03-480 | | | 48 | 49.72 | 51.33 | No Interference | No Interference | No Interference |
| HLRS 4040-05-080 | | R0.5 | 8 | 8.46 | 8.72 | 9.00 | 9.29 | 9.96 |
| HLRS 4040-05-120 | | | 12 | 12.58 | 12.98 | 13.40 | 13.85 | 14.85 |
| HLRS 4040-05-160 | | | 16 | 16.71 | 17.24 | 17.80 | 18.40 | 19.75 |
| HLRS 4040-05-200 | | | 20 | 20.84 | 21.50 | 22.20 | 22.96 | No Interference |
| HLRS 4040-05-240 | | | 24 | 24.96 | 25.76 | 26.60 | 27.51 | No Interference |
| HLRS 4040-05-320 | | | 32 | 33.21 | 34.27 | 35.41 | No Interference | No Interference |
| HLRS 4040-05-400 | | | 40 | 41.46 | 42.79 | No Interference | No Interference | No Interference |
| HLRS 4040-05-480 | | | 48 | 49.71 | 51.31 | No Interference | No Interference | No Interference |
| HLRS 4040-10-080 | | R1 | 8 | 8.44 | 8.69 | 8.95 | 9.22 | 9.84 |
| HLRS 4040-10-120 | | | 12 | 12.57 | 12.94 | 13.35 | 13.78 | 14.74 |
| HLRS 4040-10-160 | | | 16 | 16.69 | 17.20 | 17.75 | 18.33 | 19.63 |
| HLRS 4040-10-200 | | | 20 | 20.82 | 21.46 | 22.15 | 22.89 | No Interference |
| HLRS 4040-10-240 | | | 24 | 24.94 | 25.72 | 26.55 | 27.44 | No Interference |
| HLRS 4040-10-320 | | | 32 | 33.20 | 34.24 | 35.36 | No Interference | No Interference |
| HLRS 4040-10-480 | | | 48 | 49.70 | 51.28 | No Interference | No Interference | No Interference |
| HLRS 4050-005-160 | 5 | R0.05 | 16 | 16.73 | 17.27 | 17.85 | No Interference | No Interference |
| HLRS 4050-005-200 | | | 20 | 20.85 | 21.53 | No Interference | No Interference | No Interference |
| HLRS 4050-005-400 | | | 40 | 41.48 | No Interference | No Interference | No Interference | No Interference |
| HLRS 4050-01-160 | | R0.1 | 16 | 16.72 | 17.27 | 17.84 | No Interference | No Interference |
| HLRS 4050-01-200 | | | 20 | 20.85 | 21.52 | No Interference | No Interference | No Interference |
| HLRS 4050-01-400 | | | 40 | 41.48 | No Interference | No Interference | No Interference | No Interference |
| HLRS 4050-02-160 | | R0.2 | 16 | 16.72 | 17.26 | 17.83 | No Interference | No Interference |
| HLRS 4050-02-200 | | | 20 | 20.85 | 21.52 | No Interference | No Interference | No Interference |
| HLRS 4050-02-400 | | | 40 | 41.47 | No Interference | No Interference | No Interference | No Interference |
| HLRS 4050-03-160 | | R0.3 | 16 | 16.72 | 17.25 | 17.82 | No Interference | No Interference |
| HLRS 4050-03-200 | | | 20 | 20.84 | 21.51 | No Interference | No Interference | No Interference |
| HLRS 4050-03-400 | | | 40 | 41.47 | No Interference | No Interference | No Interference | No Interference |
| HLRS 4050-05-160 | | R0.5 | 16 | 16.71 | 17.24 | 17.80 | No Interference | No Interference |
| HLRS 4050-05-200 | | | 20 | 20.83 | 21.50 | No Interference | No Interference | No Interference |
| HLRS 4050-05-400 | | | 40 | 41.46 | No Interference | No Interference | No Interference | No Interference |
| HLRS 4050-10-160 | | R1 | 16 | 16.69 | 17.20 | 17.74 | No Interference | No Interference |
| HLRS 4050-10-200 | | | 20 | 20.81 | 21.46 | No Interference | No Interference | No Interference |
| HLRS 4050-10-400 | | | 40 | 41.44 | No Interference | No Interference | No Interference | No Interference |

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Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| ※ | HLRS 4060-005-120 | 6 | R0.05 | 12 | 4.8 | 5.82 | — | 65 | 6 | 15,400 |
| ※ | HLRS 4060-005-160 | | | 16 | | | | 65 | 6 | 15,400 |
| ※ | HLRS 4060-005-200 | | | 20 | | | | 70 | 6 | 15,400 |
| ※ | HLRS 4060-005-240 | | | 24 | | | | 70 | 6 | 15,400 |
| ※ | HLRS 4060-005-300 | | | 30 | | | | 100 | 6 | 18,000 |
| ※ | HLRS 4060-005-480 | | | 48 | | | | 120 | 6 | 24,000 |
| | HLRS 4060-01-120 | | R0.1 | 12 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-01-160 | | | 16 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-01-180 | | | 18 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-01-200 | | | 20 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-01-240 | | | 24 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-01-300 | | | 30 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-01-480 | | | 48 | | | | 120 | 6 | 24,000 |
| | HLRS 4060-02-120 | | R0.2 | 12 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-02-160 | | | 16 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-02-180 | | | 18 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-02-200 | | | 20 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-02-240 | | | 24 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-02-300 | | | 30 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-02-480 | | | 48 | | | | 120 | 6 | 24,000 |
| | HLRS 4060-03-120 | | R0.3 | 12 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-03-160 | | | 16 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-03-180 | | | 18 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-03-200 | | | 20 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-03-240 | | | 24 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-03-300 | | | 30 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-03-480 | | | 48 | | | | 120 | 6 | 24,000 |
| | HLRS 4060-05-120 | | R0.5 | 12 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-05-160 | | | 16 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-05-180 | | | 18 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-05-200 | | | 20 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-05-240 | | | 24 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-05-300 | | | 30 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-05-400 | | | 40 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-05-480 | | | 48 | | | | 120 | 6 | 24,000 |
| | HLRS 4060-10-120 | | R1 | 12 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-10-160 | | | 16 | | | | 65 | 6 | 15,400 |
| | HLRS 4060-10-180 | | | 18 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-10-200 | | | 20 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-10-240 | | | 24 | | | | 70 | 6 | 15,400 |
| | HLRS 4060-10-300 | | | 30 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-10-400 | | | 40 | | | | 100 | 6 | 18,000 |
| | HLRS 4060-10-480 | | | 48 | | | | 120 | 6 | 24,000 |

※Additional model

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HLRS 4060-005-120 | 6 | R0.05 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-005-160 | | | 16 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-005-200 | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-005-240 | | | 24 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-005-300 | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-005-480 | | | 48 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-120 | | R0.1 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-160 | | | 16 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-180 | | | 18 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-200 | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-240 | | | 24 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-300 | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-01-480 | | | 48 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-120 | | R0.2 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-160 | | | 16 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-180 | | | 18 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-200 | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-240 | | | 24 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-300 | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-02-480 | | | 48 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-120 | | R0.3 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-160 | | | 16 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-180 | | | 18 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-200 | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-240 | | | 24 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-300 | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-03-480 | | | 48 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-120 | | R0.5 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-160 | | | 16 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-180 | | | 18 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-200 | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-240 | | | 24 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-300 | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-400 | | | 40 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-05-480 | | | 48 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-120 | | R1 | 12 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-160 | | | 16 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-180 | | | 18 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-200 | | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-240 | | | 24 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-300 | | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-400 | | | 40 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HLRS 4060-10-480 | | | 48 | No Interference | No Interference | No Interference | No Interference | No Interference |

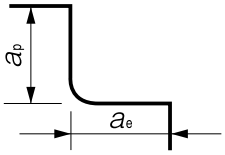
## Milling Conditions for HLRS（4 Flutes）

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD（30～45HRC） | | | | HARDENED STEELS SKD / SKT（45～55HRC） | | | | HARDENED STEELS SKD / SKH（55～65HRC） | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **4002** | **0.2** | 0.3 | 27,000 | 620 | 0.005 | 0.05 | 27,000 | 500 | 0.003 | 0.04 | 27,000 | 390 | 0.003 | 0.01 |
| | | 0.5 | 24,000 | 500 | 0.005 | 0.05 | 24,000 | 410 | 0.003 | 0.04 | 24,000 | 250 | 0.003 | 0.01 |
| | | 1 | 21,000 | 380 | 0.004 | 0.05 | 21,000 | 320 | 0.002 | 0.04 | 21,000 | 110 | 0.002 | 0.009 |
| | | 1.5 | 18,000 | 260 | 0.004 | 0.05 | 18,000 | 240 | 0.002 | 0.03 | 18,000 | 80 | 0.002 | 0.007 |
| | | 2 | 15,000 | 140 | 0.004 | 0.05 | 15,000 | 160 | 0.002 | 0.03 | 15,000 | 60 | 0.002 | 0.007 |
| **4003** | **0.3** | 0.3 | 24,500 | 660 | 0.01 | 0.075 | 23,700 | 530 | 0.006 | 0.07 | 20,000 | 330 | 0.003 | 0.028 |
| | | 0.5 | 23,300 | 600 | 0.008 | 0.075 | 22,500 | 490 | 0.006 | 0.07 | 18,500 | 270 | 0.003 | 0.028 |
| | | 1 | 20,400 | 460 | 0.006 | 0.075 | 19,500 | 400 | 0.005 | 0.07 | 17,000 | 180 | 0.003 | 0.028 |
| | | 1.5 | 17,500 | 320 | 0.004 | 0.05 | 16,500 | 310 | 0.005 | 0.07 | 16,000 | 140 | 0.003 | 0.025 |
| | | 2 | 14,600 | 180 | 0.004 | 0.05 | 13,500 | 220 | 0.005 | 0.07 | 14,500 | 100 | 0.003 | 0.025 |
| **4004** | **0.4** | 0.5 | 25,400 | 870 | 0.015 | 0.12 | 22,500 | 750 | 0.011 | 0.1 | 16,200 | 360 | 0.003 | 0.05 |
| | | 1 | 22,600 | 700 | 0.012 | 0.12 | 20,500 | 600 | 0.009 | 0.1 | 15,000 | 250 | 0.003 | 0.045 |
| | | 1.5 | 21,200 | 610 | 0.01 | 0.12 | 19,500 | 520 | 0.008 | 0.095 | 14,400 | 150 | 0.003 | 0.043 |
| | | 2 | 19,800 | 530 | 0.009 | 0.12 | 18,500 | 450 | 0.007 | 0.09 | 13,800 | 100 | 0.003 | 0.04 |
| **4005** | **0.5** | 1 | 22,000 | 800 | 0.017 | 0.155 | 20,000 | 670 | 0.012 | 0.125 | 13,500 | 300 | 0.003 | 0.065 |
| | | 2 | 19,300 | 610 | 0.013 | 0.155 | 18,000 | 530 | 0.01 | 0.12 | 12,300 | 170 | 0.003 | 0.06 |
| **4006** | **0.6** | 2 | 21,300 | 900 | 0.018 | 0.17 | 19,000 | 750 | 0.015 | 0.145 | 11,500 | 240 | 0.003 | 0.083 |
| | | 4 | 18,600 | 690 | 0.013 | 0.17 | 15,500 | 520 | 0.013 | 0.14 | 10,300 | 50 | 0.003 | 0.07 |
| **4008** | **0.8** | 2 | 20,000 | 1,100 | 0.025 | 0.2 | 18,500 | 950 | 0.02 | 0.2 | 10,000 | 280 | 0.005 | 0.12 |
| | | 3 | 18,800 | 950 | 0.021 | 0.2 | 16,500 | 830 | 0.018 | 0.2 | 9,200 | 200 | 0.005 | 0.116 |
| | | 4 | 17,500 | 840 | 0.018 | 0.2 | 15,000 | 730 | 0.016 | 0.2 | 8,800 | 120 | 0.004 | 0.112 |
| | | 6 | 14,600 | 700 | 0.015 | 0.2 | 12,500 | 600 | 0.015 | 0.2 | 8,500 | 60 | 0.004 | 0.108 |
| | | 8 | 13,100 | 450 | 0.008 | 0.13 | 11,150 | 425 | 0.008 | 0.125 | 7,500 | 50 | 0.003 | 0.057 |
| **4010** | **1** | 2 | 17,600 | 1,470 | 0.056 | 0.27 | 15,300 | 1,200 | 0.038 | 0.27 | 10,900 | 710 | 0.03 | 0.27 |
| | | 3 | 15,500 | 1,390 | 0.048 | 0.27 | 13,200 | 1,150 | 0.037 | 0.27 | 9,400 | 680 | 0.027 | 0.27 |
| | | 4 | 13,800 | 1,310 | 0.039 | 0.27 | 12,000 | 1,070 | 0.031 | 0.243 | 8,500 | 640 | 0.015 | 0.243 |
| | | 5 | 12,500 | 1,150 | 0.03 | 0.24 | 11,000 | 960 | 0.027 | 0.232 | 7,800 | 570 | 0.013 | 0.144 |
| | | 6 | 11,300 | 1,040 | 0.021 | 0.216 | 9,800 | 860 | 0.016 | 0.209 | 7,000 | 510 | 0.01 | 0.108 |
| | | 8 | 9,800 | 780 | 0.02 | 0.189 | 8,500 | 720 | 0.012 | 0.16 | 6,100 | 420 | 0.008 | 0.094 |
| | | 10 | 8,800 | 510 | 0.011 | 0.126 | 7,600 | 510 | 0.009 | 0.1 | 5,400 | 350 | 0.006 | 0.05 |
| | | 12 | 8,100 | 320 | 0.008 | 0.1 | 7,000 | 400 | 0.006 | 0.05 | 5,000 | 300 | 0.006 | 0.03 |
| | | 16 | 7,000 | 150 | 0.005 | 0.06 | 6,100 | 330 | 0.006 | 0.05 | 4,300 | 250 | 0.005 | 0.01 |
| **4012** | **1.2** | 4 | 13,200 | 1,360 | 0.032 | 0.45 | 11,900 | 1,100 | 0.024 | 0.3 | 9,200 | 1,300 | 0.02 | 0.2 |
| | | 6 | 11,200 | 1,160 | 0.028 | 0.36 | 9,600 | 980 | 0.022 | 0.252 | 7,400 | 1,200 | 0.011 | 0.095 |
| | | 10 | 9,000 | 800 | 0.017 | 0.18 | 7,300 | 600 | 0.009 | 0.15 | 6,300 | 800 | 0.006 | 0.05 |
| **4015** | **1.5** | 3 | 16,400 | 1,520 | 0.063 | 0.569 | 14,800 | 1,330 | 0.052 | 0.54 | 11,200 | 780 | 0.035 | 0.315 |
| | | 4 | 13,200 | 1,360 | 0.054 | 0.54 | 13,200 | 1,280 | 0.042 | 0.495 | 10,100 | 700 | 0.033 | 0.292 |
| | | 6 | 11,600 | 1,280 | 0.041 | 0.486 | 10,600 | 1,210 | 0.038 | 0.445 | 8,100 | 460 | 0.025 | 0.202 |
| | | 8 | 10,200 | 1,080 | 0.037 | 0.378 | 9,300 | 1,020 | 0.031 | 0.346 | 7,100 | 390 | 0.015 | 0.157 |
| | | 10 | 9,300 | 930 | 0.032 | 0.345 | 8,500 | 870 | 0.029 | 0.316 | 6,600 | 340 | 0.011 | 0.172 |
| | | 12 | 8,500 | 830 | 0.029 | 0.324 | 7,800 | 780 | 0.026 | 0.297 | 5,900 | 300 | 0.01 | 0.162 |
| | | 16 | 7,400 | 670 | 0.018 | 0.216 | 6,800 | 600 | 0.014 | 0.198 | 5,100 | 230 | 0.005 | 0.108 |
| | | 18 | 6,000 | 550 | 0.015 | 0.2 | 5,800 | 420 | 0.01 | 0.15 | 4,200 | 150 | 0.005 | 0.08 |
| **4018** | **1.8** | 8 | 10,700 | 1,120 | 0.047 | 0.495 | 9,800 | 1,060 | 0.043 | 0.497 | 7,700 | 500 | 0.02 | 0.222 |
| | | 10 | 9,600 | 1,010 | 0.04 | 0.436 | 8,900 | 950 | 0.038 | 0.421 | 7,100 | 390 | 0.015 | 0.203 |
| | | 12 | 8,100 | 850 | 0.035 | 0.303 | 7,500 | 740 | 0.032 | 0.306 | 5,900 | 290 | 0.013 | 0.159 |
| | | 14 | 7,400 | 770 | 0.027 | 0.24 | 6,900 | 660 | 0.024 | 0.24 | 5,400 | 270 | 0.008 | 0.13 |
| | | 16 | 7,200 | 730 | 0.021 | 0.207 | 6,700 | 630 | 0.019 | 0.198 | 5,200 | 260 | 0.006 | 0.113 |

## Milling Conditions for HLRS（4 Flutes）

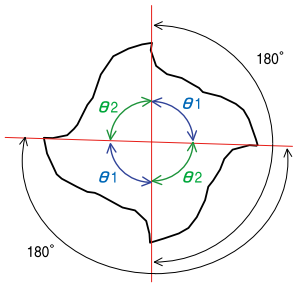
| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (mm) | 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) |
| **4020** | **2** | 4 | 15,300 | 1,570 | 0.069 | 0.72 | 14,300 | 1,460 | 0.065 | 0.81 | 11,500 | 860 | 0.031 | 0.36 |
| | | 6 | 12,800 | 1,280 | 0.064 | 0.648 | 12,000 | 1,200 | 0.06 | 0.729 | 9,700 | 700 | 0.028 | 0.324 |
| | | 8 | 11,200 | 1,160 | 0.058 | 0.612 | 10,400 | 1,100 | 0.055 | 0.648 | 8,400 | 600 | 0.026 | 0.288 |
| | | 10 | 10,000 | 1,090 | 0.049 | 0.526 | 9,300 | 1,020 | 0.047 | 0.526 | 7,600 | 450 | 0.019 | 0.234 |
| | | 12 | 9,100 | 1,030 | 0.046 | 0.405 | 8,500 | 960 | 0.044 | 0.405 | 6,900 | 420 | 0.018 | 0.18 |
| | | 16 | 7,800 | 860 | 0.042 | 0.283 | 7,300 | 700 | 0.039 | 0.315 | 5,900 | 270 | 0.016 | 0.157 |
| | | 20 | 7,000 | 800 | 0.025 | 0.198 | 6,600 | 650 | 0.024 | 0.198 | 5,300 | 290 | 0.007 | 0.118 |
| | | 24 | 6,500 | 740 | 0.02 | 0.17 | 5,600 | 500 | 0.019 | 0.14 | 4,700 | 270 | 0.007 | 0.1 |
| | | 26 | 6,000 | 680 | 0.013 | 0.15 | 5,000 | 440 | 0.012 | 0.12 | 4,000 | 220 | 0.005 | 0.08 |
| | | 30 | 5,500 | 620 | 0.01 | 0.1 | 4,400 | 390 | 0.009 | 0.09 | 3,400 | 180 | 0.005 | 0.08 |
| **4025** | **2.5** | 6 | 13,000 | 1,600 | 0.078 | 0.7 | 12,000 | 1,500 | 0.074 | 0.7 | 9,900 | 830 | 0.05 | 0.476 |
| | | 8 | 11,300 | 1,430 | 0.075 | 0.62 | 10,500 | 1,240 | 0.072 | 0.62 | 9,100 | 650 | 0.05 | 0.42 |
| | | 10 | 10,500 | 1,400 | 0.067 | 0.54 | 10,000 | 1,150 | 0.067 | 0.54 | 8,400 | 510 | 0.048 | 0.324 |
| | | 16 | 8,900 | 1,400 | 0.059 | 0.36 | 8,500 | 790 | 0.049 | 0.3 | 7,200 | 350 | 0.03 | 0.15 |
| | | 20 | 7,800 | 1,200 | 0.048 | 0.27 | 7,500 | 670 | 0.031 | 0.225 | 6,300 | 300 | 0.022 | 0.09 |
| | | 30 | 6,300 | 600 | 0.011 | 0.18 | 6,000 | 500 | 0.014 | 0.18 | 5,000 | 220 | 0.01 | 0.054 |
| **4030** | **3** | 4 | 15,000 | 3,070 | 0.128 | 0.72 | 14,000 | 2,640 | 0.08 | 0.72 | 11,500 | 980 | 0.052 | 0.576 |
| | | 6 | 14,000 | 2,890 | 0.12 | 0.72 | 13,300 | 2,500 | 0.075 | 0.72 | 10,800 | 900 | 0.05 | 0.576 |
| | | 8 | 12,500 | 2,530 | 0.105 | 0.7 | 11,800 | 2,200 | 0.07 | 0.7 | 9,900 | 810 | 0.047 | 0.56 |
| | | 10 | 11,300 | 2,160 | 0.096 | 0.7 | 10,500 | 2,090 | 0.06 | 0.7 | 9,000 | 730 | 0.045 | 0.56 |
| | | 12 | 10,500 | 2,020 | 0.084 | 0.67 | 10,000 | 1,950 | 0.052 | 0.67 | 8,100 | 660 | 0.037 | 0.502 |
| | | 14 | 9,700 | 1,800 | 0.072 | 0.65 | 9,300 | 1,700 | 0.044 | 0.65 | 7,500 | 600 | 0.032 | 0.43 |
| | | 16 | 9,200 | 1,680 | 0.064 | 0.63 | 8,800 | 1,600 | 0.04 | 0.63 | 7,100 | 570 | 0.027 | 0.378 |
| | | 18 | 8,600 | 1,610 | 0.061 | 0.605 | 8,300 | 1,540 | 0.038 | 0.605 | 6,700 | 560 | 0.023 | 0.348 |
| | | 20 | 8,400 | 1,540 | 0.058 | 0.58 | 7,900 | 1,490 | 0.036 | 0.58 | 6,300 | 550 | 0.022 | 0.319 |
| | | 24 | 7,900 | 1,490 | 0.052 | 0.513 | 7,500 | 1,420 | 0.029 | 0.513 | 6,000 | 510 | 0.017 | 0.258 |
| | | 26 | 7,500 | 1,440 | 0.046 | 0.446 | 7,100 | 1,360 | 0.023 | 0.446 | 5,700 | 480 | 0.012 | 0.198 |
| | | 30 | 7,000 | 1,260 | 0.04 | 0.38 | 6,500 | 1,230 | 0.015 | 0.38 | 5,400 | 390 | 0.007 | 0.144 |
| | | 36 | 6,500 | 1,100 | 0.035 | 0.3 | 6,100 | 1,110 | 0.01 | 0.18 | 5,100 | 300 | 0.005 | 0.1 |
| **4040** | **4** | 8 | 10,200 | 1,480 | 0.133 | 1.35 | 8,500 | 1,420 | 0.104 | 1.35 | 7,300 | 810 | 0.091 | 0.945 |
| | | 12 | 8,900 | 1,440 | 0.116 | 1.15 | 7,600 | 1,390 | 0.091 | 1.15 | 6,400 | 780 | 0.065 | 0.805 |
| | | 14 | 8,500 | 1,400 | 0.1 | 1.08 | 7,100 | 1,350 | 0.078 | 1.08 | 6,000 | 760 | 0.051 | 0.76 |
| | | 16 | 7,900 | 1,370 | 0.091 | 1 | 6,600 | 1,330 | 0.071 | 1 | 5,600 | 740 | 0.043 | 0.7 |
| | | 20 | 6,900 | 1,320 | 0.076 | 0.9 | 5,800 | 1,260 | 0.059 | 0.9 | 4,900 | 720 | 0.032 | 0.63 |
| | | 24 | 6,200 | 1,200 | 0.06 | 0.8 | 5,200 | 1,120 | 0.047 | 0.8 | 4,500 | 630 | 0.022 | 0.56 |
| | | 32 | 5,500 | 960 | 0.037 | 0.648 | 4,600 | 920 | 0.029 | 0.648 | 3,900 | 600 | 0.011 | 0.388 |
| | | 40 | 5,000 | 790 | 0.025 | 0.55 | 4,300 | 800 | 0.02 | 0.482 | 3,600 | 560 | 0.008 | 0.3 |
| | | 48 | 4,600 | 700 | 0.012 | 0.45 | 3,900 | 680 | 0.01 | 0.315 | 3,300 | 500 | 0.005 | 0.1 |
| **4050** | **5** | 16 | 7,200 | 1,700 | 0.15 | 1.5 | 5,300 | 1,200 | 0.125 | 1.15 | 4,200 | 820 | 0.063 | 1.03 |
| | | 20 | 6,700 | 1,500 | 0.14 | 1.4 | 4,800 | 1,100 | 0.1 | 1.1 | 4,000 | 740 | 0.045 | 1 |
| | | 40 | 4,600 | 880 | 0.068 | 1 | 3,300 | 700 | 0.06 | 0.68 | 2,800 | 500 | 0.025 | 0.44 |
| **4060** | **6** | 12 | 8,000 | 2,370 | 0.2 | 2.43 | 4,700 | 1,360 | 0.2 | 1.35 | 4,000 | 1,080 | 0.075 | 1.35 |
| | | 16 | 6,700 | 2,020 | 0.19 | 2.394 | 4,000 | 1,150 | 0.19 | 1.33 | 3,400 | 900 | 0.073 | 1.33 |
| | | 18 | 6,300 | 1,890 | 0.185 | 2.376 | 3,750 | 1,060 | 0.185 | 1.32 | 3,200 | 830 | 0.071 | 1.32 |
| | | 20 | 5,800 | 1,730 | 0.18 | 2.358 | 3,500 | 1,000 | 0.18 | 1.31 | 3,000 | 760 | 0.07 | 1.31 |
| | | 24 | 5,200 | 1,540 | 0.17 | 2.322 | 3,100 | 860 | 0.17 | 1.29 | 2,700 | 680 | 0.068 | 1.29 |
| | | 30 | 4,500 | 1,290 | 0.158 | 2.268 | 2,600 | 740 | 0.158 | 1.26 | 2,200 | 580 | 0.066 | 1.26 |
| | | 40 | 3,000 | 800 | 0.1 | 1.35 | 1,700 | 480 | 0.1 | 0.75 | 1,400 | 360 | 0.04 | 0.55 |
| | | 48 | 2,000 | 510 | 0.05 | 0.9 | 1,200 | 330 | 0.04 | 0.5 | 1,000 | 240 | 0.02 | 0.3 |

Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)



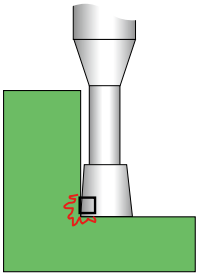

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

## Feature 1 : Variable pitch




θ1 > θ2 : The unequal division reduces chattering and tip damage.
θ1 + θ2 = 180° : Easy to measure outside diameter.

## Feature 2 : Back taper geometry

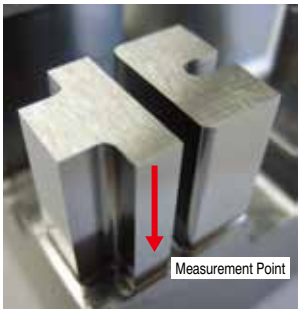


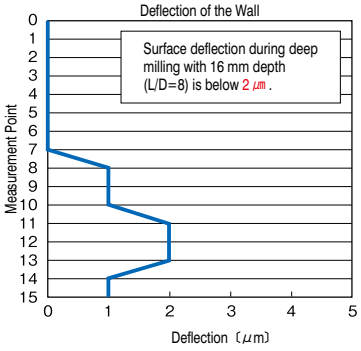
The back taper geometry reduces cutting resistance, which enables stable milling on vertical walls.

## Milling Example for Deep Milling

HLRS4000 φ 2 × CR0.3 × **Effective Length** 16 (L / D = 8) DAC10 (48HRC)

| | |
|---|---|
| Tool | HLRS 4020-03-160 |
| Spindle Speed | 7,300 $min^{-1}$ |
| Feed Rate | 1,260 mm/min |
| Axial Depth $a_p$ | 0.02 mm |
| Radial Depth $a_e$ | 0.015 mm |
| Cycle Time | 112 min |
| Coolant | Oil Mist |
| Work Size | 20 × 15 mm |



## Size φ2～φ12

# HRRS

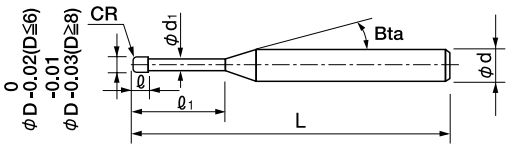
Super MG | HARD MAX | 45° | R | R ±0.01 (φ2～φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ◎ | ◎ | ◎ | ○ ～65HRC | ○ | | | | | | | | | |

## Features

**Special corner radius geometry offers greater milling amount and larger step over than a ball design.**
**Seamless corner radius reduces cutting resistance and chattering.**
**Suitable for milling hard materials up to 65HRC.**




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

Total 49 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| HRRS 4020-03-06 | 2 | R0.3 | 6 | 2 | 1.91 | 16° | 70 | 4 | 10,500 |
| HRRS 4020-05-06 | | R0.5 | | | | | 70 | 4 | 10,500 |
| HRRS 4030-08-09-3 | 3 | R0.8 | 9 | 3 | 2.92 | — | 70 | 3 | 9,800 |
| HRRS 4030-08-09 | | | | | | 16° | 70 | 6 | 10,800 |
| HRRS 4040-03-12-6 | 4 | R0.3 | 12 | 4 | 3.82 | 16° | 70 | 6 | 11,600 |
| HRRS 4040-03-20-6 | | | 20 | | | | 70 | 6 | 12,760 |
| HRRS 4040-05-12 | | R0.5 | 12 | 4 | 3.82 | — | 70 | 4 | 10,000 |
| HRRS 4040-05-12-6 | | | | | | 16° | 70 | 6 | 11,600 |
| HRRS 4040-05-20-6 | | | 20 | | | | 70 | 6 | 12,760 |
| HRRS 4040-10-12 | | R1 | 12 | 4 | 3.82 | — | 70 | 4 | 10,000 |
| HRRS 4040-10-12-6 | | | | | | 16° | 70 | 6 | 11,600 |
| HRRS 4040-10-20-6 | | | 20 | | | | 70 | 6 | 12,760 |

Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| HRRS 4050-12-15 | 5 | R1.2 | 15 | 5 | 4.82 | 16° | 70 | 6 | 12,000 |
| HRRS 4060-03-18 | 6 | R0.3 | 18 | 6 | 5.82 | — | 90 | 6 | 13,400 |
| HRRS 4060-03-30 | | | 30 | | | | 90 | 6 | 14,740 |
| HRRS 4060-05-18 | | R0.5 | 18 | | | | 90 | 6 | 13,400 |
| HRRS 4060-05-30 | | | 30 | | | | 90 | 6 | 14,740 |
| HRRS 4060-10-18 | | R1 | 18 | | | | 90 | 6 | 13,400 |
| HRRS 4060-10-30 | | | 30 | | | | 90 | 6 | 14,740 |
| HRRS 4060-15-18 | | R1.5 | 18 | | | | 90 | 6 | 13,400 |
| HRRS 4060-15-30 | | | 30 | | | | 90 | 6 | 14,740 |
| HRRS 4060-20-18 | | R2 | 18 | | | | 90 | 6 | 13,400 |
| HRRS 4080-03-24 | 8 | R0.3 | 24 | 8 | 7.82 | — | 100 | 8 | 16,700 |
| HRRS 4080-03-40 | | | 40 | | | | 100 | 8 | 18,370 |
| HRRS 4080-05-24 | | R0.5 | 24 | | | | 100 | 8 | 16,700 |
| HRRS 4080-05-40 | | | 40 | | | | 100 | 8 | 18,370 |
| HRRS 4080-10-24 | | R1 | 24 | | | | 100 | 8 | 16,700 |
| HRRS 4080-10-40 | | | 40 | | | | 100 | 8 | 18,370 |
| HRRS 4080-20-24 | | R2 | 24 | | | | 100 | 8 | 16,700 |
| HRRS 4080-20-40 | | | 40 | | | | 100 | 8 | 18,370 |
| HRRS 4080-30-24 | | R3 | 24 | | | | 100 | 8 | 16,700 |
| HRRS 4100-03-30 | 10 | R0.3 | 30 | 10 | 9.82 | — | 110 | 10 | 22,000 |
| HRRS 4100-03-50 | | | 50 | | | | 110 | 10 | 24,200 |
| HRRS 4100-05-30 | | R0.5 | 30 | | | | 110 | 10 | 22,000 |
| HRRS 4100-05-50 | | | 50 | | | | 110 | 10 | 24,200 |
| HRRS 4100-10-30 | | R1 | 30 | | | | 110 | 10 | 22,000 |
| HRRS 4100-10-50 | | | 50 | | | | 110 | 10 | 24,200 |
| HRRS 4100-20-30 | | R2 | 30 | | | | 110 | 10 | 22,000 |
| HRRS 4100-20-50 | | | 50 | | | | 110 | 10 | 24,200 |
| HRRS 4100-30-30 | | R3 | 30 | | | | 110 | 10 | 22,000 |
| HRRS 4120-03-36 | 12 | R0.3 | 36 | 12 | 11.82 | — | 120 | 12 | 27,700 |
| HRRS 4120-03-60 | | | 60 | | | | 120 | 12 | 30,470 |
| HRRS 4120-05-36 | | R0.5 | 36 | | | | 120 | 12 | 27,700 |
| HRRS 4120-05-60 | | | 60 | | | | 120 | 12 | 30,470 |
| HRRS 4120-10-36 | | R1 | 36 | | | | 120 | 12 | 27,700 |
| HRRS 4120-10-60 | | | 60 | | | | 120 | 12 | 30,470 |
| HRRS 4120-20-36 | | R2 | 36 | | | | 120 | 12 | 27,700 |
| HRRS 4120-20-60 | | | 60 | | | | 120 | 12 | 30,470 |
| HRRS 4120-40-36 | | R4 | 36 | | | | 120 | 12 | 27,700 |

## Milling Conditions for HRRS / HRRS-S

◆Roughing Effective length 3D

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS (30～45HRC) (Air Blow / Oil Mist) | | | | HARDENED STEELS (45～55HRC) (Air Blow / Oil Mist) | | | | HARDENED STEELS (55～65HRC) (Air Blow / Oil Mist) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4020-03-06** | **2** | R0.3 | 30,000 | 7,650 | 0.03 | 0.41 | 10,000 | 2,160 | 0.08 | 0.36 | 8,000 | 1,170 | 0.04 | 0.36 |
| **4020-05-06** | | R0.5 | 30,000 | 7,650 | 0.05 | 0.72 | 10,000 | 2,160 | 0.14 | 0.63 | 8,000 | 1,170 | 0.07 | 0.63 |
| **4030-08-09** | **3** | R0.8 | 25,000 | 8,100 | 0.07 | 1.08 | 10,000 | 2,970 | 0.16 | 0.95 | 7,000 | 1,710 | 0.09 | 0.95 |
| **4040-03-12-6** | **4** | R0.3 | 15,000 | 8,550 | 0.05 | 0.66 | 9,000 | 3,600 | 0.08 | 0.62 | 6,000 | 2,160 | 0.04 | 0.62 |
| **4040-05-12** | | R0.5 | 15,000 | 8,550 | 0.06 | 0.82 | 9,000 | 3,600 | 0.1 | 0.77 | 6,000 | 2,160 | 0.05 | 0.77 |
| **4040-10-12** | | R1 | 15,000 | 8,550 | 0.11 | 1.44 | 9,000 | 3,600 | 0.16 | 1.35 | 6,000 | 2,160 | 0.09 | 1.35 |
| **4050-12-15** | **5** | R1.2 | 10,000 | 8,550 | 0.16 | 1.8 | 8,000 | 4,950 | 0.18 | 1.58 | 6,000 | 2,160 | 0.14 | 1.58 |
| **4060-03-18** | **6** | R0.3 | 9,000 | 8,550 | 0.08 | 0.98 | 8,000 | 5,400 | 0.09 | 0.87 | 6,000 | 2,070 | 0.08 | 0.87 |
| **4060-05-18** | | R0.5 | 9,000 | 8,550 | 0.1 | 1.23 | 8,000 | 5,400 | 0.11 | 1.08 | 6,000 | 2,070 | 0.11 | 1.08 |
| **4060-10-18** | | R1 | 9,000 | 8,550 | 0.14 | 1.57 | 8,000 | 5,400 | 0.14 | 1.49 | 6,000 | 2,070 | 0.14 | 1.49 |
| **4060-15-18** | | R1.5 | 9,000 | 8,550 | 0.17 | 2.16 | 8,000 | 5,400 | 0.18 | 1.89 | 6,000 | 2,070 | 0.18 | 1.89 |
| **4060-20-18** | | R2 | 9,000 | 8,550 | 0.17 | 2.3 | 8,000 | 5,400 | 0.18 | 2.02 | 6,000 | 2,070 | 0.18 | 2.02 |
| **4080-03-24** | **8** | R0.3 | 7,000 | 8,550 | 0.03 | 1.2 | 6,000 | 5,850 | 0.04 | 1.04 | 4,000 | 2,070 | 0.03 | 1.04 |
| **4080-05-24** | | R0.5 | 7,000 | 8,550 | 0.04 | 1.5 | 6,000 | 5,850 | 0.05 | 1.3 | 4,000 | 2,070 | 0.04 | 1.3 |
| **4080-10-24** | | R1 | 7,000 | 8,550 | 0.05 | 1.92 | 6,000 | 5,850 | 0.06 | 1.8 | 4,000 | 2,070 | 0.05 | 1.8 |
| **4080-20-24** | | R2 | 7,000 | 8,550 | 0.21 | 2.88 | 6,000 | 5,850 | 0.23 | 2.52 | 4,000 | 2,070 | 0.18 | 2.52 |
| **4080-30-24** | | R3 | 7,000 | 8,550 | 0.21 | 3.09 | 6,000 | 5,850 | 0.23 | 2.7 | 4,000 | 2,070 | 0.18 | 2.7 |
| **4100-03-30** | **10** | R0.3 | 6,000 | 8,550 | 0.03 | 1.6 | 5,000 | 5,580 | 0.04 | 1.3 | 3,000 | 2,160 | 0.03 | 1.3 |
| **4100-05-30** | | R0.5 | 6,000 | 8,550 | 0.04 | 2 | 5,000 | 5,580 | 0.05 | 1.62 | 3,000 | 2,160 | 0.04 | 1.62 |
| **4100-10-30** | | R1 | 6,000 | 8,550 | 0.06 | 2.57 | 5,000 | 5,580 | 0.07 | 2.25 | 3,000 | 2,160 | 0.05 | 2.25 |
| **4100-20-30** | | R2 | 6,000 | 8,550 | 0.24 | 3.6 | 5,000 | 5,580 | 0.27 | 3.15 | 3,000 | 2,160 | 0.18 | 3.15 |
| **4100-30-30** | | R3 | 6,000 | 8,550 | 0.24 | 3.86 | 5,000 | 5,580 | 0.27 | 3.38 | 3,000 | 2,160 | 0.18 | 3.38 |
| **4120-03-36** | **12** | R0.3 | 5,000 | 8,550 | 0.04 | 1.93 | 4,000 | 7,290 | 0.04 | 1.56 | 2,000 | 2,250 | 0.03 | 1.56 |
| **4120-05-36** | | R0.5 | 5,000 | 8,550 | 0.05 | 2.41 | 4,000 | 7,290 | 0.05 | 1.94 | 2,000 | 2,250 | 0.04 | 1.94 |
| **4120-10-36** | | R1 | 5,000 | 8,550 | 0.07 | 3.09 | 4,000 | 7,290 | 0.07 | 2.7 | 2,000 | 2,250 | 0.05 | 2.7 |
| **4120-20-36** | | R2 | 5,000 | 8,550 | 0.27 | 4.32 | 4,000 | 7,290 | 0.27 | 3.78 | 2,000 | 2,250 | 0.18 | 3.78 |
| **4120-40-36** | | R4 | 5,000 | 8,550 | 0.27 | 4.63 | 4,000 | 7,290 | 0.27 | 4.05 | 2,000 | 2,250 | 0.18 | 4.05 |

When using an effective length of 5D, or the protruding tool experiences an "overhang", then pay attention to the tool overhang coefficient below while referring to the milling parameter table.
*Effective Length 5D: Effective Length ($\ell_1$) ÷ Diameter ($\phi$D) = 5

D:$\phi$2.0～3.0

| Overhang Length L/D | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth (mm) | Radial Depth (mm) |
|---|---|---|---|---|
| ～$\phi$D×6 | ×1 | ×1 | ×1 | ×1 |
| ～$\phi$D×7 | ×0.8 | ×0.8 | ×0.8 | ×0.9 |
| ～$\phi$D×8 | ×0.7 | ×0.7 | ×0.7 | ×0.9 |
| ～$\phi$D×9 | ×0.7 | ×0.7 | ×0.6 | ×0.8 |
| ～$\phi$D×10 | ×0.6 | ×0.6 | ×0.6 | ×0.7 |

D:$\phi$4.0～6.0

| Overhang Length L/D | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth (mm) | Radial Depth (mm) |
|---|---|---|---|---|
| ～$\phi$D×4 | ×1 | ×1 | ×1 | ×1 |
| ～$\phi$D×5 | ×0.9 | ×0.9 | ×0.9 | ×0.9 |
| ～$\phi$D×6 | ×0.8 | ×0.8 | ×0.8 | ×0.9 |
| ～$\phi$D×7 | ×0.7 | ×0.7 | ×0.6 | ×0.8 |
| ～$\phi$D×8 | ×0.5 | ×0.5 | ×0.6 | ×0.7 |

D:$\phi$8.0～12.0

| Overhang Length L/D | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth (mm) | Radial Depth (mm) |
|---|---|---|---|---|
| ～$\phi$D×4 | ×1 | ×1 | ×1 | ×1 |
| ～$\phi$D×5 | ×0.7 | ×0.7 | ×0.7 | ×0.8 |
| ～$\phi$D×6 | ×0.5 | ×0.5 | ×0.6 | ×0.7 |

D:Outside Diameter (mm) L:Overhang Length (mm)

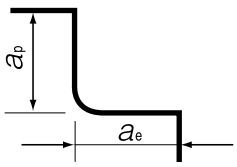
# Milling Conditions for HRRS / HRRS-S

◆Finishing (flat / inclined surface)　Effective length 3D

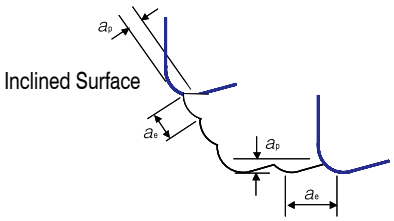
| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS (30~45HRC) (Air Blow / Oil Mist) | | | | HARDENED STEELS (45~55HRC) (Air Blow / Oil Mist) | | | | HARDENED STEELS (55~65HRC) (Air Blow / Oil Mist) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4020-03-06** | **2** | R0.3 | 30,000 | 850 | 0.1 | 0.03 | 10,000 | 355 | 0.1 | 0.04 | 8,000 | 240 | 0.05 | 0.03 |
| **4020-05-06** | | R0.5 | 30,000 | 1,100 | 0.1 | 0.04 | 10,000 | 460 | 0.1 | 0.05 | 8,000 | 310 | 0.05 | 0.04 |
| **4030-08-09** | **3** | R0.8 | 25,000 | 1,100 | 0.1 | 0.04 | 10,000 | 650 | 0.1 | 0.07 | 7,000 | 350 | 0.05 | 0.05 |
| **4040-03-12-6** | **4** | R0.3 | 15,000 | 620 | 0.08 | 0.04 | 9,000 | 365 | 0.08 | 0.04 | 6,000 | 205 | 0.04 | 0.03 |
| **4040-05-12** | | R0.5 | 15,000 | 775 | 0.1 | 0.05 | 9,000 | 455 | 0.1 | 0.05 | 6,000 | 255 | 0.05 | 0.04 |
| **4040-10-12** | | R1 | 15,000 | 1,100 | 0.1 | 0.07 | 9,000 | 650 | 0.1 | 0.07 | 6,000 | 360 | 0.05 | 0.06 |
| **4050-12-15** | **5** | R1.2 | 10,000 | 1,100 | 0.1 | 0.11 | 8,000 | 650 | 0.1 | 0.08 | 6,000 | 360 | 0.05 | 0.06 |
| **4060-03-18** | **6** | R0.3 | 9,000 | 550 | 0.16 | 0.06 | 8,000 | 300 | 0.16 | 0.04 | 6,000 | 170 | 0.08 | 0.03 |
| **4060-05-18** | | R0.5 | 9,000 | 690 | 0.2 | 0.08 | 8,000 | 375 | 0.2 | 0.05 | 6,000 | 215 | 0.1 | 0.04 |
| **4060-10-18** | | R1 | 9,000 | 975 | 0.2 | 0.11 | 8,000 | 530 | 0.2 | 0.07 | 6,000 | 310 | 0.1 | 0.05 |
| **4060-15-18** | | R1.5 | 9,000 | 1,200 | 0.2 | 0.13 | 8,000 | 650 | 0.2 | 0.08 | 6,000 | 380 | 0.1 | 0.06 |
| **4060-20-18** | | R2 | 9,000 | 1,385 | 0.2 | 0.15 | 8,000 | 750 | 0.2 | 0.09 | 6,000 | 435 | 0.1 | 0.07 |
| **4080-03-24** | **8** | R0.3 | 7,000 | 480 | 0.04 | 0.07 | 6,000 | 260 | 0.04 | 0.05 | 4,000 | 145 | 0.04 | 0.05 |
| **4080-05-24** | | R0.5 | 7,000 | 598 | 0.05 | 0.09 | 6,000 | 322 | 0.05 | 0.06 | 4,000 | 184 | 0.05 | 0.06 |
| **4080-10-24** | | R1 | 7,000 | 845 | 0.05 | 0.12 | 6,000 | 455 | 0.05 | 0.08 | 4,000 | 265 | 0.05 | 0.07 |
| **4080-20-24** | | R2 | 7,000 | 1,200 | 0.2 | 0.17 | 6,000 | 650 | 0.2 | 0.11 | 4,000 | 380 | 0.1 | 0.1 |
| **4080-30-24** | | R3 | 7,000 | 1,465 | 0.2 | 0.21 | 6,000 | 795 | 0.2 | 0.13 | 4,000 | 465 | 0.1 | 0.12 |
| **4100-03-30** | **10** | R0.3 | 6,000 | 478 | 0.04 | 0.08 | 5,000 | 258 | 0.04 | 0.05 | 3,000 | 147 | 0.04 | 0.06 |
| **4100-05-30** | | R0.5 | 6,000 | 598 | 0.05 | 0.1 | 5,000 | 322 | 0.05 | 0.06 | 3,000 | 184 | 0.05 | 0.07 |
| **4100-10-30** | | R1 | 6,000 | 845 | 0.05 | 0.14 | 5,000 | 455 | 0.05 | 0.09 | 3,000 | 265 | 0.05 | 0.09 |
| **4100-20-30** | | R2 | 6,000 | 1,200 | 0.2 | 0.2 | 5,000 | 650 | 0.2 | 0.13 | 3,000 | 380 | 0.1 | 0.13 |
| **4100-30-30** | | R3 | 6,000 | 1,470 | 0.2 | 0.25 | 5,000 | 795 | 0.2 | 0.16 | 3,000 | 465 | 0.1 | 0.16 |
| **4120-03-36** | **12** | R0.3 | 5,000 | 480 | 0.04 | 0.1 | 4,000 | 260 | 0.04 | 0.07 | 2,000 | 145 | 0.04 | 0.09 |
| **4120-05-36** | | R0.5 | 5,000 | 598 | 0.05 | 0.12 | 4,000 | 322 | 0.05 | 0.08 | 2,000 | 184 | 0.05 | 0.1 |
| **4120-10-36** | | R1 | 5,000 | 845 | 0.05 | 0.17 | 4,000 | 455 | 0.05 | 0.11 | 2,000 | 265 | 0.05 | 0.13 |
| **4120-20-36** | | R2 | 5,000 | 1,200 | 0.2 | 0.24 | 4,000 | 650 | 0.2 | 0.16 | 2,000 | 380 | 0.1 | 0.19 |
| **4120-40-36** | | R4 | 5,000 | 1,695 | 0.2 | 0.34 | 4,000 | 915 | 0.2 | 0.23 | 2,000 | 535 | 0.1 | 0.27 |

When using an effective length of 5D, or the protruding tool experiences an "overhang", then pay attention to the tool overhang coefficient found on page 364 while referring to the milling parameter table.
*Effective Length 5D: Effective Length ($\ell_1$) ÷ Diameter ($\phi$D) = 5

Roughing Parameter



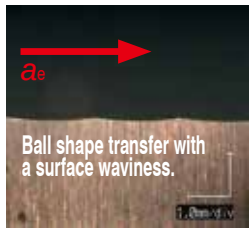
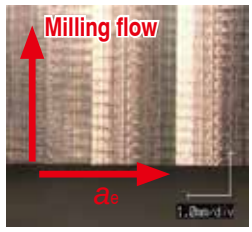
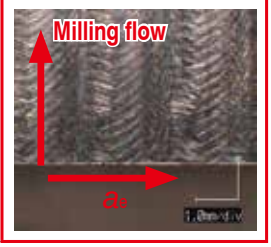

Finishing Parameter
(Flat / Inclined Surface)

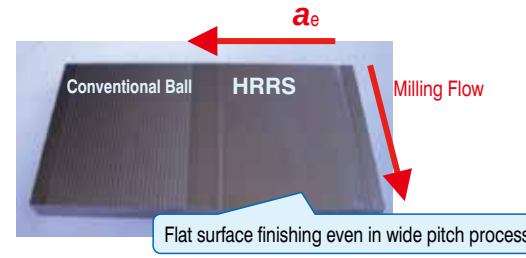



$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Only adjust the spindle speed when calculate milling conditions based on the overhang length in finishing process.
・Recommend air blow or oil mist.

## Flat Milling Example: Milling with HRRS$\phi$12 x CR4 SKD11 (60HRC)

| | Conventional Ball R6 | HRRS 4120-40-36 |
|---|---|---|
| Side |  | |
| Top |  |  |




HRRS Surface Roughness
Maximum Surface Roughness (calculated value) = 2.375 μm

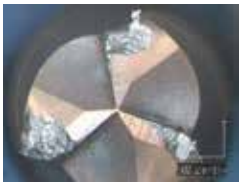
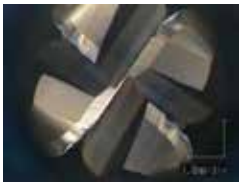
| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Milling Distance | Overhang Length |
|---|---|---|---|---|---|
| 2,000 $min^{-1}$ | 535 mm/min | 0.1 mm | 2 mm | 100 mm × 35 Times | 55 mm |

**HRRS Series NAK80 (40HRC) Milling Video**

**HRRS Series DH31S (52HRC) Milling Video**

**HRRS Series DH31 (52HRC) Milling Video**

## Pocket Milling Example: Milling with HRRS $\phi$6 × CR1.5 SKD11 (60HRC)

| | HRRS | Competitor A: 4 Flutes | Competitor B: 4 Flutes | Competitor B: 3 Flutes |
|---|---|---|---|---|
| Depth 0.9 mm | | | |  |
| Depth 12.3 mm |  | | | Broken |
| Depth 16.5 mm | | | Broken | |
| | | | | |

Pocket Milling
Cycle Time: 40 min

| Spindle Speed | Z helical Approach | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Cycle Time | Coolant |
|---|---|---|---|---|---|---|---|
| 2,700 $min^{-1}$ | 1,350 mm/min | 2,000 mm/min | 0.3 mm (0.05D) | 1.5 mm (0.25D) | 20 mm | 40 min | Air Blow (Nozzle) |

**Longer tool life on 60HRC milling.**

## Size φ2～φ12

### Short Shank Series

# HRRS-S

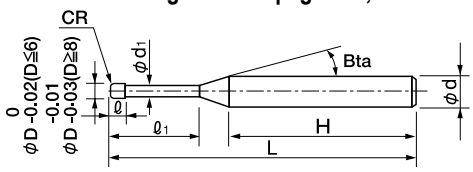
Super MG | HARD MAX | 45° | R | R ±0.01 (φ2～φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ◎ | ◎ | ◎ | ○ ～65HRC | ○ | | | | | | | | | |

## Features

**Shorter overall length and overhang offer higher feed and precision.**
**Achieves larger step over by seamless corner radius design.**
**Rated to 65HRC milling. Refer to page 364, 365 for Milling Conditions.**



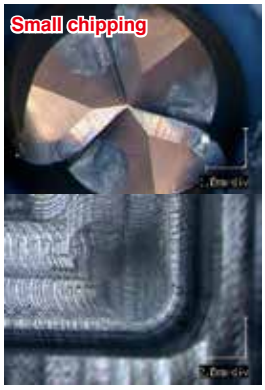

The shank taper angle and the shank length (H) shown are not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 26 models

Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shank Length H | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|
| **HRRS 4020-03-06S** | 2 | R0.3 | 6 | 2 | 1.91 | 16° | 45 | 4 | 33.0 | 9,450 |
| **HRRS 4020-05-06S** | | R0.5 | | | | | 45 | 4 | 33.0 | 9,450 |
| **HRRS 4030-08-09-3S** | 3 | R0.8 | 9 | 3 | 2.92 | — | 50 | 3 | 38.5 | 8,820 |
| **HRRS 4030-08-09S** | | | | | | 16° | 50 | 6 | 32.0 | 9,720 |
| **HRRS 4040-05-12S** | 4 | R0.5 | 12 | 4 | 3.82 | — | 50 | 4 | 35.0 | 9,000 |
| **HRRS 4040-05-12-6S** | | | | | | 16° | 50 | 6 | 31.0 | 10,440 |
| **HRRS 4040-10-12S** | | R1 | | | | — | 50 | 4 | 35.0 | 9,000 |
| **HRRS 4040-10-12-6S** | | | | | | 16° | 50 | 6 | 31.0 | 10,440 |
| **HRRS 4050-12-15S** | 5 | R1.2 | 15 | 5 | 4.82 | 16° | 50 | 6 | 30.0 | 10,800 |
| **HRRS 4060-05-18S** | 6 | R0.5 | 18 | 6 | 5.82 | — | 50 | 6 | 29.0 | 12,060 |
| **HRRS 4060-10-18S** | | R1 | | | | | 50 | 6 | 29.0 | 12,060 |
| **HRRS 4060-15-18S** | | R1.5 | | | | | 50 | 6 | 29.0 | 12,060 |
| **HRRS 4060-20-18S** | | R2 | | | | | 50 | 6 | 29.0 | 12,060 |
| **HRRS 4080-05-24S** | 8 | R0.5 | 24 | 8 | 7.82 | — | 60 | 8 | 33.0 | 15,030 |
| **HRRS 4080-10-24S** | | R1 | | | | | 60 | 8 | 33.0 | 15,030 |
| **HRRS 4080-20-24S** | | R2 | | | | | 60 | 8 | 33.0 | 15,030 |
| **HRRS 4080-30-24S** | | R3 | | | | | 60 | 8 | 33.0 | 15,030 |
| **HRRS 4100-03-30S** | 10 | R0.3 | 30 | 10 | 9.82 | — | 65 | 10 | 31.5 | 19,800 |
| **HRRS 4100-05-30S** | | R0.5 | | | | | 65 | 10 | 31.5 | 19,800 |
| **HRRS 4100-10-30S** | | R1 | | | | | 65 | 10 | 31.5 | 19,800 |
| **HRRS 4100-20-30S** | | R2 | | | | | 65 | 10 | 31.5 | 19,800 |
| **HRRS 4100-30-30S** | | R3 | | | | | 65 | 10 | 31.5 | 19,800 |
| **HRRS 4120-05-36S** | 12 | R0.5 | 36 | 12 | 11.82 | — | 75 | 12 | 35.5 | 24,930 |
| **HRRS 4120-10-36S** | | R1 | | | | | 75 | 12 | 35.5 | 24,930 |
| **HRRS 4120-20-36S** | | R2 | | | | | 75 | 12 | 35.5 | 24,930 |
| **HRRS 4120-40-36S** | | R4 | | | | | 75 | 12 | 35.5 | 24,930 |

## Pocket Milling Example: Milling with HRRS $\phi$6 × CR1.5 NAK80 (40HRC)

| HRRS | Competitor A: 4 Flutes | Competitor B: 4 Flutes | Competitor B: 3 Flutes |
|---|---|---|---|
| | | |  |
| CR1.5, FL6 mm, EFL18 mm | CR1.5, FL6 mm, EFL18 mm | CR1.5, FL12 mm | CR1.5, FL12 mm |

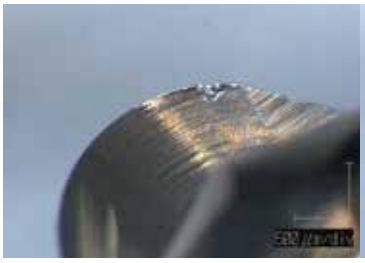
| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Cycle Time | Pocket Size |
|---|---|---|---|---|---|---|
| 9,000 min$^{-1}$ | 11,000 mm/min | 0.3 mm (0.05D) | 3 mm (0.5D) | 20 mm | 20 min | 40 × 180 × Depth 15 mm |

**Excellent chipping resistance and surface quality !**

### Original corner radius design offers high rigidity and reduces cutting resistance.

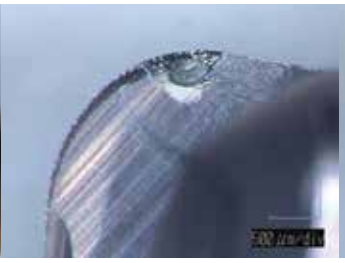
After milling SKD11 (60HRC)

HRRS



Seamless corner radius with equal rake angle design. Reduces the cutting resistance and offers excellent chip evacuation to protect from the tool damage.

Competitor



Flat and non-helix gash design. Badly damaged at tip point where cutting chips are trapped by poor chip evacuation.

Competitor

Flat and helical gash design. Huge tool damage at tangent point where the gash shape abruptly changed and cutting chips could not evacuate properly.

| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Pocket Size |
|---|---|---|---|---|---|
| 2,700 min$^{-1}$ | 2,000 mm/min | 0.3 mm | 1.5 mm | 20 mm | 40 × 40 × 0.3 mm |

### Longer tool life with variable pitch design. Recommended for various coolant.

## Size φ2～φ12

# CRRS

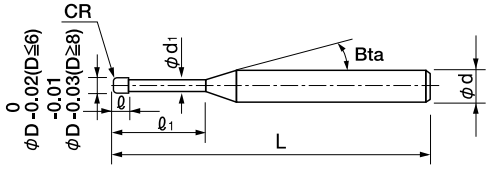
Super MG | UT COAT | 45° | R | R ±0.01 (φ2～φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ◎ | ◎ | | |

## Features

**Broad application range from Copper and Raw Materials to Hardened Steels (55HRC). UTCOAT offers long tool life. Variable pitch, high helix and positive rake angle offer stable milling. Reduced cutting resistance when using a helical approach or inclined angles.**




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

Total 24 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| **CRRS 4020-05-06** | 2 | R0.5 | 6 | 2 | 1.91 | 16° | 70 | 4 | 10,500 |
| **CRRS 4030-08-09** | 3 | R0.8 | 9 | 3 | 2.92 | 16° | 70 | 6 | 10,800 |
| **CRRS 4040-03-12** | 4 | R0.3 | 12 | 4 | 3.82 | 16° | 60 | 6 | 11,600 |
| **CRRS 4040-05-12-4** | | R0.5 | | | | — | 70 | 4 | 10,000 |
| **CRRS 4040-05-12** | | | | | | 16° | 60 | 6 | 11,600 |
| **CRRS 4040-10-12-4** | | R1 | | | | — | 70 | 4 | 10,000 |
| **CRRS 4040-10-12** | | | | | | 16° | 70 | 6 | 11,600 |
| **CRRS 4050-12-15** | 5 | R1.2 | 15 | 5 | 4.82 | 16° | 70 | 6 | 12,000 |
| **CRRS 4060-03-18** | 6 | R0.3 | 18 | 6 | 5.82 | — | 90 | 6 | 13,400 |
| **CRRS 4060-05-18** | | R0.5 | | | | | 60 | 6 | 13,400 |
| **CRRS 4060-10-18** | | R1 | | | | | 60 | 6 | 13,400 |
| **CRRS 4060-15-18** | | R1.5 | | | | | 90 | 6 | 13,400 |
| **CRRS 4080-03-24** | 8 | R0.3 | 24 | 8 | 7.82 | — | 100 | 8 | 16,700 |
| **CRRS 4080-05-26** | | R0.5 | 26 | | | | 70 | 8 | 16,700 |
| **CRRS 4080-10-26** | | R1 | | | | | 70 | 8 | 16,700 |
| **CRRS 4080-20-24** | | R2 | 24 | | | | 100 | 8 | 16,700 |
| **CRRS 4100-03-30** | 10 | R0.3 | 30 | 10 | 9.82 | — | 110 | 10 | 22,000 |
| **CRRS 4100-05-30** | | R0.5 | | | | | 80 | 10 | 22,000 |
| **CRRS 4100-10-30** | | R1 | | | | | 80 | 10 | 22,000 |
| **CRRS 4100-20-30** | | R2 | | | | | 110 | 10 | 22,000 |
| **CRRS 4120-03-36** | 12 | R0.3 | 36 | 12 | 11.82 | — | 120 | 12 | 27,700 |
| **CRRS 4120-05-36** | | R0.5 | | | | | 120 | 12 | 27,700 |
| **CRRS 4120-10-36** | | R1 | | | | | 120 | 12 | 27,700 |
| **CRRS 4120-20-36** | | R2 | | | | | 120 | 12 | 27,700 |

# Milling Conditions for CRRS

◆Roughing

| WORK MATERIAL | | | CARBON STEELS S45C / S55C (~225HB) | | | | ALLOY STEELS SK / SCM / SUS(225~325HB) *Use cutting oils for Stainless Steels. | | | | PREHARDENED STEELS HARDENED STEELS NAK / HPM / SKD / SKT / STAVAX(30~55HRC) *Recommend oil mist. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4020-05-06** | **2** | R0.5 | 30,000 | 7,200 | 0.08 | 0.8 | 30,000 | 7,200 | 0.04 | 0.66 | 24,000 | 7,000 | 0.02 | 0.59 |
| **4030-08-09** | **3** | R0.8 | 20,000 | 8,400 | 0.09 | 1.2 | 20,000 | 7,200 | 0.04 | 1.08 | 16,000 | 7,000 | 0.04 | 0.88 |
| **4040-03-12** | **4** | R0.3 | 15,000 | 9,600 | 0.09 | 1.6 | 15,000 | 7,200 | 0.05 | 1.32 | 12,000 | 7,000 | 0.05 | 1.17 |
| **4040-05-12-4** | | R0.5 | 15,000 | 9,600 | 0.1 | 1.6 | 15,000 | 7,200 | 0.05 | 1.35 | 12,000 | 7,000 | 0.05 | 1.26 |
| **4040-05-12** | | | 15,000 | 9,600 | 0.1 | 1.6 | 15,000 | 7,200 | 0.05 | 1.35 | 12,000 | 7,000 | 0.05 | 1.26 |
| **4040-10-12-4** | | R1 | 15,000 | 9,600 | 0.11 | 1.6 | 15,000 | 7,200 | 0.05 | 1.53 | 12,000 | 7,000 | 0.06 | 1.33 |
| **4040-10-12** | | | 15,000 | 9,600 | 0.11 | 1.6 | 15,000 | 7,200 | 0.05 | 1.53 | 12,000 | 7,000 | 0.06 | 1.33 |
| **4050-12-15** | **5** | R1.2 | 12,000 | 10,800 | 0.13 | 2 | 12,000 | 7,200 | 0.06 | 1.8 | 9,600 | 6,300 | 0.06 | 1.54 |
| **4060-03-18** | **6** | R0.3 | 10,000 | 12,000 | 0.13 | 2.4 | 10,000 | 7,200 | 0.07 | 1.94 | 8,000 | 5,250 | 0.07 | 1.63 |
| **4060-05-18** | | R0.5 | 10,000 | 12,000 | 0.14 | 2.4 | 10,000 | 7,200 | 0.07 | 1.98 | 8,000 | 5,250 | 0.07 | 1.75 |
| **4060-10-18** | | R1 | 10,000 | 12,000 | 0.15 | 2.4 | 10,000 | 7,200 | 0.07 | 2.16 | 8,000 | 5,250 | 0.08 | 1.75 |
| **4060-15-18** | | R1.5 | 10,000 | 12,000 | 0.17 | 2.4 | 10,000 | 7,200 | 0.08 | 2.34 | 8,000 | 5,250 | 0.11 | 1.75 |
| **4080-03-24** | **8** | R0.3 | 7,500 | 12,000 | 0.17 | 2.86 | 7,500 | 7,200 | 0.08 | 2.76 | 6,000 | 4,100 | 0.15 | 1.77 |
| **4080-05-26** | | R0.5 | 7,500 | 12,000 | 0.18 | 2.64 | 7,500 | 7,200 | 0.08 | 2.61 | 6,000 | 4,100 | 0.14 | 1.76 |
| **4080-10-26** | | R1 | 7,500 | 12,000 | 0.18 | 2.72 | 7,500 | 7,200 | 0.09 | 2.7 | 6,000 | 4,100 | 0.16 | 1.76 |
| **4080-20-24** | | R2 | 7,500 | 12,000 | 0.22 | 2.88 | 7,500 | 7,200 | 0.1 | 2.79 | 6,000 | 4,100 | 0.18 | 1.96 |
| **4100-03-30** | **10** | R0.3 | 6,000 | 12,000 | 0.2 | 3.04 | 5,000 | 5,400 | 0.14 | 2.82 | 4,800 | 4,100 | 0.18 | 1.89 |
| **4100-05-30** | | R0.5 | 6,000 | 12,000 | 0.22 | 3.04 | 5,000 | 5,400 | 0.14 | 2.88 | 4,800 | 4,100 | 0.18 | 2.03 |
| **4100-10-30** | | R1 | 6,000 | 12,000 | 0.24 | 3.28 | 5,000 | 5,400 | 0.14 | 2.97 | 4,800 | 4,100 | 0.19 | 2.1 |
| **4100-20-30** | | R2 | 6,000 | 12,000 | 0.26 | 3.44 | 5,000 | 5,400 | 0.14 | 3.06 | 4,800 | 4,100 | 0.2 | 2.45 |
| **4120-03-36** | **12** | R0.3 | 5,000 | 12,000 | 0.21 | 3.32 | 3,000 | 4,320 | 0.18 | 2.9 | 4,000 | 4,100 | 0.19 | 2.15 |
| **4120-05-36** | | R0.5 | 5,000 | 12,000 | 0.24 | 3.32 | 3,000 | 4,320 | 0.18 | 2.96 | 4,000 | 4,100 | 0.19 | 2.32 |
| **4120-10-36** | | R1 | 5,000 | 12,000 | 0.26 | 3.59 | 3,000 | 4,320 | 0.18 | 3.06 | 4,000 | 4,100 | 0.2 | 2.4 |
| **4120-20-36** | | R2 | 5,000 | 12,000 | 0.28 | 3.76 | 3,000 | 4,320 | 0.18 | 3.15 | 4,000 | 4,100 | 0.21 | 2.8 |

| WORK MATERIAL | | | TITANIUM / TITANIUM ALLOYS Ti-6Al-4V | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4020-05-06** | **2** | R0.5 | 21,420 | 4,010 | 0.03 | 0.33 | 5,140 | 810 | 0.03 | 0.33 |
| **4030-08-09** | **3** | R0.8 | 14,280 | 4,010 | 0.03 | 0.54 | 3,430 | 810 | 0.03 | 0.54 |
| **4040-03-12** | **4** | R0.3 | 10,710 | 4,010 | 0.04 | 0.66 | 2,570 | 810 | 0.04 | 0.66 |
| **4040-05-12-4** | | R0.5 | 10,710 | 4,010 | 0.04 | 0.68 | 2,570 | 810 | 0.04 | 0.68 |
| **4040-05-12** | | | 10,710 | 4,010 | 0.04 | 0.68 | 2,570 | 810 | 0.04 | 0.68 |
| **4040-10-12-4** | | R1 | 10,710 | 4,010 | 0.04 | 0.77 | 2,570 | 810 | 0.04 | 0.77 |
| **4040-10-12** | | | 10,710 | 4,010 | 0.04 | 0.77 | 2,570 | 810 | 0.04 | 0.77 |
| **4050-12-15** | **5** | R1.2 | 8,570 | 4,010 | 0.04 | 0.9 | 2,060 | 810 | 0.04 | 0.9 |
| **4060-03-18** | **6** | R0.3 | 7,140 | 4,010 | 0.05 | 1 | 1,740 | 810 | 0.05 | 1 |
| **4060-05-18** | | R0.5 | 7,140 | 4,010 | 0.05 | 1 | 1,740 | 810 | 0.05 | 1 |
| **4060-10-18** | | R1 | 7,140 | 4,010 | 0.05 | 1.08 | 1,740 | 810 | 0.05 | 1.08 |
| **4060-15-18** | | R1.5 | 7,140 | 4,010 | 0.05 | 1.08 | 1,740 | 810 | 0.05 | 1.08 |
| **4080-03-24** | **8** | R0.3 | 5,360 | 4,000 | 0.05 | 1.28 | 1,580 | 800 | 0.05 | 1.28 |
| **4080-05-26** | | R0.5 | 5,360 | 4,000 | 0.05 | 1.31 | 1,580 | 800 | 0.05 | 1.31 |
| **4080-10-26** | | R1 | 5,360 | 4,000 | 0.05 | 1.35 | 1,580 | 800 | 0.05 | 1.35 |
| **4080-20-24** | | R2 | 5,360 | 4,000 | 0.05 | 1.4 | 1,580 | 800 | 0.05 | 1.4 |
| **4100-03-30** | **10** | R0.3 | 3,570 | 3,010 | 0.09 | 1.41 | 1,050 | 550 | 0.09 | 1.41 |
| **4100-05-30** | | R0.5 | 3,570 | 3,010 | 0.09 | 1.44 | 1,050 | 550 | 0.09 | 1.44 |
| **4100-10-30** | | R1 | 3,570 | 3,010 | 0.09 | 1.49 | 1,050 | 550 | 0.09 | 1.49 |
| **4100-20-30** | | R2 | 3,570 | 3,010 | 0.09 | 1.53 | 1,050 | 550 | 0.09 | 1.53 |
| **4120-03-36** | **12** | R0.3 | 2,140 | 2,400 | 0.12 | 1.45 | 640 | 410 | 0.12 | 1.45 |
| **4120-05-36** | | R0.5 | 2,140 | 2,400 | 0.12 | 1.48 | 640 | 410 | 0.12 | 1.48 |
| **4120-10-36** | | R1 | 2,140 | 2,400 | 0.12 | 1.53 | 640 | 410 | 0.12 | 1.53 |
| **4120-20-36** | | R2 | 2,140 | 2,400 | 0.12 | 1.58 | 640 | 410 | 0.12 | 1.58 |

# Milling Conditions for CRRS

◆Finishing（Flat / Inclined surface）

| WORK MATERIAL | | | CARBON STEELS S45C / S55C (～225HB) | | | | ALLOY STEELS SK / SCM / SUS(225～325HB) *Use cutting oils for Stainless Steels. | | | | PREHARDENED STEELS HARDENED STEELS NAK / HPM / SKD / SKT / STAVAX(30～55HRC) *Recommend oil mist. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4020-05-06** | **2** | R0.5 | 30,000 | 1,720 | 0.1 | 0.06 | 30,000 | 1,510 | 0.05 | 0.05 | 24,000 | 1,070 | 0.05 | 0.04 |
| **4030-08-09** | **3** | R0.8 | 20,000 | 1,890 | 0.1 | 0.09 | 20,000 | 1,660 | 0.05 | 0.08 | 16,000 | 1,160 | 0.05 | 0.07 |
| **4040-03-12** | **4** | R0.3 | 15,000 | 1,050 | 0.1 | 0.07 | 15,000 | 910 | 0.05 | 0.06 | 12,000 | 620 | 0.05 | 0.05 |
| **4040-05-12-4** | | R0.5 | 15,000 | 1,360 | 0.1 | 0.09 | 15,000 | 1,180 | 0.05 | 0.08 | 12,000 | 810 | 0.05 | 0.07 |
| **4040-05-12** | | | 15,000 | 1,360 | 0.1 | 0.09 | 15,000 | 1,180 | 0.05 | 0.08 | 12,000 | 810 | 0.05 | 0.07 |
| **4040-10-12-4** | | R1 | 15,000 | 1,920 | 0.1 | 0.13 | 15,000 | 1,670 | 0.05 | 0.11 | 12,000 | 1,150 | 0.05 | 0.1 |
| **4040-10-12** | | | 15,000 | 1,920 | 0.1 | 0.13 | 15,000 | 1,670 | 0.05 | 0.11 | 12,000 | 1,150 | 0.05 | 0.1 |
| **4050-12-15** | **5** | R1.2 | 12,000 | 1,910 | 0.1 | 0.16 | 12,000 | 1,630 | 0.05 | 0.14 | 9,600 | 1,120 | 0.05 | 0.12 |
| **4060-03-18** | **6** | R0.3 | 10,000 | 890 | 0.2 | 0.09 | 10,000 | 760 | 0.1 | 0.08 | 8,000 | 510 | 0.1 | 0.06 |
| **4060-05-18** | | R0.5 | 10,000 | 1,150 | 0.2 | 0.12 | 10,000 | 990 | 0.1 | 0.1 | 8,000 | 670 | 0.1 | 0.08 |
| **4060-10-18** | | R1 | 10,000 | 1,630 | 0.2 | 0.16 | 10,000 | 1,400 | 0.1 | 0.14 | 8,000 | 950 | 0.1 | 0.12 |
| **4060-15-18** | | R1.5 | 10,000 | 2,000 | 0.2 | 0.2 | 10,000 | 1,720 | 0.1 | 0.17 | 8,000 | 1,170 | 0.1 | 0.15 |
| **4080-03-24** | **8** | R0.3 | 7,500 | 1,170 | 0.2 | 0.11 | 7,500 | 1,050 | 0.1 | 0.09 | 6,000 | 720 | 0.1 | 0.08 |
| **4080-05-26** | | R0.5 | 7,500 | 990 | 0.2 | 0.13 | 7,500 | 860 | 0.1 | 0.11 | 6,000 | 580 | 0.1 | 0.1 |
| **4080-10-26** | | R1 | 7,500 | 1,410 | 0.2 | 0.19 | 7,500 | 1,210 | 0.1 | 0.16 | 6,000 | 830 | 0.1 | 0.14 |
| **4080-20-24** | | R2 | 7,500 | 1,990 | 0.2 | 0.27 | 7,500 | 1,720 | 0.1 | 0.23 | 6,000 | 1,170 | 0.1 | 0.2 |
| **4100-03-30** | **10** | R0.3 | 6,000 | 720 | 0.2 | 0.12 | 5,000 | 510 | 0.1 | 0.1 | 4,800 | 400 | 0.1 | 0.08 |
| **4100-05-30** | | R0.5 | 6,000 | 940 | 0.2 | 0.16 | 5,000 | 660 | 0.1 | 0.13 | 4,800 | 520 | 0.1 | 0.11 |
| **4100-10-30** | | R1 | 6,000 | 1,330 | 0.2 | 0.22 | 5,000 | 940 | 0.1 | 0.19 | 4,800 | 740 | 0.1 | 0.15 |
| **4100-20-30** | | R2 | 6,000 | 1,890 | 0.2 | 0.32 | 5,000 | 1,340 | 0.1 | 0.27 | 4,800 | 1,050 | 0.1 | 0.22 |
| **4120-03-36** | **12** | R0.3 | 5,000 | 680 | 0.2 | 0.14 | 3,000 | 330 | 0.1 | 0.1 | 4,000 | 360 | 0.1 | 0.09 |
| **4120-05-36** | | R0.5 | 5,000 | 880 | 0.2 | 0.18 | 3,000 | 430 | 0.1 | 0.14 | 4,000 | 480 | 0.1 | 0.12 |
| **4120-10-36** | | R1 | 5,000 | 1,240 | 0.2 | 0.24 | 3,000 | 610 | 0.1 | 0.2 | 4,000 | 680 | 0.1 | 0.16 |
| **4120-20-36** | | R2 | 5,000 | 1,760 | 0.2 | 0.35 | 3,000 | 870 | 0.1 | 0.29 | 4,000 | 960 | 0.1 | 0.24 |

| WORK MATERIAL | | | TITANIUM / TITANIUM ALLOYS Ti-6Al-4V | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (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) |
| **4020-05-06** | **2** | R0.5 | 21,420 | 840 | 0.04 | 0.03 | 5,140 | 170 | 0.04 | 0.03 |
| **4030-08-09** | **3** | R0.8 | 14,280 | 920 | 0.04 | 0.04 | 3,430 | 190 | 0.04 | 0.04 |
| **4040-03-12** | **4** | R0.3 | 10,710 | 510 | 0.04 | 0.03 | 2,570 | 100 | 0.04 | 0.03 |
| **4040-05-12-4** | | R0.5 | 10,710 | 660 | 0.04 | 0.04 | 2,570 | 130 | 0.04 | 0.04 |
| **4040-05-12** | | | 10,710 | 660 | 0.04 | 0.04 | 2,570 | 130 | 0.04 | 0.04 |
| **4040-10-12-4** | | R1 | 10,710 | 930 | 0.04 | 0.06 | 2,570 | 190 | 0.04 | 0.06 |
| **4040-10-12** | | | 10,710 | 930 | 0.04 | 0.06 | 2,570 | 190 | 0.04 | 0.06 |
| **4050-12-15** | **5** | R1.2 | 8,570 | 910 | 0.03 | 0.07 | 2,060 | 180 | 0.03 | 0.07 |
| **4060-03-18** | **6** | R0.3 | 7,140 | 420 | 0.07 | 0.04 | 1,740 | 90 | 0.07 | 0.04 |
| **4060-05-18** | | R0.5 | 7,140 | 550 | 0.07 | 0.05 | 1,740 | 110 | 0.07 | 0.05 |
| **4060-10-18** | | R1 | 7,140 | 780 | 0.07 | 0.07 | 1,740 | 160 | 0.07 | 0.07 |
| **4060-15-18** | | R1.5 | 7,140 | 960 | 0.06 | 0.08 | 1,740 | 190 | 0.06 | 0.08 |
| **4080-03-24** | **8** | R0.3 | 5,360 | 400 | 0.06 | 0.04 | 1,580 | 80 | 0.06 | 0.04 |
| **4080-05-26** | | R0.5 | 5,360 | 480 | 0.06 | 0.06 | 1,580 | 100 | 0.06 | 0.06 |
| **4080-10-26** | | R1 | 5,360 | 670 | 0.06 | 0.08 | 1,580 | 130 | 0.06 | 0.08 |
| **4080-20-24** | | R2 | 5,360 | 960 | 0.05 | 0.12 | 1,580 | 190 | 0.05 | 0.12 |
| **4100-03-30** | **10** | R0.3 | 3,570 | 280 | 0.06 | 0.05 | 1,050 | 50 | 0.06 | 0.05 |
| **4100-05-30** | | R0.5 | 3,570 | 370 | 0.06 | 0.07 | 1,050 | 70 | 0.06 | 0.07 |
| **4100-10-30** | | R1 | 3,570 | 520 | 0.06 | 0.1 | 1,050 | 100 | 0.06 | 0.1 |
| **4100-20-30** | | R2 | 3,570 | 750 | 0.06 | 0.14 | 1,050 | 140 | 0.06 | 0.14 |
| **4120-03-36** | **12** | R0.3 | 2,140 | 240 | 0.07 | 0.05 | 640 | 40 | 0.07 | 0.05 |
| **4120-05-36** | | R0.5 | 2,140 | 310 | 0.07 | 0.07 | 640 | 50 | 0.07 | 0.07 |
| **4120-10-36** | | R1 | 2,140 | 400 | 0.07 | 0.11 | 640 | 70 | 0.07 | 0.12 |
| **4120-20-36** | | R2 | 2,140 | 520 | 0.07 | 0.17 | 640 | 100 | 0.07 | 0.17 |

# Milling Conditions for CRRS

Please adjust milling parameter referring following table.

D : Outside Diameter (mm)
L : Overhang Length (mm)

D : φ2.0～3.0

| Overhang Length L/D | Spindle Speed (min⁻¹) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| L/D≦6 | ×1 | ×1 | ×1 | ×1 |
| L/D=7 | ×0.8 | ×0.8 | ×0.8 | ×0.9 |
| L/D=8 | ×0.7 | ×0.7 | ×0.7 | ×0.9 |
| L/D=9 | ×0.7 | ×0.7 | ×0.6 | ×0.8 |
| L/D=10 | ×0.6 | ×0.6 | ×0.6 | ×0.7 |

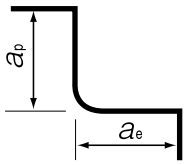
D : φ4.0～6.0

| Overhang Length L/D | Spindle Speed (min⁻¹) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| L/D≦4 | ×1 | ×1 | ×1 | ×1 |
| L/D=5 | ×0.9 | ×0.8 | ×0.9 | ×0.9 |
| L/D=6 | ×0.8 | ×0.7 | ×0.8 | ×0.9 |
| L/D=7 | ×0.7 | ×0.6 | ×0.6 | ×0.8 |
| L/D=8 | ×0.5 | ×0.4 | ×0.6 | ×0.7 |

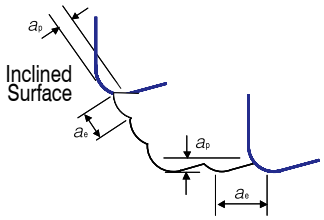
D : φ8.0～12.0

| Overhang Length L/D | Spindle Speed (min⁻¹) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| L/D≦4 | ×1 | ×1 | ×1 | ×1 |
| L/D=5 | ×0.7 | ×0.6 | ×0.6 | ×0.8 |
| L/D=6 | ×0.5 | ×0.4 | ×0.5 | ×0.7 |

Roughing Parameter




Finishing Parameter
(Flat / Inclined Surface)



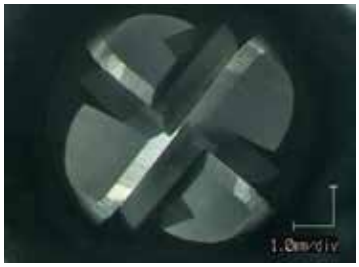

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Only adjust the spindle speed to calculate milling conditions based on the overhang length in finishing process.
・Every coolant offers stable milling.
・Recommend wet coolant for Stainless Steels.

## Tools After Milling by Different Work Materials CRRS$\phi$6 × CR0.5

| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Cycle Time | Coolant |
|---|---|---|---|---|---|---|
| 10,000 min$^{-1}$ | 12,000 mm/min | 0.14 mm | 2.4 mm | 24 mm | 90 min | Air Blow (Nozzle) |

### S50C



Relief Wear Width

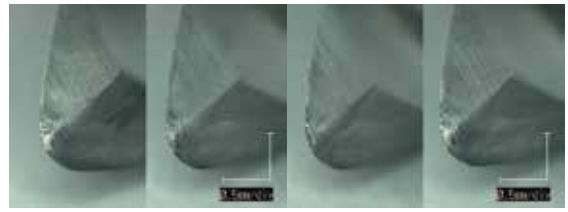
0.070 mm

| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Cycle Time | Coolant |
|---|---|---|---|---|---|---|
| 10,000 min$^{-1}$ | 7,200 mm/min | 0.07 mm | 1.98 mm | 24 mm | 84 min | Water Soluble |

### SUS304

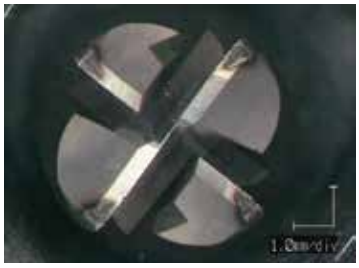
Relief Wear Width

0.032 mm



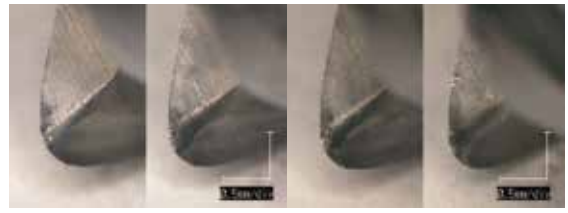
| Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Overhang Length | Cycle Time | Coolant |
|---|---|---|---|---|---|---|
| 8,000 min$^{-1}$ | 5,250 mm/min | 0.07 mm | 1.75 mm | 24 mm | 56 min | Oil Mist |

### STAVAX (52HRC)



Relief Wear Width

0.087 mm



## Size φ1～φ6

# DCLRS

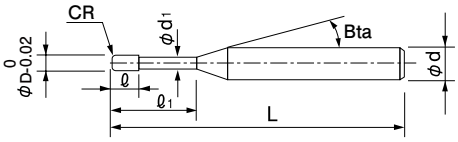
MG | DIA | 30° | R | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |

## Features

**Diamond coated 4 Flute Long Neck Radius End Mills for Graphite Electrodes.**
**Original diamond coating offers excellent resistance to wear on Graphite milling.**
**Long life tool with optimized flute geometry and high adhesion diamond coating.**




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

Total 39 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| DCLRS 4010-002-060 | 1 | R0.02 | 6 | 2 | 0.97 | 16° | 50 | 4 | 16,000 |
| DCLRS 4010-002-100 | | | 10 | | | | 50 | 4 | 16,000 |
| DCLRS 4010-002-200 | | | 20 | | | | 60 | 4 | 16,000 |
| DCLRS 4010-005-060 | | R0.05 | 6 | | | | 50 | 4 | 16,000 |
| DCLRS 4010-005-100 | | | 10 | | | | 50 | 4 | 16,000 |
| DCLRS 4010-005-200 | | | 20 | | | | 60 | 4 | 16,000 |
| DCLRS 4015-002-120 | 1.5 | R0.02 | 12 | 3 | 1.47 | 16° | 55 | 4 | 16,000 |
| DCLRS 4015-002-200 | | | 20 | | | | 60 | 4 | 16,000 |
| DCLRS 4015-002-300 | | | 30 | | | | 80 | 4 | 17,000 |
| DCLRS 4015-005-120 | | R0.05 | 12 | | | | 55 | 4 | 16,000 |
| DCLRS 4015-005-200 | | | 20 | | | | 60 | 4 | 16,000 |
| DCLRS 4015-005-300 | | | 30 | | | | 80 | 4 | 17,000 |

Next Page ➡

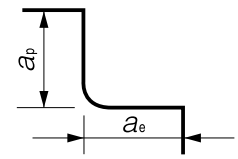
Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| **DCLRS 4020-005-100** | 2 | R0.05 | 10 | 4 | 1.98 | 16° | 50 | 4 | 16,000 |
| **DCLRS 4020-005-200** | | | 20 | | | | 60 | 4 | 16,000 |
| **DCLRS 4020-02-100** | | R0.2 | 10 | | | | 50 | 4 | 16,000 |
| **DCLRS 4020-02-200** | | | 20 | | | | 60 | 4 | 16,000 |
| **DCLRS 4020-02-300** | | | 30 | | | | 80 | 4 | 17,000 |
| **DCLRS 4020-05-100** | | R0.5 | 10 | | | | 50 | 4 | 16,000 |
| **DCLRS 4020-05-200** | | | 20 | | | | 60 | 4 | 16,000 |
| **DCLRS 4020-05-300** | | | 30 | | | | 80 | 4 | 17,000 |
| **DCLRS 4030-005-160** | 3 | R0.05 | 16 | 6 | 2.95 | 16° | 60 | 4 | 18,000 |
| **DCLRS 4030-005-200** | | | 20 | | | | 60 | 4 | 18,000 |
| **DCLRS 4030-005-300** | | | 30 | | | | 80 | 4 | 20,000 |
| **DCLRS 4030-02-160** | | R0.2 | 16 | | | | 60 | 4 | 18,000 |
| **DCLRS 4030-02-200** | | | 20 | | | | 60 | 4 | 18,000 |
| **DCLRS 4030-02-300** | | | 30 | | | | 80 | 4 | 20,000 |
| **DCLRS 4030-05-160** | | R0.5 | 16 | | | | 60 | 4 | 18,000 |
| **DCLRS 4030-05-200** | | | 20 | | | | 60 | 4 | 18,000 |
| **DCLRS 4030-05-300** | | | 30 | | | | 80 | 4 | 20,000 |
| **DCLRS 4040-02-200** | 4 | R0.2 | 20 | 8 | 3.93 | 16° | 60 | 6 | 20,000 |
| **DCLRS 4040-02-300** | | | 30 | | | | 80 | 6 | 20,000 |
| **DCLRS 4040-02-400** | | | 40 | | | | 80 | 6 | 20,000 |
| **DCLRS 4040-05-200** | | R0.5 | 20 | | | | 60 | 6 | 20,000 |
| **DCLRS 4040-05-300** | | | 30 | | | | 80 | 6 | 20,000 |
| **DCLRS 4040-05-400** | | | 40 | | | | 80 | 6 | 20,000 |
| **DCLRS 4060-02-300** | 6 | R0.2 | 30 | 12 | 5.93 | — | 100 | 6 | 23,000 |
| **DCLRS 4060-02-600** | | | 60 | | | | 120 | 6 | 30,000 |
| **DCLRS 4060-05-300** | | R0.5 | 30 | | | | 100 | 6 | 23,000 |
| **DCLRS 4060-05-600** | | | 60 | | | | 120 | 6 | 30,000 |

## Milling Conditions for DCLRS

| WORK MATERIAL | | | | GRAPHITE | | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4010-002-060** | **1** | R0.02 | 6 | 26,000 | 1,700 | 0.12 | 0.7 |
| **4010-002-100** | | | 10 | 22,000 | 1,300 | 0.12 | 0.6 |
| **4010-002-200** | | | 20 | 13,000 | 750 | 0.1 | 0.5 |
| **4010-005-060** | | R0.05 | 6 | 26,000 | 1,700 | 0.12 | 0.6 |
| **4010-005-100** | | | 10 | 22,000 | 1,300 | 0.12 | 0.5 |
| **4010-005-200** | | | 20 | 13,000 | 750 | 0.1 | 0.4 |
| **4015-002-120** | **1.5** | R0.02 | 12 | 19,000 | 1,700 | 0.18 | 1.1 |
| **4015-002-200** | | | 20 | 15,000 | 1,300 | 0.14 | 0.9 |
| **4015-002-300** | | | 30 | 10,000 | 800 | 0.11 | 0.7 |
| **4015-005-120** | | R0.05 | 12 | 19,000 | 1,700 | 0.18 | 0.95 |
| **4015-005-200** | | | 20 | 15,000 | 1,300 | 0.14 | 0.75 |
| **4015-005-300** | | | 30 | 10,000 | 800 | 0.11 | 0.6 |
| **4020-005-100** | **2** | R0.05 | 10 | 20,000 | 2,400 | 0.3 | 1.4 |
| **4020-005-200** | | | 20 | 16,000 | 1,800 | 0.25 | 1.35 |
| **4020-02-100** | | R0.2 | 10 | 20,000 | 2,400 | 0.3 | 1.2 |
| **4020-02-200** | | | 20 | 16,000 | 1,800 | 0.25 | 1.15 |
| **4020-02-300** | | | 30 | 12,000 | 1,300 | 0.2 | 1.1 |
| **4020-05-100** | | R0.5 | 10 | 20,000 | 2,400 | 0.3 | 0.95 |
| **4020-05-200** | | | 20 | 16,000 | 1,800 | 0.25 | 0.9 |
| **4020-05-300** | | | 30 | 12,000 | 1,300 | 0.2 | 0.85 |
| **4030-005-160** | **3** | R0.05 | 16 | 16,500 | 3,100 | 0.4 | 2.3 |
| **4030-005-200** | | | 20 | 16,000 | 2,900 | 0.4 | 2.1 |
| **4030-005-300** | | | 30 | 14,000 | 2,300 | 0.4 | 1.9 |
| **4030-02-160** | | R0.2 | 16 | 16,500 | 3,100 | 0.4 | 2 |
| **4030-02-200** | | | 20 | 16,000 | 2,900 | 0.4 | 1.8 |
| **4030-02-300** | | | 30 | 14,000 | 2,300 | 0.4 | 1.6 |
| **4030-05-160** | | R0.5 | 16 | 16,500 | 3,100 | 0.4 | 1.7 |
| **4030-05-200** | | | 20 | 16,000 | 2,900 | 0.4 | 1.5 |
| **4030-05-300** | | | 30 | 14,000 | 2,300 | 0.4 | 1.4 |
| **4040-02-200** | **4** | R0.2 | 20 | 14,000 | 3,400 | 0.5 | 2.7 |
| **4040-02-300** | | | 30 | 13,000 | 3,000 | 0.5 | 2.6 |
| **4040-02-400** | | | 40 | 12,000 | 2,600 | 0.5 | 2.5 |
| **4040-05-200** | | R0.5 | 20 | 14,000 | 3,400 | 0.5 | 2.3 |
| **4040-05-300** | | | 30 | 13,000 | 3,000 | 0.5 | 2.2 |
| **4040-05-400** | | | 40 | 12,000 | 2,600 | 0.5 | 2.1 |
| **4060-02-300** | **6** | R0.2 | 30 | 13,000 | 4,300 | 0.75 | 4 |
| **4060-02-600** | | | 60 | 10,000 | 2,800 | 0.75 | 3.7 |
| **4060-05-300** | | R0.5 | 30 | 13,000 | 4,300 | 0.75 | 3.5 |
| **4060-05-600** | | | 60 | 10,000 | 2,800 | 0.75 | 3.1 |

Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

**Size φ3～φ12**

# CXLRS

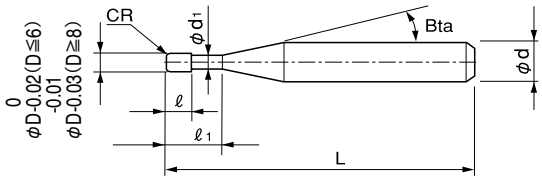
Super MG | UT COAT | 42°~45° | R | R ±0.01 (φ3～φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005 | Variable Pitch | Variable Helix

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ○ | | ◎ | | | ○ | ○ | | |

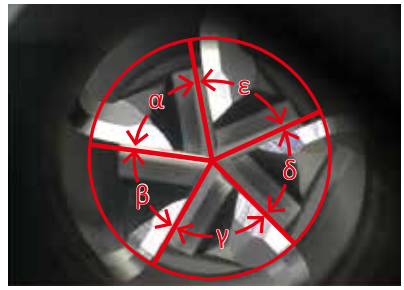
## Features

**Broad application range from Carbon Steels to Hardened Steels (55HRC).**
**Variable pitch, variable helix and positive rake angle design offers highly efficient side milling.**
**Seamless Corner Radius design reduces cutting resistance.**




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

### Variable Pitch




$\alpha \neq \beta \neq \gamma \neq \delta \neq \varepsilon$

### Seamless Corner Radius

### Variable Helix

$\beta_1 \neq \beta_2$

Total 30 models

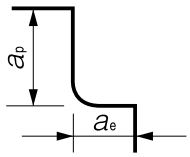
Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| **CXLRS 5030-05-09** | 3 | R0.5 | 9 | 6 | 2.95 | 16° | 50 | 6 | 10,800 |
| **CXLRS 5030-05-12** | | | 12 | | | | 50 | 6 | 10,800 |
| **CXLRS 5040-05-12** | 4 | R0.5 | 12 | 8 | 3.85 | 16° | 60 | 6 | 11,600 |
| **CXLRS 5040-05-16** | | | 16 | | | | 60 | 6 | 11,600 |
| **CXLRS 5040-10-12** | | R1 | 12 | | | | 60 | 6 | 11,600 |
| **CXLRS 5040-10-16** | | | 16 | | | | 60 | 6 | 11,600 |
| **CXLRS 5060-05-18** | 6 | R0.5 | 18 | 12 | 5.85 | — | 70 | 6 | 13,400 |
| **CXLRS 5060-05-24** | | | 24 | | | | 70 | 6 | 13,400 |
| **CXLRS 5060-10-18** | | R1 | 18 | | | | 70 | 6 | 13,400 |
| **CXLRS 5060-10-24** | | | 24 | | | | 70 | 6 | 13,400 |
| **CXLRS 5080-05-24** | 8 | R0.5 | 24 | 16 | 7.8 | — | 70 | 8 | 16,700 |
| **CXLRS 5080-05-32** | | | 32 | | | | 70 | 8 | 16,700 |
| **CXLRS 5080-10-24** | | R1 | 24 | | | | 70 | 8 | 16,700 |
| **CXLRS 5080-10-32** | | | 32 | | | | 70 | 8 | 16,700 |
| **CXLRS 5100-05-30** | 10 | R0.5 | 30 | 20 | 9.8 | — | 80 | 10 | 22,000 |
| **CXLRS 5100-05-40** | | | 40 | | | | 80 | 10 | 22,000 |
| **CXLRS 5100-10-30** | | R1 | 30 | | | | 80 | 10 | 22,000 |
| **CXLRS 5100-10-40** | | | 40 | | | | 80 | 10 | 22,000 |
| **CXLRS 5100-15-30** | | R1.5 | 30 | | | | 80 | 10 | 22,000 |
| **CXLRS 5100-15-40** | | | 40 | | | | 80 | 10 | 22,000 |
| **CXLRS 5100-20-30** | | R2 | 30 | | | | 80 | 10 | 22,000 |
| **CXLRS 5100-20-40** | | | 40 | | | | 80 | 10 | 22,000 |
| **CXLRS 5120-05-36** | 12 | R0.5 | 36 | 24 | 11.8 | — | 80 | 12 | 27,700 |
| **CXLRS 5120-05-48** | | | 48 | | | | 100 | 12 | 27,700 |
| **CXLRS 5120-10-36** | | R1 | 36 | | | | 80 | 12 | 27,700 |
| **CXLRS 5120-10-48** | | | 48 | | | | 100 | 12 | 27,700 |
| **CXLRS 5120-15-36** | | R1.5 | 36 | | | | 80 | 12 | 27,700 |
| **CXLRS 5120-15-48** | | | 48 | | | | 100 | 12 | 27,700 |
| **CXLRS 5120-20-36** | | R2 | 36 | | | | 80 | 12 | 27,700 |
| **CXLRS 5120-20-48** | | | 48 | | | | 100 | 12 | 27,700 |

## Milling Conditions for CXLRS

| WORK MATERIAL | | | CARBON STEELS S45C / S50C Annealed Materials (～225HB) | | | | ALLOY STEELS SK / SCM Annealed Materials (225～325HB) | | | | PREHARDENED STEELS HPM / NAK (30～45HRC) | | | | HARDENED STEELS SKD / SKT / STAVAX (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **5030** | **3** | **9** | 20,000 | 6,000 | 6 | 0.24 | 20,000 | 6,000 | 6 | 0.24 | 20,000 | 6,400 | 6 | 0.09 | 20,000 | 12,000 | 6 | 0.05 |
| | | **12** | 20,000 | 6,000 | 6 | 0.19 | 20,000 | 6,000 | 6 | 0.19 | 20,000 | 6,400 | 6 | 0.07 | 20,000 | 12,000 | 6 | 0.04 |
| **5040** | **4** | **12** | 18,200 | 5,460 | 8 | 0.32 | 18,200 | 5,460 | 8 | 0.32 | 15,900 | 4,770 | 8 | 0.12 | 15,000 | 11,500 | 8 | 0.05 |
| | | **16** | 18,200 | 5,460 | 8 | 0.26 | 18,200 | 5,460 | 8 | 0.26 | 15,900 | 4,770 | 8 | 0.1 | 15,000 | 11,500 | 8 | 0.04 |
| **5060** | **6** | **18** | 12,200 | 5,100 | 12 | 0.48 | 12,200 | 5,100 | 12 | 0.48 | 12,000 | 5,000 | 12 | 0.18 | 10,000 | 7,600 | 12 | 0.1 |
| | | **24** | 12,200 | 5,100 | 12 | 0.38 | 12,200 | 5,100 | 12 | 0.38 | 12,000 | 5,000 | 12 | 0.14 | 10,000 | 7,600 | 12 | 0.08 |
| **5080** | **8** | **24** | 9,100 | 4,550 | 16 | 0.64 | 9,100 | 4,550 | 16 | 0.64 | 9,000 | 4,500 | 16 | 0.32 | 7,600 | 5,600 | 16 | 0.15 |
| | | **32** | 9,100 | 4,550 | 16 | 0.51 | 9,100 | 4,550 | 16 | 0.51 | 9,000 | 4,500 | 16 | 0.26 | 7,600 | 5,600 | 16 | 0.12 |
| **5100** | **10** | **30** | 7,300 | 3,650 | 20 | 0.8 | 7,300 | 3,650 | 20 | 0.8 | 7,300 | 3,650 | 20 | 0.4 | 6,000 | 4,500 | 20 | 0.22 |
| | | **40** | 7,300 | 3,650 | 20 | 0.64 | 7,300 | 3,650 | 20 | 0.64 | 7,300 | 3,650 | 20 | 0.32 | 6,000 | 4,500 | 20 | 0.176 |
| **5120** | **12** | **36** | 6,100 | 3,050 | 24 | 0.96 | 6,100 | 3,050 | 24 | 0.96 | 6,100 | 3,050 | 24 | 0.48 | 5,000 | 3,800 | 24 | 0.25 |
| | | **48** | 6,100 | 3,050 | 24 | 0.77 | 6,100 | 3,050 | 24 | 0.77 | 6,100 | 3,050 | 24 | 0.38 | 5,000 | 3,800 | 24 | 0.2 |

Note:
- Please be sure to use water soluble coolant.
- These milling parameters are for reference only. For best result, fine parameter adjustments may be required, depending on the milling shape / application / machine and so on.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- WARNING: Because of high material removal rate, you must pay attention to your chip and coolant management.




Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## Milling Example：CXLRS $\phi$6 × CR0.5 × Effective Length 24 Roughing RAMAX（32HRC）

Size：500 x 500 mm
Coolant：Air Blow
Milling Method：Vortex（Trochoid）

Spindle Speed：14,000 $min^{-1}$
Feed Rate：7,000 mm/min
Axial Depth $a_p$：12 mm
Radial Depth $a_e$：0.5 mm

CXLRS
Roughing Video

**Size φ6～φ12**

# HHRS

Super MG | HARD MAX | 45° | R | R ±0.01 (φ6) | R ±0.015 (φ8～φ12) | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ○ | | | ○ | ○ | | |

## Features

**Long Neck Radius design for milling on Hard Materials.**
**High rigid 6 Flute Radius End Mills.**

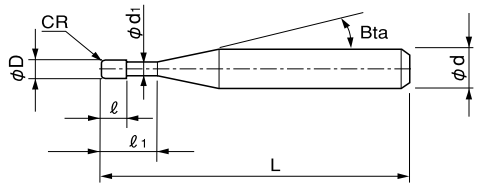


Photo of the tip

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

Total 14 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| HHRS 6060-01-210 | 6 | R0.1 | 21 | 6 | 5.95 | — | 60 | 6 | 16,800 |
| HHRS 6060-02-210 | | R0.2 | | | | | 60 | 6 | 16,800 |
| HHRS 6060-03-210 | | R0.3 | | | | | 60 | 6 | 16,800 |
| HHRS 6060-05-210 | | R0.5 | | | | | 60 | 6 | 16,800 |
| HHRS 6060-10-210 | | R1 | | | | | 60 | 6 | 16,800 |
| HHRS 6080-03-260 | 8 | R0.3 | 26 | 8 | 7.81 | — | 80 | 8 | 21,780 |
| HHRS 6080-05-260 | | R0.5 | | | | | 80 | 8 | 21,780 |
| HHRS 6080-10-260 | | R1 | | | | | 80 | 8 | 21,780 |
| HHRS 6100-03-310 | 10 | R0.3 | 31 | 10 | 9.81 | — | 80 | 10 | 22,990 |
| HHRS 6100-05-310 | | R0.5 | | | | | 80 | 10 | 22,990 |
| HHRS 6100-10-310 | | R1 | | | | | 80 | 10 | 22,990 |
| HHRS 6120-03-370 | 12 | R0.3 | 37 | 12 | 11.81 | — | 100 | 12 | 32,670 |
| HHRS 6120-05-370 | | R0.5 | | | | | 100 | 12 | 32,670 |
| HHRS 6120-10-370 | | R1 | | | | | 100 | 12 | 32,670 |

## Milling Conditions for HHRS

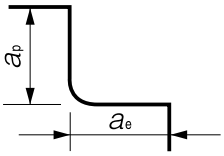
Side Milling

| WORK MATERIAL | | CARBON STEELS S45C / S50C | | ALLOY STEELS SK / SCM / SUS | | PREHARDENED STEELS HARDENED STEELS (30~45HRC) | | HARDENED STEELS (45~55HRC) | | HARDENED STEELS (55~65HRC) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **6060** | **6** | 6,300 | 2,650 | 6,300 | 2,650 | 6,300 | 2,650 | 4,800 | 2,000 | 3,200 | 1,600 |
| **6080** | **8** | 4,750 | 2,650 | 4,750 | 2,650 | 4,750 | 2,650 | 3,600 | 2,000 | 2,400 | 1,600 |
| **6100** | **10** | 3,800 | 2,650 | 3,800 | 2,650 | 3,800 | 2,650 | 2,850 | 2,000 | 2,000 | 1,600 |
| **6120** | **12** | 3,150 | 2,650 | 3,150 | 2,650 | 3,150 | 2,650 | 2,400 | 2,000 | 1,600 | 1,600 |
| Milling Amount (mm) | | $a_p$:1D $a_e$:0.04D | | $a_p$:1D $a_e$:0.04D | | $a_p$:1D $a_e$:0.04D | | $a_p$:0.8D $a_e$:0.02D | | $a_p$:0.5D $a_e$:0.01D | |

Bottom Surface Milling

| WORK MATERIAL | | CARBON STEELS S45C / S50C | | ALLOY STEELS SK / SCM / SUS | | PREHARDENED STEELS HARDENED STEELS (30~45HRC) | | HARDENED STEELS (45~55HRC) | | HARDENED STEELS (55~65HRC) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **6060** | **6** | 6,300 | 2,650 | 6,300 | 2,650 | 6,300 | 2,650 | 4,800 | 2,000 | 3,200 | 1,600 |
| **6080** | **8** | 4,750 | 2,650 | 4,750 | 2,650 | 4,750 | 2,650 | 3,600 | 2,000 | 2,400 | 1,600 |
| **6100** | **10** | 3,800 | 2,650 | 3,800 | 2,650 | 3,800 | 2,650 | 2,850 | 2,000 | 2,000 | 1,600 |
| **6120** | **12** | 3,150 | 2,650 | 3,150 | 2,650 | 3,150 | 2,650 | 2,400 | 2,000 | 1,600 | 1,600 |
| Milling Amount (mm) | | $a_p$:0.02D $a_e$:0.2D | | $a_p$:0.02D $a_e$:0.2D | | $a_p$:0.02D $a_e$:0.2D | | $a_p$:0.015D $a_e$:0.2D | | $a_p$:0.01D $a_e$:0.2D | |

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- When milling on a side or bottom surface, set the ap amount taking into consideration the remaining corner area.
- Recommend wet coolant for Stainless Steels.



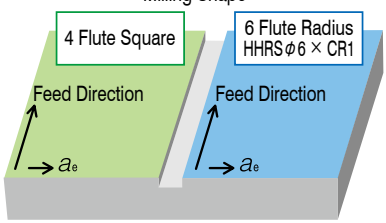

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

## Bottom Surface Milling Comparison between HHRS & 4 Flute Square End Mills NAK80 (40HRC)

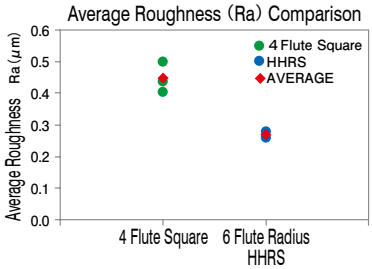
Better bottom surface roughness compared to 4 flute square type.

| Spindle Speed | Feed Rate | Axial Depth $a_p$ | Radial Depth $a_e$ | Overhang Length | Coolant |
|---|---|---|---|---|---|
| 6,300 $min^{-1}$ | 2,650 mm/min | 0.12 mm | 1.2 mm | 22 mm | Air blow (Nozzle) |

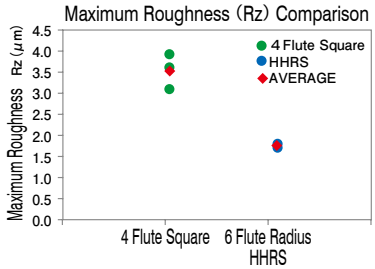
Milling Shape




Average Roughness (Ra) Comparison




Maximum Roughness (Rz) Comparison



## Size φ1～φ6

# HTNRS

Super MG | HARD MAX | 45° | R | R ±0.01 | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

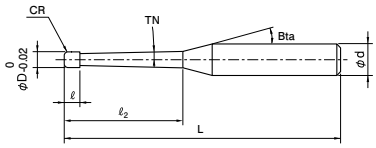
Additional 28 models

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

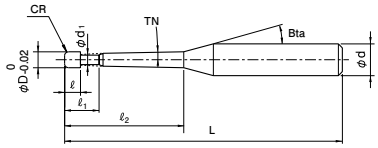
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ◎ | ◎ | ◎ | ○ ～65HRC | ○ | | | | | | | | | |

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

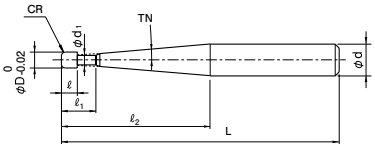
**Shape A**




**Shape B**




**Shape C**




Total 111 models

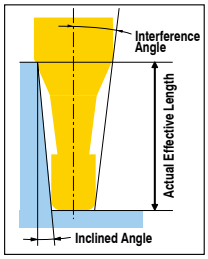
Unit（mm）

| | Model Number | Outside Diameter φD | Corner Radius CR | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | HTNRS 4010-020608 | 1 | R0.2 | 0.4° | 6 | — | 1 | — | 16° | 50 | 4 |
| | HTNRS 4010-021008 | | | | 10 | | | | | 50 | 4 |
| | HTNRS 4010-022008 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 4010-023008 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 4010-020618 | | | 0.9° | 6 | | | | | 50 | 4 |
| | HTNRS 4010-021018 | | | | 10 | | | | | 50 | 4 |
| | HTNRS 4010-021518 | | | | 15 | | | | | 50 | 4 |
| | HTNRS 4010-022018 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 4010-022518 | | | | 25 | | | | | 60 | 4 |
| | HTNRS 4010-023018 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 4010-023518 | | | | 35 | | | | | 80 | 4 |
| | HTNRS 4010-024018 | | | | 40 | | | | | 80 | 4 |
| | HTNRS 4010-025018 | | | | 50 | | | | | 90 | 4 |
| ※ | HTNRS 4010-020628 | | | 1.4° | 6 | 1.8 | | 0.94 | | 50 | 4 |
| ※ | HTNRS 4010-021028 | | | | 10 | | | | | 50 | 4 |
| ※ | HTNRS 4010-022028 | | | | 20 | | | | | 60 | 4 |
| ※ | HTNRS 4010-023028 | | | | 30 | | | | | 70 | 4 |

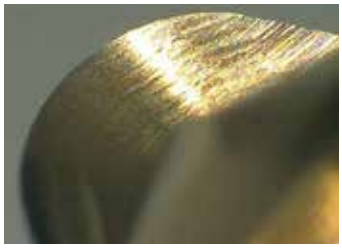
※Additional model

## Features

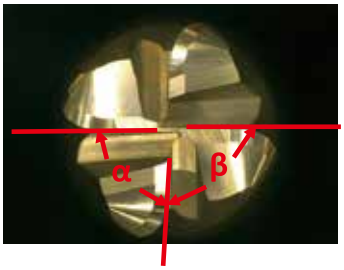
**4 Flute Taper Neck Radius End Mills for milling hard materials.**
**Corner radius design from the edge to the periphery ensures less cutting resistance, and the variable pitch design minimizes chattering and vibration.**
**Can achieve stable milling and excellent surface finish on deep milling.**
**HARDMAX coating offers longer tool life when milling hard materials. Recommended to use with any type of coolant.**




### Feature ①
**Seamless Corner Radius**
**High rigidity! Less cutting resistance!**



### Feature ②
**Variable Pitch design**
**Minimizing vibration and chattering !**




※ **Variable Pitch**：$\alpha \neq \beta$

### Feature ③
**A wide choice of Taper Neck Angles available**
**More efficient with 1.4° · 1.9° · 2.9° !**

Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Neck Taper Angle TN | Neck Length ℓ2 | Shape | Price ¥ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 30' | 1° | 1°30' | 2° | 3° |
| HTNRS 4010-020608 | 1 | R0.2 | 0.4° | 6 | A | 10,000 | 7.37° | 6.56 | 6.92 | 7.20 | 7.45 | 8.00 |
| HTNRS 4010-021008 | | | | 10 | | 10,000 | 5.54° | 10.61 | 11.12 | 11.50 | 11.89 | 12.77 |
| HTNRS 4010-022008 | | | | 20 | | 10,000 | 3.42° | 20.73 | 21.52 | 22.24 | 23.00 | 24.71 |
| HTNRS 4010-023008 | | | | 30 | | 12,000 | 2.47° | 30.83 | 31.91 | 32.97 | 34.11 | No Interference |
| HTNRS 4010-020618 | | | 0.9° | 6 | | 10,000 | 7.49° | — | 6.61 | 6.96 | 7.23 | 7.76 |
| HTNRS 4010-021018 | | | | 10 | | 10,000 | 5.65° | — | 10.66 | 11.15 | 11.53 | 12.38 |
| HTNRS 4010-021518 | | | | 15 | | 10,000 | 4.33° | — | 15.72 | 16.35 | 16.92 | 18.17 |
| HTNRS 4010-022018 | | | | 20 | | 10,000 | 3.50° | — | 20.77 | 21.56 | 22.30 | 23.95 |
| HTNRS 4010-022518 | | | | 25 | | 10,000 | 2.94° | — | 25.82 | 26.76 | 27.68 | No Interference |
| HTNRS 4010-023018 | | | | 30 | | 12,000 | 2.54° | — | 30.87 | 31.96 | 33.06 | No Interference |
| HTNRS 4010-023518 | | | | 35 | | 14,000 | 2.23° | — | 35.92 | 37.16 | 38.44 | No Interference |
| HTNRS 4010-024018 | | | | 40 | | 14,000 | 1.99° | — | 40.96 | 42.36 | No Interference | No Interference |
| HTNRS 4010-025018 | | | | 50 | | 15,000 | 1.64° | — | 51.02 | 52.74 | No Interference | No Interference |
| HTNRS 4010-020628 | | | 1.4° | 6 | B | 10,000 | 7.61° | — | — | 6.66 | 7.00 | 7.53 |
| HTNRS 4010-021028 | | | | 10 | | 10,000 | 5.77° | — | — | 10.71 | 11.18 | 12.00 |
| HTNRS 4010-022028 | | | | 20 | | 10,000 | 3.59° | — | — | 20.81 | 21.59 | 23.20 |
| HTNRS 4010-023028 | | | | 30 | | 12,000 | 2.61° | — | — | 30.91 | 32.01 | No Interference |

Next Page ➡

Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | HTNRS 40125-020618 | 1.25 | R0.2 | 0.9° | 6 | — | 1.25 | — | 16° | 50 | 4 |
| | HTNRS 40125-021018 | | | | 10 | | | | | 50 | 4 |
| | HTNRS 40125-021518 | | | | 15 | | | | | 50 | 4 |
| | HTNRS 40125-022018 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 40125-023018 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 40125-024018 | | | | 40 | | | | | 80 | 4 |
| | HTNRS 40125-025018 | | | | 50 | | | | | 90 | 4 |
| | HTNRS 4015-030608 | 1.5 | R0.3 | 0.4° | 6 | — | 1.5 | — | 16° | 50 | 4 |
| | HTNRS 4015-031008 | | | | 10 | | | | | 50 | 4 |
| | HTNRS 4015-032008 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 4015-033008 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 4015-030618 | | | 0.9° | 6 | | | | | 50 | 4 |
| | HTNRS 4015-031018 | | | | 10 | | | | | 50 | 4 |
| | HTNRS 4015-031518 | | | | 15 | | | | | 50 | 4 |
| | HTNRS 4015-032018 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 4015-032518 | | | | 25 | | | | | 60 | 4 |
| | HTNRS 4015-033018 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 4015-034018 | | | | 40 | | | | | 80 | 4 |
| | HTNRS 4015-035018 | | | | 50 | | | | | 90 | 4 |
| ※ | HTNRS 4015-030628 | | | 1.4° | 6 | 2.7 | | 1.43 | | 50 | 4 |
| ※ | HTNRS 4015-031028 | | | | 10 | | | | | 50 | 4 |
| ※ | HTNRS 4015-032028 | | | | 20 | | | | | 60 | 4 |
| ※ | HTNRS 4015-033028 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 40175-030618 | 1.75 | R0.3 | 0.9° | 6 | — | 1.75 | — | 16° | 50 | 4 |
| | HTNRS 40175-031018 | | | | 10 | | | | | 50 | 4 |
| | HTNRS 40175-031518 | | | | 15 | | | | | 60 | 4 |
| | HTNRS 40175-032018 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 40175-033018 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 40175-034018 | | | | 40 | | | | | 80 | 4 |
| | HTNRS 40175-035018 | | | | 50 | | | | | 90 | 4 |
| | HTNRS 4020-052008 | 2 | R0.5 | 0.4° | 20 | — | 2 | — | 16° | 60 | 4 |
| | HTNRS 4020-052608 | | | | 26 | | | | | 60 | 4 |
| | HTNRS 4020-053008 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 4020-053608 | | | | 36 | | | | | 80 | 4 |
| | HTNRS 4020-054008 | | | | 40 | | | | | 80 | 4 |
| | HTNRS 4020-051018 | | | 0.9° | 10 | | | | | 60 | 4 |
| | HTNRS 4020-051518 | | | | 15 | | | | | 60 | 4 |
| | HTNRS 4020-052018 | | | | 20 | | | | | 60 | 4 |
| | HTNRS 4020-052518 | | | | 25 | | | | | 60 | 4 |
| | HTNRS 4020-053018 | | | | 30 | | | | | 70 | 4 |
| | HTNRS 4020-053518 | | | | 35 | | | | | 80 | 4 |
| | HTNRS 4020-054018 | | | | 40 | | | | | 80 | 4 |
| | HTNRS 4020-054518 | | | | 45 | | | | | 90 | 4 |
| | HTNRS 4020-055018 | | | | 50 | | | | | 90 | 4 |
| ※ | HTNRS 4020-053028 | | | 1.4° | 30 | 3.6 | | 1.9 | | 70 | 4 |
| ※ | HTNRS 4020-054028 | | | | 40 | | | | | 80 | 4 |
| ※ | HTNRS 4020-053038 | | | 1.9° | 30 | | | | | 70 | 6 |
| ※ | HTNRS 4020-054038 | | | | 40 | | | | | 80 | 6 |
| ※ | HTNRS 4020-053058 | | | 2.9° | 30 | | | | | 70 | 6 |
| ※ | HTNRS 4020-054258 | | | | 42 | | | | — | 90 | 6 |

※Additional model

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Neck Taper Angle TN | Neck Length ℓ2 | Shape | Price ¥ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 30' | 1° | 1°30' | 2° | 3° |
| **HTNRS 40125-020618** | 1.25 | R0.2 | 0.9° | 6 | A | 10,000 | 7.14° | — | 6.63 | 6.97 | 7.24 | 7.77 |
| **HTNRS 40125-021018** | | | | 10 | | 10,000 | 5.34° | — | 10.68 | 11.16 | 11.55 | 12.40 |
| **HTNRS 40125-021518** | | | | 15 | | 10,000 | 4.05° | — | 15.74 | 16.37 | 16.93 | 18.18 |
| **HTNRS 40125-022018** | | | | 20 | | 10,000 | 3.27° | — | 20.79 | 21.57 | 22.31 | 23.96 |
| **HTNRS 40125-023018** | | | | 30 | | 12,000 | 2.36° | — | 30.89 | 31.97 | 33.07 | No Interference |
| **HTNRS 40125-024018** | | | | 40 | | 14,000 | 1.84° | — | 40.97 | 42.37 | No Interference | No Interference |
| **HTNRS 40125-025018** | | | | 50 | | 15,000 | 1.51° | — | 51.03 | 52.75 | No Interference | No Interference |
| **HTNRS 4015-030608** | 1.5 | R0.3 | 0.4° | 6 | A | 10,000 | 6.69° | 6.62 | 6.96 | 7.23 | 7.47 | 8.01 |
| **HTNRS 4015-031008** | | | | 10 | | 10,000 | 4.92° | 10.66 | 11.15 | 11.52 | 11.91 | 12.79 |
| **HTNRS 4015-032008** | | | | 20 | | 10,000 | 2.96° | 20.78 | 21.55 | 22.26 | 23.03 | No Interference |
| **HTNRS 4015-033008** | | | | 30 | | 12,000 | 2.12° | 30.87 | 31.94 | 33.00 | 34.13 | No Interference |
| **HTNRS 4015-030618** | | | 0.9° | 6 | | 10,000 | 6.80° | — | 6.69 | 7.01 | 7.27 | 7.79 |
| **HTNRS 4015-031018** | | | | 10 | | 10,000 | 5.03° | — | 10.73 | 11.19 | 11.57 | 12.42 |
| **HTNRS 4015-031518** | | | | 15 | | 10,000 | 3.79° | — | 15.79 | 16.39 | 16.95 | 18.20 |
| **HTNRS 4015-032018** | | | | 20 | | 10,000 | 3.04° | — | 20.84 | 21.60 | 22.34 | 23.99 |
| **HTNRS 4015-032518** | | | | 25 | | 10,000 | 2.54° | — | 25.88 | 26.80 | 27.72 | No Interference |
| **HTNRS 4015-033018** | | | | 30 | | 12,000 | 2.18° | — | 30.93 | 32.00 | 33.10 | No Interference |
| **HTNRS 4015-034018** | | | | 40 | | 14,000 | 1.70° | — | 41.01 | 42.40 | No Interference | No Interference |
| **HTNRS 4015-035018** | | | | 50 | | 15,000 | 1.39° | — | 51.07 | No Interference | No Interference | No Interference |
| **HTNRS 4015-030628** | | | 1.4° | 6 | B | 10,000 | 6.92° | — | — | 6.76 | 7.06 | 7.58 |
| **HTNRS 4015-031028** | | | | 10 | | 10,000 | 5.13° | — | — | 10.80 | 11.23 | 12.05 |
| **HTNRS 4015-032028** | | | | 20 | | 10,000 | 3.12° | — | — | 20.89 | 21.65 | 23.25 |
| **HTNRS 4015-033028** | | | | 30 | | 12,000 | 2.24° | — | — | 30.98 | 32.07 | No Interference |
| **HTNRS 40175-030618** | 1.75 | R0.3 | 0.9° | 6 | A | 10,000 | 6.37° | — | 6.75 | 7.06 | 7.31 | 7.84 |
| **HTNRS 40175-031018** | | | | 10 | | 10,000 | 4.66° | — | 10.79 | 11.23 | 11.61 | 12.46 |
| **HTNRS 40175-031518** | | | | 15 | | 10,000 | 3.49° | — | 15.84 | 16.43 | 16.99 | 18.24 |
| **HTNRS 40175-032018** | | | | 20 | | 10,000 | 2.78° | — | 20.89 | 21.63 | 22.38 | No Interference |
| **HTNRS 40175-033018** | | | | 30 | | 12,000 | 1.99° | — | 30.98 | 32.04 | No Interference | No Interference |
| **HTNRS 40175-034018** | | | | 40 | | 14,000 | 1.54° | — | 41.06 | 42.44 | No Interference | No Interference |
| **HTNRS 40175-035018** | | | | 50 | | 15,000 | 1.26° | — | 51.11 | No Interference | No Interference | No Interference |
| **HTNRS 4020-052008** | 2 | R0.5 | 0.4° | 20 | A | 11,000 | 2.48° | 20.86 | 21.60 | 22.30 | 23.06 | No Interference |
| **HTNRS 4020-052608** | | | | 26 | | 11,000 | 1.98° | 26.92 | 27.83 | 28.75 | No Interference | No Interference |
| **HTNRS 4020-053008** | | | | 30 | | 11,000 | 1.75° | 30.95 | 31.98 | 33.04 | No Interference | No Interference |
| **HTNRS 4020-053608** | | | | 36 | | 14,000 | 1.49° | 37.00 | 38.22 | No Interference | No Interference | No Interference |
| **HTNRS 4020-054008** | | | | 40 | | 14,000 | 1.35° | 41.03 | 42.37 | No Interference | No Interference | No Interference |
| **HTNRS 4020-051018** | | | 0.9° | 10 | | 11,000 | 4.33° | — | 10.84 | 11.25 | 11.63 | 12.46 |
| **HTNRS 4020-051518** | | | | 15 | | 11,000 | 3.21° | — | 15.88 | 16.45 | 17.01 | 18.25 |
| **HTNRS 4020-052018** | | | | 20 | | 11,000 | 2.54° | — | 20.93 | 21.66 | 22.39 | No Interference |
| **HTNRS 4020-052518** | | | | 25 | | 11,000 | 2.11° | — | 25.97 | 26.86 | 27.77 | No Interference |
| **HTNRS 4020-053018** | | | | 30 | | 11,000 | 1.80° | — | 31.01 | 32.06 | No Interference | No Interference |
| **HTNRS 4020-053518** | | | | 35 | | 14,000 | 1.57° | — | 36.05 | 37.26 | No Interference | No Interference |
| **HTNRS 4020-054018** | | | | 40 | | 14,000 | 1.39° | — | 41.09 | No Interference | No Interference | No Interference |
| **HTNRS 4020-054518** | | | | 45 | | 15,000 | 1.25° | — | 46.10 | No Interference | No Interference | No Interference |
| **HTNRS 4020-055018** | | | | 50 | | 15,000 | 1.14° | — | 51.14 | No Interference | No Interference | No Interference |
| **HTNRS 4020-053028** | | | 1.4° | 30 | B | 11,000 | 1.85° | — | — | 31.07 | No Interference | No Interference |
| **HTNRS 4020-054028** | | | | 40 | | 14,000 | 1.43° | — | — | No Interference | No Interference | No Interference |
| **HTNRS 4020-053038** | | | 1.9° | 30 | | 12,000 | 3.39° | — | — | — | 31.12 | 33.41 |
| **HTNRS 4020-054038** | | | | 40 | | 15,000 | 2.69° | — | — | — | 41.19 | No Interference |
| **HTNRS 4020-053058** | | | 2.9° | 30 | | 12,000 | 3.58° | — | — | — | — | 31.23 |
| **HTNRS 4020-054258** | | | | 42 | C | 16,500 | 2.74° | — | — | — | — | No Interference |

Next Page ➡

Unit (mm)

| | Model Number | Outside Diameter φD | Corner Radius CR | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | HTNRS 4030-082008 | 3 | R0.8 | 0.4° | 20 | — | 3 | — | 16° | 60 | 6 |
| | HTNRS 4030-082608 | | | | 26 | | | | | 60 | 6 |
| | HTNRS 4030-083008 | | | | 30 | | | | | 70 | 6 |
| | HTNRS 4030-083608 | | | | 36 | | | | | 80 | 6 |
| | HTNRS 4030-084008 | | | | 40 | | | | | 80 | 6 |
| | HTNRS 4030-082018 | | | 0.9° | 20 | | | | | 60 | 6 |
| | HTNRS 4030-082518 | | | | 25 | | | | | 60 | 6 |
| | HTNRS 4030-083018 | | | | 30 | | | | | 70 | 6 |
| | HTNRS 4030-083518 | | | | 35 | | | | | 80 | 6 |
| | HTNRS 4030-084018 | | | | 40 | | | | | 80 | 6 |
| | HTNRS 4030-085018 | | | | 50 | | | | | 90 | 6 |
| | HTNRS 4030-086018 | | | | 60 | | | | | 100 | 6 |
| ※ | HTNRS 4030-083028 | | | 1.4° | 30 | 4.5 | | 2.89 | | 70 | 6 |
| ※ | HTNRS 4030-084028 | | | | 40 | | | | | 80 | 6 |
| ※ | HTNRS 4030-083038 | | | 1.9° | 30 | | | | | 70 | 6 |
| ※ | HTNRS 4030-084038 | | | | 40 | | | | | 80 | 6 |
| ※ | HTNRS 4030-083358 | | | 2.9° | 33 | | | | — | 80 | 6 |
| | HTNRS 4040-102508 | 4 | R1 | 0.4° | 25 | — | 4 | — | 16° | 60 | 6 |
| | HTNRS 4040-103008 | | | | 30 | | | | | 70 | 6 |
| | HTNRS 4040-103508 | | | | 35 | | | | | 80 | 6 |
| | HTNRS 4040-104008 | | | | 40 | | | | | 80 | 6 |
| | HTNRS 4040-104508 | | | | 45 | | | | | 90 | 6 |
| | HTNRS 4040-105008 | | | | 50 | | | | | 90 | 6 |
| | HTNRS 4040-102018 | | | 0.9° | 20 | | | | | 60 | 6 |
| | HTNRS 4040-102518 | | | | 25 | | | | | 60 | 6 |
| | HTNRS 4040-103018 | | | | 30 | | | | | 70 | 6 |
| | HTNRS 4040-103518 | | | | 35 | | | | | 80 | 6 |
| | HTNRS 4040-104018 | | | | 40 | | | | | 80 | 6 |
| | HTNRS 4040-105018 | | | | 50 | | | | | 90 | 6 |
| | HTNRS 4040-106018 | | | | 60 | | | | | 100 | 6 |
| ※ | HTNRS 4040-104928 | | | 1.4° | 49 | 6 | | 3.8 | — | 90 | 6 |
| ※ | HTNRS 4040-106028 | | | | 60 | | | | 16° | 100 | 8 |
| ※ | HTNRS 4040-103038 | | | 1.9° | 30 | | | | | 70 | 8 |
| ※ | HTNRS 4040-106738 | | | | 67 | | | | — | 120 | 8 |
| ※ | HTNRS 4040-104558 | | | 2.9° | 45 | | | | | 90 | 8 |
| | HTNRS 4060-152018 | 6 | R1.5 | 0.9° | 20 | — | 6 | — | 16° | 60 | 8 |
| | HTNRS 4060-153018 | | | | 30 | | | | | 70 | 8 |
| | HTNRS 4060-154018 | | | | 40 | | | | | 80 | 8 |
| | HTNRS 4060-155018 | | | | 50 | | | | | 90 | 8 |
| | HTNRS 4060-156018 | | | | 60 | | | | | 100 | 8 |
| ※ | HTNRS 4060-155128 | | | 1.4° | 51 | 9 | | 5.8 | — | 90 | 8 |
| ※ | HTNRS 4060-153938 | | | 1.9° | 39 | | | | | 80 | 8 |
| ※ | HTNRS 4060-156938 | | | | 69 | | | | | 110 | 10 |
| ※ | HTNRS 4060-154758 | | | 2.9° | 47 | | | | | 90 | 10 |

※Additional model

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Neck Taper Angle TN | Neck Length ℓ2 | Shape | Price ¥ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 30' | 1° | 1°30' | 2° | 3° |
| HTNRS 4030-082008 | 3 | R0.8 | 0.4° | 20 | A | 12,000 | 3.48° | 20.88 | 21.60 | 22.30 | 23.05 | 24.72 |
| HTNRS 4030-082608 | | | | 26 | | 12,000 | 2.82° | 26.94 | 27.84 | 28.74 | 29.72 | No Interference |
| HTNRS 4030-083008 | | | | 30 | | 12,000 | 2.51° | 30.97 | 31.99 | 33.04 | 34.16 | No Interference |
| HTNRS 4030-083608 | | | | 36 | | 14,000 | 2.14° | 37.02 | 38.22 | 39.48 | 40.82 | No Interference |
| HTNRS 4030-084008 | | | | 40 | | 14,000 | 1.96° | 41.05 | 42.38 | 43.78 | No Interference | No Interference |
| HTNRS 4030-082018 | | | 0.9° | 20 | | 12,000 | 3.56° | — | 20.98 | 21.69 | 22.41 | 24.03 |
| HTNRS 4030-082518 | | | | 25 | | 12,000 | 2.99° | — | 26.02 | 26.89 | 27.79 | No Interference |
| HTNRS 4030-083018 | | | | 30 | | 12,000 | 2.57° | — | 31.06 | 32.09 | 33.18 | No Interference |
| HTNRS 4030-083518 | | | | 35 | | 14,000 | 2.25° | — | 36.10 | 37.29 | 38.56 | No Interference |
| HTNRS 4030-084018 | | | | 40 | | 14,000 | 2.01° | — | 41.13 | 42.49 | 43.94 | No Interference |
| HTNRS 4030-085018 | | | | 50 | | 15,000 | 1.65° | — | 51.18 | 52.87 | No Interference | No Interference |
| HTNRS 4030-086018 | | | | 60 | | 16,000 | 1.40° | — | 61.25 | No Interference | No Interference | No Interference |
| HTNRS 4030-083028 | | | 1.4° | 30 | B | 12,000 | 2.64° | — | — | 31.14 | 32.19 | No Interference |
| HTNRS 4030-084028 | | | | 40 | | 14,000 | 2.06° | — | — | 41.21 | 42.61 | No Interference |
| HTNRS 4030-083038 | | | 1.9° | 30 | | 12,000 | 2.71° | — | — | — | 31.21 | No Interference |
| HTNRS 4030-084038 | | | | 40 | | 14,000 | 2.12° | — | — | — | 41.28 | No Interference |
| HTNRS 4030-083358 | | | 2.9° | 33 | C | 16,500 | 2.64° | — | — | — | — | No Interference |
| HTNRS 4040-102508 | 4 | R1 | 0.4° | 25 | A | 12,000 | 2.12° | 25.49 | 26.28 | 27.13 | 28.04 | No Interference |
| HTNRS 4040-103008 | | | | 30 | | 12,000 | 1.80° | 30.52 | 31.48 | 32.50 | No Interference | No Interference |
| HTNRS 4040-103508 | | | | 35 | | 14,000 | 1.57° | 35.55 | 36.67 | 37.87 | No Interference | No Interference |
| HTNRS 4040-104008 | | | | 40 | | 14,000 | 1.39° | 40.58 | 41.87 | No Interference | No Interference | No Interference |
| HTNRS 4040-104508 | | | | 45 | | 15,000 | 1.24° | 45.61 | 47.06 | No Interference | No Interference | No Interference |
| HTNRS 4040-105008 | | | | 50 | | 15,000 | 1.13° | 50.63 | 52.24 | No Interference | No Interference | No Interference |
| HTNRS 4040-102018 | | | 0.9° | 20 | | 12,000 | 2.64° | — | 20.57 | 21.23 | 21.93 | No Interference |
| HTNRS 4040-102518 | | | | 25 | | 12,000 | 2.18° | — | 25.60 | 26.43 | 27.32 | No Interference |
| HTNRS 4040-103018 | | | | 30 | | 12,000 | 1.85° | — | 30.64 | 31.63 | No Interference | No Interference |
| HTNRS 4040-103518 | | | | 35 | | 14,000 | 1.61° | — | 35.67 | 36.83 | No Interference | No Interference |
| HTNRS 4040-104018 | | | | 40 | | 14,000 | 1.42° | — | 40.70 | No Interference | No Interference | No Interference |
| HTNRS 4040-105018 | | | | 50 | | 15,000 | 1.16° | — | 50.75 | No Interference | No Interference | No Interference |
| HTNRS 4040-106018 | | | | 60 | | 16,000 | 0.98° | — | No Interference | No Interference | No Interference | No Interference |
| HTNRS 4040-104928 | | | 1.4° | 49 | C | 15,000 | 1.21° | — | — | No Interference | No Interference | No Interference |
| HTNRS 4040-106028 | | | | 60 | B | 17,000 | 1.88° | — | — | 60.94 | No Interference | No Interference |
| HTNRS 4040-103038 | | | 1.9° | 30 | | 16,000 | 3.46° | — | — | — | 30.89 | 33.13 |
| HTNRS 4040-106738 | | | | 67 | C | 23,000 | 1.75° | — | — | — | No Interference | No Interference |
| HTNRS 4040-104558 | | | 2.9° | 45 | | 18,000 | 2.62° | — | — | — | — | No Interference |
| HTNRS 4060-152018 | 6 | R1.5 | 0.9° | 20 | A | 17,000 | 2.69° | — | 20.63 | 21.28 | 21.97 | No Interference |
| HTNRS 4060-153018 | | | | 30 | | 17,000 | 1.88° | — | 30.70 | 31.68 | No Interference | No Interference |
| HTNRS 4060-154018 | | | | 40 | | 17,000 | 1.44° | — | 40.76 | No Interference | No Interference | No Interference |
| HTNRS 4060-155018 | | | | 50 | | 17,000 | 1.17° | — | 50.83 | No Interference | No Interference | No Interference |
| HTNRS 4060-156018 | | | | 60 | | 18,000 | 0.98° | — | No Interference | No Interference | No Interference | No Interference |
| HTNRS 4060-155128 | | | 1.4° | 51 | C | 17,000 | 1.18° | — | — | No Interference | No Interference | No Interference |
| HTNRS 4060-153938 | | | 1.9° | 39 | | 17,000 | 1.55° | — | — | — | No Interference | No Interference |
| HTNRS 4060-156938 | | | | 69 | | 23,500 | 1.71° | — | — | — | No Interference | No Interference |
| HTNRS 4060-154758 | | | 2.9° | 47 | | 23,000 | 2.53° | — | — | — | — | No Interference |

## Milling Conditions for HTNRS

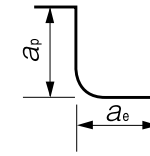
| WORK MATERIAL | | | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC) | | | | HARDENED STEELS SKD / SKT (45~55HRC) | | | | HARDENED STEELS SKD / SKH (55~65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Neck Taper Angle TN | Neck Length (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) |
| **4010-020608** | | | | 6 | 20,000 | 2,600 | 0.06 | 0.44 | 11,600 | 980 | 0.029 | 0.23 | 8,900 | 530 | 0.012 | 0.09 |
| **4010-021008** | | | 0.4° | 10 | 19,000 | 2,450 | 0.03 | 0.42 | 11,000 | 920 | 0.015 | 0.21 | 8,500 | 480 | 0.008 | 0.07 |
| **4010-022008** | | | | 20 | 17,000 | 2,150 | 0.008 | 0.37 | 9,700 | 800 | 0.005 | 0.18 | 7,600 | 400 | 0.004 | 0.05 |
| **4010-023008** | | | | 30 | 12,000 | 1,500 | 0.003 | 0.26 | 7,200 | 570 | 0.002 | 0.12 | 6,000 | 310 | 0.002 | 0.04 |
| **4010-020618** | | | | 6 | 20,000 | 2,600 | 0.06 | 0.45 | 11,600 | 980 | 0.029 | 0.24 | 8,900 | 530 | 0.012 | 0.1 |
| **4010-021018** | | | | 10 | 19,000 | 2,450 | 0.03 | 0.43 | 11,000 | 920 | 0.015 | 0.22 | 8,500 | 480 | 0.008 | 0.075 |
| **4010-021518** | | | | 15 | 18,500 | 2,400 | 0.02 | 0.41 | 10,700 | 880 | 0.01 | 0.21 | 8,200 | 450 | 0.006 | 0.065 |
| **4010-022018** | | | | 20 | 18,000 | 2,300 | 0.01 | 0.4 | 10,400 | 850 | 0.006 | 0.2 | 8,000 | 430 | 0.005 | 0.05 |
| **4010-022518** | **1** | R0.2 | 0.9° | 25 | 17,000 | 2,150 | 0.008 | 0.38 | 9,900 | 800 | 0.005 | 0.19 | 7,700 | 410 | 0.004 | 0.05 |
| **4010-023018** | | | | 30 | 16,000 | 2,000 | 0.007 | 0.35 | 9,400 | 750 | 0.004 | 0.18 | 7,400 | 390 | 0.004 | 0.05 |
| **4010-023518** | | | | 35 | 15,000 | 1,850 | 0.006 | 0.32 | 8,800 | 700 | 0.004 | 0.16 | 7,000 | 370 | 0.003 | 0.05 |
| **4010-024018** | | | | 40 | 14,000 | 1,750 | 0.005 | 0.3 | 8,300 | 660 | 0.003 | 0.15 | 6,700 | 350 | 0.003 | 0.05 |
| **4010-025018** | | | | 50 | 12,000 | 1,500 | 0.003 | 0.28 | 7,200 | 570 | 0.002 | 0.14 | 6,000 | 310 | 0.002 | 0.05 |
| **4010-020628** | | | | 6 | 20,000 | 2,600 | 0.06 | 0.46 | 11,600 | 980 | 0.029 | 0.25 | 8,900 | 530 | 0.012 | 0.11 |
| **4010-021028** | | | 1.4° | 10 | 20,000 | 2,600 | 0.04 | 0.45 | 11,400 | 960 | 0.02 | 0.24 | 8,750 | 510 | 0.01 | 0.08 |
| **4010-022028** | | | | 20 | 19,000 | 2,400 | 0.02 | 0.4 | 10,900 | 900 | 0.01 | 0.2 | 8,400 | 470 | 0.005 | 0.06 |
| **4010-023028** | | | | 30 | 18,000 | 2,300 | 0.01 | 0.4 | 10,400 | 850 | 0.006 | 0.2 | 8,000 | 430 | 0.005 | 0.05 |
| **40125-020618** | | | | 6 | 16,000 | 2,600 | 0.075 | 0.56 | 9,200 | 990 | 0.036 | 0.3 | 7,100 | 540 | 0.015 | 0.12 |
| **40125-021018** | | | | 10 | 16,000 | 2,600 | 0.057 | 0.55 | 9,200 | 990 | 0.027 | 0.29 | 7,100 | 540 | 0.012 | 0.1 |
| **40125-021518** | | | | 15 | 15,500 | 2,500 | 0.04 | 0.53 | 8,900 | 950 | 0.019 | 0.27 | 6,900 | 500 | 0.01 | 0.08 |
| **40125-022018** | **1.25** | R0.2 | 0.9° | 20 | 15,000 | 2,400 | 0.022 | 0.51 | 8,700 | 900 | 0.011 | 0.26 | 6,700 | 470 | 0.007 | 0.07 |
| **40125-023018** | | | | 30 | 14,400 | 2,300 | 0.011 | 0.47 | 8,300 | 860 | 0.006 | 0.23 | 6,400 | 440 | 0.005 | 0.06 |
| **40125-024018** | | | | 40 | 12,800 | 2,000 | 0.008 | 0.42 | 7,500 | 750 | 0.004 | 0.21 | 5,900 | 390 | 0.004 | 0.06 |
| **40125-025018** | | | | 50 | 11,000 | 1,700 | 0.006 | 0.37 | 6,500 | 650 | 0.003 | 0.19 | 5,300 | 350 | 0.003 | 0.06 |
| **4015-030608** | | | | 6 | 13,500 | 2,600 | 0.09 | 0.67 | 7,800 | 990 | 0.043 | 0.36 | 6,000 | 540 | 0.018 | 0.15 |
| **4015-031008** | | | 0.4° | 10 | 13,500 | 2,600 | 0.083 | 0.66 | 7,700 | 980 | 0.04 | 0.35 | 6,000 | 540 | 0.017 | 0.13 |
| **4015-032008** | | | | 20 | 12,500 | 2,400 | 0.028 | 0.61 | 7,000 | 880 | 0.015 | 0.31 | 5,500 | 460 | 0.009 | 0.09 |
| **4015-033008** | | | | 30 | 12,000 | 2,300 | 0.012 | 0.55 | 6,900 | 860 | 0.007 | 0.27 | 5,350 | 440 | 0.006 | 0.07 |
| **4015-030618** | | | | 6 | 13,500 | 2,600 | 0.09 | 0.67 | 7,800 | 990 | 0.043 | 0.36 | 6,000 | 540 | 0.018 | 0.15 |
| **4015-031018** | | | | 10 | 13,500 | 2,600 | 0.083 | 0.67 | 7,800 | 990 | 0.04 | 0.36 | 6,000 | 540 | 0.017 | 0.14 |
| **4015-031518** | | | | 15 | 13,000 | 2,500 | 0.055 | 0.65 | 7,500 | 950 | 0.029 | 0.34 | 5,800 | 500 | 0.013 | 0.12 |
| **4015-032018** | | | | 20 | 12,500 | 2,400 | 0.035 | 0.63 | 7,200 | 900 | 0.018 | 0.32 | 5,600 | 470 | 0.01 | 0.1 |
| **4015-032518** | **1.5** | R0.3 | 0.9° | 25 | 12,500 | 2,400 | 0.025 | 0.61 | 7,000 | 880 | 0.013 | 0.31 | 5,500 | 460 | 0.009 | 0.08 |
| **4015-033018** | | | | 30 | 12,000 | 2,300 | 0.015 | 0.6 | 6,900 | 860 | 0.008 | 0.3 | 5,350 | 440 | 0.007 | 0.07 |
| **4015-034018** | | | | 40 | 12,000 | 2,300 | 0.012 | 0.55 | 6,900 | 860 | 0.007 | 0.27 | 5,350 | 440 | 0.006 | 0.07 |
| **4015-035018** | | | | 50 | 10,500 | 2,000 | 0.009 | 0.5 | 6,100 | 740 | 0.005 | 0.25 | 4,850 | 380 | 0.005 | 0.07 |
| **4015-030628** | | | | 6 | 13,500 | 2,600 | 0.09 | 0.67 | 7,800 | 990 | 0.043 | 0.36 | 6,000 | 540 | 0.018 | 0.15 |
| **4015-031028** | | | 1.4° | 10 | 13,500 | 2,600 | 0.085 | 0.67 | 7,800 | 990 | 0.04 | 0.36 | 6,000 | 540 | 0.017 | 0.15 |
| **4015-032028** | | | | 20 | 13,000 | 2,500 | 0.05 | 0.63 | 7,300 | 920 | 0.02 | 0.33 | 5,600 | 480 | 0.011 | 0.11 |
| **4015-033028** | | | | 30 | 12,500 | 2,400 | 0.025 | 0.61 | 7,000 | 880 | 0.013 | 0.31 | 5,500 | 460 | 0.009 | 0.08 |

## Milling Conditions for HTNRS

| WORK MATERIAL | | | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC) | | | | HARDENED STEELS SKD / SKT (45~55HRC) | | | | HARDENED STEELS SKD / SKH (55~65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Neck Taper Angle TN | Neck Length (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) |
| **40175-030618** | **1.75** | R0.3 | 0.9° | 6 | 11,500 | 2,600 | 0.105 | 0.78 | 6,600 | 990 | 0.05 | 0.42 | 5,100 | 540 | 0.021 | 0.17 |
| **40175-031018** | | | | 10 | 11,500 | 2,600 | 0.105 | 0.78 | 6,600 | 990 | 0.05 | 0.42 | 5,100 | 540 | 0.021 | 0.17 |
| **40175-031518** | | | | 15 | 11,500 | 2,600 | 0.07 | 0.76 | 6,500 | 950 | 0.037 | 0.4 | 5,000 | 510 | 0.017 | 0.14 |
| **40175-032018** | | | | 20 | 11,000 | 2,450 | 0.047 | 0.74 | 6,400 | 920 | 0.024 | 0.38 | 4,900 | 480 | 0.013 | 0.12 |
| **40175-033018** | | | | 30 | 11,000 | 2,450 | 0.027 | 0.71 | 6,400 | 920 | 0.014 | 0.36 | 4,900 | 480 | 0.01 | 0.1 |
| **40175-034018** | | | | 40 | 10,000 | 2,200 | 0.016 | 0.67 | 5,800 | 820 | 0.009 | 0.33 | 4,450 | 420 | 0.008 | 0.08 |
| **40175-035018** | | | | 50 | 10,000 | 2,200 | 0.013 | 0.62 | 5,800 | 820 | 0.008 | 0.31 | 4,450 | 420 | 0.007 | 0.08 |
| **4020-052008** | **2** | R0.5 | 0.4° | 20 | 9,500 | 2,450 | 0.06 | 0.85 | 5,500 | 920 | 0.025 | 0.43 | 4,250 | 480 | 0.015 | 0.13 |
| **4020-052608** | | | | 26 | 9,500 | 2,450 | 0.04 | 0.83 | 5,500 | 920 | 0.021 | 0.42 | 4,250 | 480 | 0.013 | 0.12 |
| **4020-053008** | | | | 30 | 9,000 | 2,300 | 0.03 | 0.79 | 5,400 | 880 | 0.016 | 0.41 | 4,100 | 450 | 0.012 | 0.11 |
| **4020-053608** | | | | 36 | 9,000 | 2,300 | 0.02 | 0.75 | 5,200 | 850 | 0.011 | 0.39 | 4,000 | 430 | 0.01 | 0.1 |
| **4020-054008** | | | | 40 | 9,000 | 2,300 | 0.02 | 0.7 | 5,200 | 850 | 0.01 | 0.38 | 4,000 | 430 | 0.009 | 0.1 |
| **4020-051018** | | | 0.9° | 10 | 10,000 | 2,600 | 0.12 | 0.9 | 5,800 | 990 | 0.057 | 0.49 | 4,450 | 540 | 0.024 | 0.2 |
| **4020-051518** | | | | 15 | 10,000 | 2,600 | 0.09 | 0.88 | 5,600 | 950 | 0.044 | 0.47 | 4,350 | 510 | 0.02 | 0.17 |
| **4020-052018** | | | | 20 | 9,500 | 2,450 | 0.06 | 0.86 | 5,500 | 920 | 0.03 | 0.45 | 4,250 | 480 | 0.016 | 0.15 |
| **4020-052518** | | | | 25 | 9,500 | 2,450 | 0.05 | 0.85 | 5,500 | 920 | 0.025 | 0.43 | 4,250 | 480 | 0.015 | 0.13 |
| **4020-053018** | | | | 30 | 9,500 | 2,450 | 0.04 | 0.83 | 5,500 | 920 | 0.021 | 0.42 | 4,250 | 480 | 0.013 | 0.12 |
| **4020-053518** | | | | 35 | 9,000 | 2,300 | 0.03 | 0.81 | 5,300 | 880 | 0.016 | 0.41 | 4,100 | 450 | 0.012 | 0.11 |
| **4020-054018** | | | | 40 | 9,000 | 2,300 | 0.02 | 0.8 | 5,200 | 850 | 0.012 | 0.4 | 4,000 | 430 | 0.01 | 0.1 |
| **4020-054518** | | | | 45 | 9,000 | 2,300 | 0.02 | 0.75 | 5,200 | 850 | 0.011 | 0.39 | 4,000 | 430 | 0.01 | 0.1 |
| **4020-055018** | | | | 50 | 9,000 | 2,300 | 0.017 | 0.75 | 5,200 | 850 | 0.01 | 0.38 | 4,000 | 430 | 0.009 | 0.1 |
| **4020-053028** | | | 1.4° | 30 | 9,500 | 2,450 | 0.05 | 0.85 | 5,500 | 920 | 0.025 | 0.43 | 4,250 | 480 | 0.015 | 0.13 |
| **4020-054028** | | | | 40 | 9,500 | 2,450 | 0.04 | 0.83 | 5,500 | 920 | 0.02 | 0.42 | 4,250 | 480 | 0.013 | 0.12 |
| **4020-053038** | | | 1.9° | 30 | 9,500 | 2,450 | 0.06 | 0.85 | 5,500 | 920 | 0.03 | 0.43 | 4,250 | 480 | 0.017 | 0.14 |
| **4020-054038** | | | | 40 | 9,500 | 2,450 | 0.05 | 0.85 | 5,500 | 920 | 0.025 | 0.43 | 4,250 | 480 | 0.015 | 0.13 |
| **4020-053058** | | | 2.9° | 30 | 9,500 | 2,450 | 0.07 | 0.85 | 5,500 | 920 | 0.035 | 0.45 | 4,250 | 480 | 0.017 | 0.16 |
| **4020-054258** | | | | 42 | 9,500 | 2,450 | 0.06 | 0.85 | 5,500 | 920 | 0.03 | 0.45 | 4,250 | 480 | 0.016 | 0.15 |
| **4030-082008** | **3** | R0.8 | 0.4° | 20 | 6,500 | 2,500 | 0.12 | 1.06 | 3,900 | 960 | 0.05 | 0.58 | 3,200 | 550 | 0.029 | 0.25 |
| **4030-082608** | | | | 26 | 6,300 | 2,400 | 0.08 | 1.04 | 3,800 | 940 | 0.038 | 0.56 | 3,100 | 520 | 0.025 | 0.22 |
| **4030-083008** | | | | 30 | 6,300 | 2,400 | 0.064 | 1.01 | 3,800 | 920 | 0.034 | 0.55 | 3,100 | 510 | 0.022 | 0.21 |
| **4030-083608** | | | | 36 | 6,300 | 2,400 | 0.05 | 1 | 3,800 | 920 | 0.028 | 0.52 | 3,100 | 510 | 0.02 | 0.19 |
| **4030-084008** | | | | 40 | 6,300 | 2,400 | 0.04 | 0.98 | 3,800 | 920 | 0.023 | 0.51 | 3,100 | 510 | 0.018 | 0.17 |
| **4030-082018** | | | 0.9° | 20 | 6,700 | 2,600 | 0.13 | 1.07 | 4,000 | 1,000 | 0.065 | 0.6 | 3,300 | 590 | 0.034 | 0.28 |
| **4030-082518** | | | | 25 | 6,500 | 2,500 | 0.1 | 1.05 | 3,900 | 960 | 0.05 | 0.58 | 3,200 | 550 | 0.029 | 0.25 |
| **4030-083018** | | | | 30 | 6,300 | 2,400 | 0.072 | 1.03 | 3,800 | 920 | 0.038 | 0.56 | 3,100 | 510 | 0.024 | 0.22 |
| **4030-083518** | | | | 35 | 6,300 | 2,400 | 0.064 | 1.01 | 3,800 | 920 | 0.034 | 0.55 | 3,100 | 510 | 0.022 | 0.21 |
| **4030-084018** | | | | 40 | 6,300 | 2,400 | 0.056 | 1 | 3,800 | 920 | 0.03 | 0.54 | 3,100 | 510 | 0.021 | 0.2 |
| **4030-085018** | | | | 50 | 6,300 | 2,400 | 0.04 | 0.98 | 3,800 | 920 | 0.023 | 0.51 | 3,100 | 510 | 0.018 | 0.17 |
| **4030-086018** | | | | 60 | 6,000 | 2,300 | 0.024 | 0.96 | 3,600 | 870 | 0.015 | 0.49 | 2,900 | 470 | 0.015 | 0.15 |
| **4030-083028** | | | 1.4° | 30 | 6,500 | 2,500 | 0.09 | 1.03 | 3,900 | 960 | 0.045 | 0.57 | 3,200 | 550 | 0.03 | 0.24 |
| **4030-084028** | | | | 40 | 6,300 | 2,400 | 0.06 | 1.01 | 3,800 | 920 | 0.035 | 0.55 | 3,100 | 510 | 0.02 | 0.21 |
| **4030-083038** | | | 1.9° | 30 | 6,500 | 2,500 | 0.1 | 1.05 | 3,900 | 960 | 0.05 | 0.58 | 3,200 | 550 | 0.03 | 0.25 |
| **4030-084038** | | | | 40 | 6,300 | 2,400 | 0.07 | 1.03 | 3,800 | 920 | 0.04 | 0.56 | 3,100 | 510 | 0.025 | 0.22 |
| **4030-083358** | | | 2.9° | 33 | 6,700 | 2,500 | 0.12 | 1.07 | 3,900 | 1,000 | 0.06 | 0.6 | 3,200 | 590 | 0.03 | 0.28 |

| WORK MATERIAL | | | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Corner Radius (mm) | Neck Taper Angle TN | Neck Length (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) |
| **4040-102508** | 4 | R1 | 0.4° | 25 | 5,000 | 2,600 | 0.17 | 1.42 | 3,000 | 1,000 | 0.085 | 0.8 | 2,450 | 600 | 0.045 | 0.38 |
| **4040-103008** | | | | 30 | 5,000 | 2,600 | 0.13 | 1.39 | 2,900 | 960 | 0.065 | 0.77 | 2,400 | 540 | 0.038 | 0.34 |
| **4040-103508** | | | | 35 | 4,800 | 2,450 | 0.09 | 1.37 | 2,900 | 920 | 0.048 | 0.75 | 2,350 | 480 | 0.032 | 0.3 |
| **4040-104008** | | | | 40 | 4,800 | 2,450 | 0.08 | 1.35 | 2,900 | 920 | 0.043 | 0.74 | 2,350 | 480 | 0.03 | 0.28 |
| **4040-104508** | | | | 45 | 4,800 | 2,450 | 0.07 | 1.33 | 2,900 | 920 | 0.038 | 0.72 | 2,350 | 480 | 0.028 | 0.26 |
| **4040-105008** | | | | 50 | 4,800 | 2,450 | 0.06 | 1.32 | 2,900 | 920 | 0.034 | 0.7 | 2,350 | 480 | 0.026 | 0.25 |
| **4040-102018** | | | 0.9° | 20 | 5,000 | 2,600 | 0.19 | 1.44 | 3,000 | 1,000 | 0.095 | 0.82 | 2,450 | 600 | 0.048 | 0.4 |
| **4040-102518** | | | | 25 | 5,000 | 2,600 | 0.17 | 1.42 | 3,000 | 1,000 | 0.085 | 0.8 | 2,450 | 600 | 0.045 | 0.38 |
| **4040-103018** | | | | 30 | 5,000 | 2,600 | 0.15 | 1.41 | 3,000 | 1,000 | 0.076 | 0.79 | 2,450 | 600 | 0.042 | 0.36 |
| **4040-103518** | | | | 35 | 4,800 | 2,450 | 0.12 | 1.39 | 2,900 | 960 | 0.062 | 0.77 | 2,400 | 540 | 0.037 | 0.33 |
| **4040-104018** | | | | 40 | 4,800 | 2,450 | 0.09 | 1.37 | 2,900 | 920 | 0.048 | 0.75 | 2,350 | 480 | 0.032 | 0.3 |
| **4040-105018** | | | | 50 | 4,800 | 2,450 | 0.08 | 1.35 | 2,900 | 920 | 0.043 | 0.72 | 2,350 | 480 | 0.029 | 0.27 |
| **4040-106018** | | | | 60 | 4,800 | 2,450 | 0.06 | 1.32 | 2,900 | 920 | 0.034 | 0.7 | 2,350 | 480 | 0.026 | 0.25 |
| **4040-104928** | | | 1.4° | 49 | 4,800 | 2,500 | 0.1 | 1.37 | 2,900 | 960 | 0.05 | 0.74 | 2,350 | 540 | 0.035 | 0.28 |
| **4040-106028** | | | | 60 | 4,800 | 2,500 | 0.08 | 1.35 | 2,900 | 960 | 0.04 | 0.72 | 2,350 | 540 | 0.03 | 0.27 |
| **4040-103038** | | | 1.9° | 30 | 5,000 | 2,600 | 0.15 | 1.42 | 3,000 | 1,000 | 0.08 | 0.8 | 2,450 | 600 | 0.045 | 0.38 |
| **4040-106738** | | | | 67 | 4,800 | 2,500 | 0.12 | 1.4 | 2,900 | 960 | 0.05 | 0.78 | 2,350 | 540 | 0.03 | 0.35 |
| **4040-104558** | | | 2.9° | 45 | 5,000 | 2,600 | 0.15 | 1.41 | 3,000 | 1,000 | 0.08 | 0.79 | 2,450 | 600 | 0.045 | 0.36 |
| **4060-152018** | 6 | R1.5 | 0.9° | 20 | 3,350 | 2,600 | 0.28 | 2.16 | 2,000 | 1,000 | 0.14 | 1.24 | 1,650 | 600 | 0.072 | 0.6 |
| **4060-153018** | | | | 30 | 3,350 | 2,600 | 0.28 | 2.16 | 2,000 | 1,000 | 0.14 | 1.24 | 1,650 | 600 | 0.072 | 0.6 |
| **4060-154018** | | | | 40 | 3,350 | 2,600 | 0.26 | 2.14 | 2,000 | 1,000 | 0.131 | 1.21 | 1,650 | 600 | 0.068 | 0.57 |
| **4060-155018** | | | | 50 | 3,350 | 2,600 | 0.2 | 2.1 | 2,000 | 1,000 | 0.103 | 1.17 | 1,650 | 600 | 0.058 | 0.51 |
| **4060-156018** | | | | 60 | 3,150 | 2,400 | 0.14 | 2.06 | 1,900 | 920 | 0.075 | 1.12 | 1,550 | 510 | 0.048 | 0.45 |
| **4060-155128** | | | 1.4° | 51 | 3,350 | 2,600 | 0.2 | 2.1 | 2,000 | 1,000 | 0.1 | 1.17 | 1,650 | 600 | 0.058 | 0.51 |
| **4060-153938** | | | 1.9° | 39 | 3,350 | 2,600 | 0.26 | 2.14 | 2,000 | 1,000 | 0.13 | 1.21 | 1,650 | 600 | 0.068 | 0.57 |
| **4060-156938** | | | | 69 | 3,150 | 2,400 | 0.14 | 2.06 | 1,900 | 920 | 0.075 | 1.12 | 1,550 | 510 | 0.048 | 0.45 |
| **4060-154758** | | | 2.9° | 47 | 3,350 | 2,600 | 0.26 | 2.14 | 2,000 | 1,000 | 0.13 | 1.21 | 1,650 | 600 | 0.068 | 0.57 |

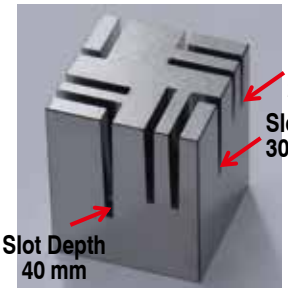
Side Milling
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
・Every coolant offers stable milling.

## Milling Example of Taper Slotting
HTNRS φ2 × CR0.5 × Neck Length 20・30・40

SKD61 (45HRC)




- Work Size : 50 × 50 × 60 mm
- Inclined Angle : 1°
- Slot Length : 27 mm (L Shape Slot)
  21 mm (Straight Slot)
- Slot Width : 2.6 mm (Bottom)
- Slot Depth : 20, 30, 40 mm
- Coolant : Water Soluble

### ① Performance compared with straight neck type…Depth 20 mm L shape slotting

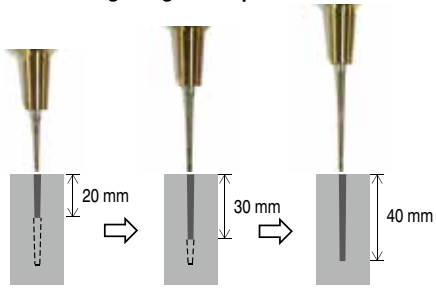
| Milling Process | Tool | Neck Shape Helix Angle | Tool Size (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Cycle Time |
|---|---|---|---|---|---|---|---|
| Roughing | HTNRS 4020-052018 | Taper Neck 0.9° 45° Helix Angle | φ2 × CR0.5 × Neck Length 20 | 9,500 | 2,450 | 0.064 | 20 min 18 sec |
| Roughing | HLRS 4020-05-200 | Straight Neck 30° Helix Angle | φ2 × CR0.5 × Effective Length 20 | 7,000 | 800 | 0.025 | 1 h 30 min 9 sec |

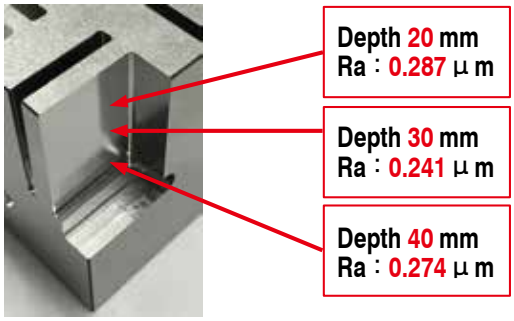
**Taper neck 7 times more efficient in 20 mm depth slotting !**

### ② Depth 40 mm L shape slotting

| Milling Process | Tool | Neck Shape Helix Angle | Tool Size (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Cycle Time |
|---|---|---|---|---|---|---|---|
| Roughing | HTNRS 4020-052018 | Taper Neck 0.9° 45° Helix Angle | φ2 × CR0.5 × Neck Length 20 mm | 9,500 | 2,450 | 0.064 | 27 min 8 sec |
| Roughing | HTNRS 4020-053018 | | φ2 × CR0.5 × Neck Length 30 mm | 9,500 | 2,450 | 0.047 | 15 min 32 sec |
| Roughing | HTNRS 4020-054018 | | φ2 × CR0.5 × Neck Length 40 mm | 9,000 | 2,300 | 0.02 | 40 min 26 sec |
| Finishing | | | | 4,500 | 500 | 0.0001 (Cusp Height) | 4 h 28 min 50 sec |

**Slotting image of depth 40 mm**




**40 mm slot depth roughing process completed in 1h 23 min ! Excellent surface finishing !**

## Size R0.05～R3

# HGB

Super MG | HMG COAT | 30° | R ±0.002 R0.05～R0.075 | R ±0.003 R0.1～R2 | R ±0.005 R2.5～R3 | Shank Dia 0/-0.004

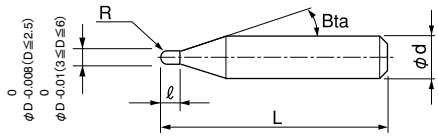
Additional 2 models

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ | | | | | | | | | | |

## Features

**Newly developed "HMGCOAT", carbide grade and tool shape offer higher wear/chipping resistance as compared to conventional tools.**
**Achieves longer tool life and highly precise milling on hard materials.**




High Precision Diameter Tolerance / Radius Accuracy / Shank Diameter Tolerance

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.05 ～ R0.075 | 0/-0.008 | ±0.002 | 0/-0.004 (h4) |
| R0.1 ～ R1.25 | | ±0.003 | |
| R1.5 ～ R2 | 0/-0.01 | | |
| R2.5 ～ R3 | | ±0.005 | |

**Shank diameter tolerance h4!**

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

Total 20 models

Unit（mm）

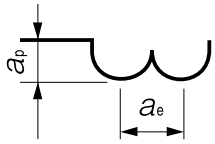
| | Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|
| ※ | HGB 2001-0010 | R0.05 | 0.1 | 16° | 50 | 4 | 12,960 |
| ※ | HGB 20015-0015 | R0.075 | 0.15 | 16° | 50 | 4 | 12,600 |
| | HGB 2002-0030 | R0.1 | 0.3 | 16° | 50 | 4 | 9,120 |
| | HGB 2003-0030 | R0.15 | 0.3 | 16° | 50 | 4 | 7,440 |
| | HGB 2003-0045 | | 0.45 | | 50 | 4 | 7,440 |
| | HGB 2004-0040 | R0.2 | 0.4 | 16° | 50 | 4 | 5,040 |
| | HGB 2004-0060 | | 0.6 | | 50 | 4 | 5,040 |
| | HGB 2005-0050 | R0.25 | 0.5 | 16° | 50 | 4 | 4,680 |
| | HGB 2005-0075 | | 0.75 | | 50 | 4 | 4,680 |
| | HGB 2006-0060 | R0.3 | 0.6 | 16° | 50 | 4 | 4,560 |
| | HGB 2006-0090 | | 0.9 | | 50 | 4 | 4,560 |
| | HGB 2008-0120 | R0.4 | 1.2 | 16° | 50 | 4 | 4,560 |
| | HGB 2010-0150 | R0.5 | 1.5 | 16° | 50 | 4 | 4,150 |
| | HGB 2015-0225 | R0.75 | 2.25 | 16° | 50 | 4 | 5,040 |
| | HGB 2020-0300 | R1 | 3 | 16° | 50 | 4 | 3,720 |
| | HGB 2025-0375 | R1.25 | 3.75 | 16° | 50 | 4 | 6,370 |
| | HGB 2030-0450 | R1.5 | 4.5 | 16° | 50 | 6 | 4,560 |
| | HGB 2040-0600 | R2 | 6 | 16° | 50 | 6 | 5,160 |
| | HGB 2050-0750 | R2.5 | 7.5 | 16° | 50 | 6 | 6,240 |
| | HGB 2060-0900 | R3 | 9 | — | 50 | 6 | 6,480 |

※Additional model

## Milling Conditions for HGB

| 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) |
| **2001-0010** | **R0.05** | 0.1 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 150 | 0.003 | 0.006 | 40,000 | 120 | 0.002 | 0.004 |
| **20015-0015** | **R0.075** | 0.15 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 170 | 0.005 | 0.01 | 40,000 | 135 | 0.003 | 0.006 |
| **2002-0030** | **R0.1** | 0.3 | 44,000 | 250 | 0.01 | 0.03 | 42,000 | 250 | 0.01 | 0.03 | 40,000 | 200 | 0.008 | 0.024 | 36,000 | 150 | 0.006 | 0.018 |
| **2003-0030** | **R0.15** | 0.3 | 44,000 | 400 | 0.01 | 0.03 | 42,000 | 350 | 0.01 | 0.03 | 40,000 | 300 | 0.01 | 0.03 | 36,000 | 250 | 0.008 | 0.024 |
| **2003-0045** | | 0.45 | 44,000 | 400 | 0.01 | 0.03 | 42,000 | 350 | 0.01 | 0.03 | 40,000 | 300 | 0.01 | 0.03 | 36,000 | 250 | 0.008 | 0.024 |
| **2004-0040** | **R0.2** | 0.4 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-0060** | | 0.6 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2005-0050** | **R0.25** | 0.5 | 44,000 | 900 | 0.02 | 0.065 | 40,000 | 800 | 0.015 | 0.05 | 36,000 | 600 | 0.015 | 0.05 | 30,000 | 400 | 0.015 | 0.03 |
| **2005-0075** | | 0.75 | 44,000 | 900 | 0.02 | 0.065 | 40,000 | 800 | 0.015 | 0.05 | 36,000 | 600 | 0.015 | 0.05 | 30,000 | 400 | 0.015 | 0.03 |
| **2006-0060** | **R0.3** | 0.6 | 40,000 | 1,400 | 0.045 | 0.15 | 36,000 | 1,200 | 0.025 | 0.13 | 32,000 | 1,000 | 0.02 | 0.1 | 25,000 | 600 | 0.02 | 0.1 |
| **2006-0090** | | 0.9 | 40,000 | 1,400 | 0.045 | 0.15 | 36,000 | 1,200 | 0.025 | 0.13 | 32,000 | 1,000 | 0.02 | 0.1 | 25,000 | 600 | 0.02 | 0.1 |
| **2008-0120** | **R0.4** | 1.2 | 35,000 | 1,600 | 0.06 | 0.21 | 30,000 | 1,600 | 0.04 | 0.17 | 26,000 | 1,350 | 0.04 | 0.15 | 20,000 | 700 | 0.02 | 0.12 |
| **2010-0150** | **R0.5** | 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 |
| **2015-0225** | **R0.75** | 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 |
| **2020-0300** | **R1** | 3 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 14,700 | 2,160 | 0.1 | 0.35 | 11,040 | 1,080 | 0.08 | 0.35 |
| **2025-0375** | **R1.25** | 3.75 | 24,500 | 2,950 | 0.35 | 0.85 | 12,250 | 2,150 | 0.17 | 0.6 | 12,840 | 2,220 | 0.12 | 0.45 | 9,660 | 1,110 | 0.1 | 0.45 |
| **2030-0450** | **R1.5** | 4.5 | 21,000 | 3,000 | 0.4 | 1 | 10,500 | 2,200 | 0.2 | 0.7 | 11,040 | 2,280 | 0.15 | 0.55 | 8,280 | 1,140 | 0.12 | 0.55 |
| **2040-0600** | **R2** | 6 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 9,480 | 2,400 | 0.18 | 0.75 | 7,080 | 1,200 | 0.15 | 0.75 |
| **2050-0750** | **R2.5** | 7.5 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 8,160 | 2,520 | 0.2 | 0.85 | 6,120 | 1,260 | 0.15 | 0.85 |
| **2060-0900** | **R3** | 9 | 13,000 | 3,500 | 0.6 | 1.8 | 6,500 | 2,500 | 0.3 | 1.3 | 6,840 | 2,640 | 0.25 | 1 | 5,000 | 1,500 | 0.2 | 1 |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

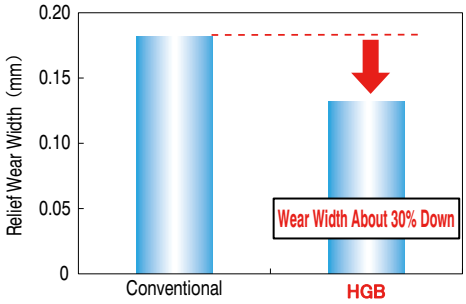



Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- Every coolant offers stable milling.

## Wear Comparison HGB R3 × Length of Cut 9 HAP10 (64HRC)

**Tools after milling**

Conventional HGB




| | |
|---|---|
| Tool | HGB 2060-0900 |
| Spindle Speed | 6,840 $min^{-1}$ |
| Feed Rate | 2,640 mm/min |
| Axial Depth $a_p$ | 0.25 mm |
| Radial Depth $a_e$ | 1 mm |
| Coolant | Air Blow (Through Spindle) |
| Milling Shape | Square Pocket (55 x 17.5 x Depth 6.9 mm) × 5 Pockets |
| Cycle Time | 75 min |

* Refer to page 581 for tool geometry, and page 582 for milling examples.

## Size R0.03～R6

# HSB

Super MG | HARD MAX | Shank Dia 0/-0.005

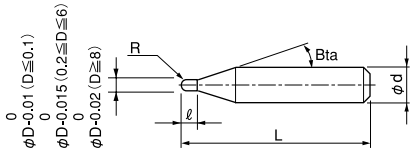
Additional 1 model

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | |

## Features

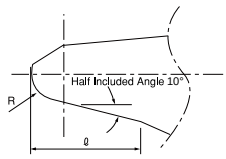
**Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.**
**HARDMAX coat offers heat resistance, durability and lubricity at a high level.**
**Every coolant offers stable milling.**
**Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.**
**The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.**




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

**ATTENTION**

HSB 1001-0020-6 (R0.05) is a tapered ball end mill with single tapered flute of 10˚ (See the figure on right).




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

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

Total 71 models

Unit (mm)

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

UDC Series
CBN Series
Square
Long Neck Square
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Long Neck Ball
Taper Neck Ball
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



Next Page ➡

Unit (mm)

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

※Additional model

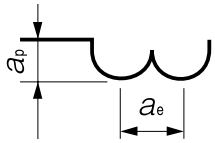
## Milling Conditions for HSB / HSB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11(55~62HRC) | | | | HARDENED STEELS HAP10(62~66HRC) | | | | HARDENED STEELS HAP72(66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Length of Cut (mm) | Spindle Speed ($min^{-1}$) | 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) |
| **20006-0006** | **R0.03** | 0.06 | 30,000 | 100 | 0.002 or below | 0.02 | — | — | — | — | — | — | — | — | — | — | — | — |
| **20008-0008** | **R0.04** | 0.08 | 30,000 | 130 | 0.003 or below | 0.03 | — | — | — | — | — | — | — | — | — | — | — | — |
| **1001-0020-6** | **R0.05** | 0.2 | 30,000 | 30 | 0.002 or below | 0.02 | — | — | — | — | — | — | — | — | — | — | — | — |
| **2001-0010** | | 0.1 | 30,000 | 200 | 0.004 or below | 0.04 | — | — | — | — | — | — | — | — | — | — | — | — |
| **2002-0020(-6)** | **R0.1** | 0.2 | 60,000 | 200 | 0.003 | 0.005 | 60,000 | 200 | 0.002 | 0.003 | 60,000 | 130 | 0.002 | 0.003 | 45,000 | 65 | 0.002 | 0.003 |
| **2002-0030** | | 0.3 | 60,000 | 200 | 0.003 | 0.005 | 60,000 | 200 | 0.002 | 0.003 | 60,000 | 130 | 0.002 | 0.003 | 45,000 | 65 | 0.002 | 0.003 |
| **2003-0030(-6)** | **R0.15** | 0.3 | 60,000 | 350 | 0.006 | 0.008 | 45,000 | 310 | 0.004 | 0.007 | 43,500 | 180 | 0.003 | 0.005 | 32,500 | 90 | 0.003 | 0.005 |
| **2003-0045** | | 0.45 | 60,000 | 350 | 0.006 | 0.008 | 45,000 | 310 | 0.004 | 0.007 | 43,500 | 180 | 0.003 | 0.005 | 32,500 | 90 | 0.003 | 0.005 |
| **2004-0040(-6)** | **R0.2** | 0.4 | 50,000 | 500 | 0.01 | 0.02 | 37,500 | 420 | 0.007 | 0.012 | 35,000 | 240 | 0.005 | 0.008 | 26,250 | 120 | 0.005 | 0.008 |
| **2004-0060** | | 0.6 | 50,000 | 500 | 0.01 | 0.02 | 37,500 | 420 | 0.007 | 0.012 | 35,000 | 240 | 0.005 | 0.008 | 26,250 | 120 | 0.005 | 0.008 |
| **2005-0050(-6)** | **R0.25** | 0.5 | 44,000 | 650 | 0.015 | 0.04 | 33,000 | 530 | 0.01 | 0.02 | 30,000 | 300 | 0.007 | 0.01 | 22,500 | 150 | 0.007 | 0.01 |
| **2005-0075** | | 0.75 | 44,000 | 650 | 0.015 | 0.04 | 33,000 | 530 | 0.01 | 0.02 | 30,000 | 300 | 0.007 | 0.01 | 22,500 | 150 | 0.007 | 0.01 |
| **2006-0060(-6)** | **R0.3** | 0.6 | 40,000 | 1,100 | 0.03 | 0.13 | 30,000 | 1,200 | 0.02 | 0.1 | 26,500 | 800 | 0.01 | 0.075 | 20,000 | 400 | 0.01 | 0.075 |
| **2006-0090** | | 0.9 | 40,000 | 1,100 | 0.03 | 0.13 | 30,000 | 1,200 | 0.02 | 0.1 | 26,500 | 800 | 0.01 | 0.075 | 20,000 | 400 | 0.01 | 0.075 |
| **2007-0100** | **R0.35** | 1 | 37,000 | 1,350 | 0.045 | 0.17 | 28,500 | 1,400 | 0.03 | 0.135 | 25,000 | 900 | 0.015 | 0.1 | 18,750 | 450 | 0.015 | 0.1 |
| **2008-0080(-6)** | **R0.4** | 0.8 | 35,000 | 1,600 | 0.06 | 0.21 | 27,000 | 1,600 | 0.04 | 0.17 | 23,500 | 1,000 | 0.02 | 0.12 | 17,500 | 500 | 0.02 | 0.12 |
| **2008-0120** | | 1.2 | 35,000 | 1,600 | 0.06 | 0.21 | 27,000 | 1,600 | 0.04 | 0.17 | 23,500 | 1,000 | 0.02 | 0.12 | 17,500 | 500 | 0.02 | 0.12 |
| **2009-0130** | **R0.45** | 1.3 | 32,500 | 1,650 | 0.1 | 0.28 | 25,500 | 1,800 | 0.055 | 0.21 | 22,000 | 1,300 | 0.025 | 0.14 | 16,500 | 650 | 0.025 | 0.14 |
| **2010-0100(-6)** | | 1 | 30,000 | 1,750 | 0.2 | 0.4 | 24,000 | 2,000 | 0.1 | 0.3 | 21,000 | 1,750 | 0.05 | 0.2 | 16,000 | 875 | 0.05 | 0.2 |
| **2010-0150** | **R0.5** | 1.5 | 30,000 | 1,750 | 0.2 | 0.4 | 24,000 | 2,000 | 0.1 | 0.3 | 21,000 | 1,750 | 0.05 | 0.2 | 16,000 | 875 | 0.05 | 0.2 |
| **2010-0250** | | 2.5 | 30,000 | 1,750 | 0.1 | 0.3 | 24,000 | 2,000 | 0.05 | 0.2 | 21,000 | 1,750 | 0.03 | 0.17 | 16,000 | 875 | 0.03 | 0.17 |
| **2011-0160** | **R0.55** | 1.6 | 30,000 | 1,900 | 0.21 | 0.43 | 22,000 | 2,000 | 0.105 | 0.32 | 19,000 | 1,750 | 0.05 | 0.22 | 14,250 | 875 | 0.05 | 0.22 |
| **2012-0180** | **R0.6** | 1.8 | 30,000 | 2,000 | 0.22 | 0.46 | 20,500 | 2,000 | 0.11 | 0.34 | 17,800 | 1,750 | 0.05 | 0.23 | 13,350 | 875 | 0.05 | 0.23 |
| **2013-0190** | **R0.65** | 1.9 | 30,000 | 2,150 | 0.23 | 0.49 | 19,000 | 2,000 | 0.115 | 0.36 | 16,600 | 1,750 | 0.05 | 0.24 | 12,450 | 875 | 0.05 | 0.24 |
| **2014-0210** | **R0.7** | 2.1 | 30,000 | 2,300 | 0.24 | 0.52 | 18,000 | 2,000 | 0.12 | 0.39 | 15,700 | 1,750 | 0.055 | 0.27 | 11,800 | 875 | 0.055 | 0.27 |
| **2015-0150(-6)** | | 1.5 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| **2015-0200** | **R0.75** | 2 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| **2015-0225** | | 2.25 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| **2015-0400** | | 4 | 30,000 | 2,450 | 0.15 | 0.45 | 17,000 | 2,000 | 0.07 | 0.31 | 15,000 | 1,750 | 0.04 | 0.24 | 11,250 | 875 | 0.04 | 0.24 |
| **2016-0240** | **R0.8** | 2.4 | 30,000 | 2,550 | 0.25 | 0.58 | 16,200 | 2,000 | 0.13 | 0.43 | 14,200 | 1,750 | 0.06 | 0.3 | 10,650 | 875 | 0.06 | 0.3 |
| **2017-0250** | **R0.85** | 2.5 | 30,000 | 2,600 | 0.26 | 0.61 | 15,500 | 2,000 | 0.135 | 0.46 | 13,500 | 1,750 | 0.065 | 0.32 | 10,100 | 875 | 0.065 | 0.32 |
| **2018-0270** | **R0.9** | 2.7 | 30,000 | 2,700 | 0.28 | 0.65 | 15,000 | 2,000 | 0.14 | 0.48 | 13,000 | 1,750 | 0.07 | 0.34 | 9,750 | 875 | 0.07 | 0.34 |
| **2019-0280** | **R0.95** | 2.8 | 29,000 | 2,800 | 0.3 | 0.69 | 14,500 | 2,000 | 0.145 | 0.49 | 12,600 | 1,750 | 0.075 | 0.36 | 9,450 | 875 | 0.075 | 0.36 |
| **2020-0200(-6)** | | 2 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 12,250 | 1,800 | 0.08 | 0.35 | 9,200 | 900 | 0.08 | 0.35 |
| **2020-0300** | **R1** | 3 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 12,250 | 1,800 | 0.08 | 0.35 | 9,200 | 900 | 0.08 | 0.35 |
| **2020-0600** | | 6 | 28,000 | 2,900 | 0.2 | 0.6 | 14,000 | 2,100 | 0.1 | 0.4 | 12,250 | 1,800 | 0.06 | 0.3 | 9,200 | 900 | 0.06 | 0.3 |
| **2025-0250(-6)** | | 2.5 | 24,500 | 2,950 | 0.35 | 0.85 | 12,250 | 2,150 | 0.17 | 0.6 | 10,700 | 1,850 | 0.1 | 0.45 | 8,050 | 925 | 0.1 | 0.45 |
| **2025-0375** | **R1.25** | 3.75 | 24,500 | 2,950 | 0.35 | 0.85 | 12,250 | 2,150 | 0.17 | 0.6 | 10,700 | 1,850 | 0.1 | 0.45 | 8,050 | 925 | 0.1 | 0.45 |
| **2025-0600** | | 6 | 24,500 | 2,950 | 0.26 | 0.75 | 12,250 | 2,150 | 0.125 | 0.5 | 10,700 | 1,850 | 0.08 | 0.4 | 8,050 | 925 | 0.08 | 0.4 |
| **2030-0300** | | 3 | 21,000 | 3,000 | 0.4 | 1 | 10,500 | 2,200 | 0.2 | 0.7 | 9,200 | 1,900 | 0.12 | 0.55 | 6,900 | 950 | 0.12 | 0.55 |
| **2030-0450** | **R1.5** | 4.5 | 21,000 | 3,000 | 0.4 | 1 | 10,500 | 2,200 | 0.2 | 0.7 | 9,200 | 1,900 | 0.12 | 0.55 | 6,900 | 950 | 0.12 | 0.55 |
| **2030-0800** | | 8 | 21,000 | 3,000 | 0.3 | 0.9 | 10,500 | 2,200 | 0.15 | 0.65 | 9,200 | 1,900 | 0.1 | 0.5 | 6,900 | 950 | 0.1 | 0.5 |
| **2040-0400** | | 4 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 7,900 | 2,000 | 0.15 | 0.75 | 5,900 | 1,000 | 0.15 | 0.75 |
| **2040-0600(-4)** | **R2** | 6 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 7,900 | 2,000 | 0.15 | 0.75 | 5,900 | 1,000 | 0.15 | 0.75 |
| **2040-0800** | | 8 | 18,000 | 3,200 | 0.5 | 1.3 | 9,000 | 2,300 | 0.25 | 0.95 | 7,900 | 2,000 | 0.15 | 0.75 | 5,900 | 1,000 | 0.15 | 0.75 |
| **2050-0500** | | 5 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |
| **2050-0750** | **R2.5** | 7.5 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |
| **2050-0800** | | 8 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |
| **2050-1200** | | 12 | 15,600 | 3,500 | 0.5 | 1.5 | 7,800 | 2,500 | 0.25 | 1.05 | 6,800 | 2,100 | 0.15 | 0.85 | 5,100 | 1,050 | 0.15 | 0.85 |

# Milling Conditions for HSB / HSB-S

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

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

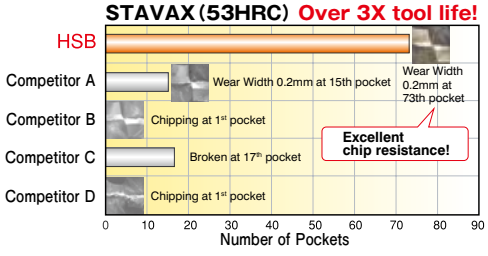



Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
・Reduce the milling parameters when a straight shank tool exceeds 35 mm of overhang length.
・Every coolant offers stable milling.

## R3 Ball Tool Life Comparison: Market Leading Performance on Wear Resistance!

### HSB offers the highest wear resistance for various work materials.

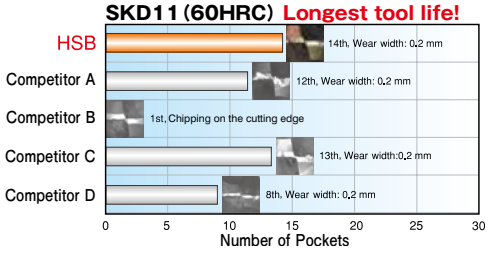
**STAVAX (53HRC) Over 3X tool life!**

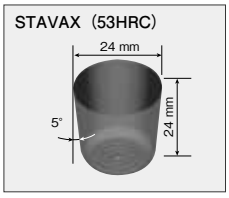


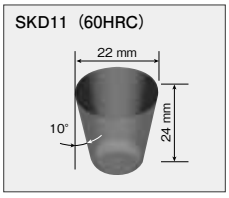

Tool Size: R3

| Work Material | | STAVAX (53HRC) | SKD11 (60HRC) |
|---|---|---|---|
| Spindle Speed | $n$ | 13,000 $min^{-1}$ | 6,500 $min^{-1}$ |
| Feed Rate | $V_f$ | 3,500 mm/min | 2,500 mm/min |
| Velocity | $V_c$ | 245 m/min | 122 m/min |
| Feed per tooth | $f_z$ | 0.135 mm/tooth | 0.19 mm/tooth |
| Axial Depth | $a_p$ | 0.6 mm | 0.3 mm |
| Radial Depth | $a_e$ | 1.8 mm | 1.3 mm |
| Overhang Length | | 30 mm | 30 mm |
| Cycle Time | | 3 min/pocket | 6.5 min/pocket |
| Coolant | | Air Blow | |
| Milling Method | | Contouring | |

**SKD11 (60HRC) Longest tool life!**




* Refer to page 580 for tool geometry.

**Size R0.1～R2**

**Short Shank Series**

# HSB-S

Super MG | HARD MAX | 30° | R ±0.003 | Shank Dia 0/-0.004

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | |

## Features

**Short Shank Ball End Mills for high accuracy shrink-fit tool holder.**
**Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.**
**HARDMAX coat offers heat resistance, durability and lubricity at a high level.**
**Every coolant offers stable milling.**
**Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.**
**The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.**

## Better Tolerance Design! Diameter Tolerance, Ball Radius Accuracy, and Shank Diameter Tolerance

HSB / HSLB Tolerance

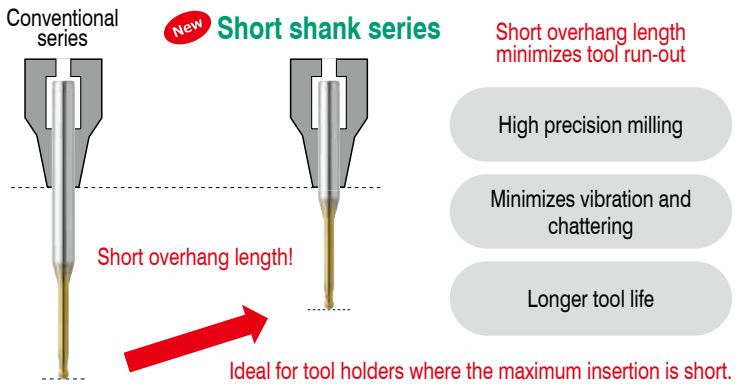
| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.1 ～ R3 | 0/-0.015 | ±0.005 | 0/-0.005 (h5) |

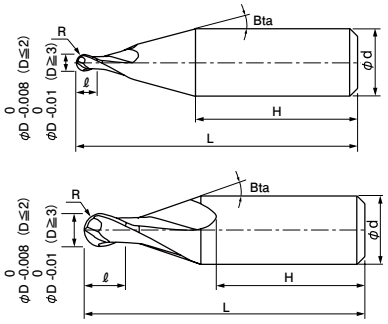
**HSB-S / HSLB-S Tolerance**

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.1 ～ R1 | **0/-0.008** | **±0.003** | **0/-0.004 (h4)** |
| R1.5 ～ R2 | **0/-0.01** | | |
| R3 | | ±0.005 | |

**Shank diameter tolerance h4!**

## Short overhang length with short shank length!






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

Total 10 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shank Length H | Price ¥ |
|---|---|---|---|---|---|---|---|
| **HSB 2002-0020S** | R0.1 | 0.2 | 16° | 35 | 4 | 26.0 | 8,520 |
| **HSB 2003-0030S** | R0.15 | 0.3 | 16° | 35 | 4 | 26.0 | 6,960 |
| **HSB 2004-0040S** | R0.2 | 0.4 | 16° | 35 | 4 | 26.0 | 4,680 |
| **HSB 2006-0060S** | R0.3 | 0.6 | 16° | 35 | 4 | 26.0 | 4,200 |
| **HSB 2008-0080S** | R0.4 | 0.8 | 16° | 35 | 4 | 26.5 | 4,200 |
| **HSB 2010-0100S** | R0.5 | 1 | 16° | 35 | 4 | 26.5 | 3,840 |
| **HSB 2015-0150S** | R0.75 | 1.5 | 16° | 35 | 4 | 26.5 | 4,680 |
| **HSB 2020-0200S** | R1 | 2 | 16° | 35 | 4 | 25.5 | 3,480 |
| **HSB 2030-0300S** | R1.5 | 3 | 16° | 40 | 6 | 27.0 | 4,200 |
| **HSB 2040-0400S** | R2 | 4 | 16° | 40 | 6 | 26.0 | 4,800 |

## Size R1.5～R6

# HBL

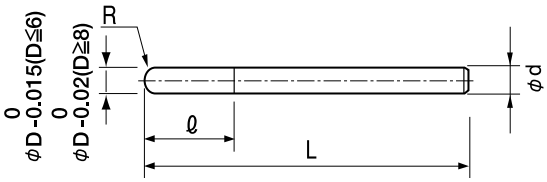
Super MG | HARD MAX | 30° | R ±0.005 (R1.5～R3) | R ±0.007 (R4～R6) | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ○ | | ○ | | | ◎ | | | ○ | ○ | | |

## Features

**Long shank ball design for hard materials.**
**HARDMAX coating for high speed milling for hard materials.**
**Both dry and wet coolant offer stable and long tool life.**
**Diameter Tolerance: 0/-0.015 (D≦6)、0/-0.02 (D≧8)**




Shank part should not make contact with the work piece.

Total 6 models

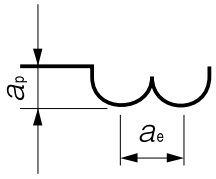
Unit（mm）

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| **HBL 2030-0800** | R1.5 | 4.5 | 80 | 3 | 12,200 |
| **HBL 2040-1000** | R2 | 6 | 100 | 4 | 13,900 |
| **HBL 2060-1400** | R3 | 18 | 140 | 6 | 21,100 |
| **HBL 2080-1600** | R4 | 20 | 160 | 8 | 29,480 |
| **HBL 2100-1800** | R5 | 25 | 180 | 10 | 35,700 |
| **HBL 2120-2000** | R6 | 25 | 200 | 12 | 46,090 |

## Milling Conditions for HBL

| WORK MATERIAL | | CARBON STEELS S45C / S50C (~225HB) | | | | ALLOY STEELS SK / SCM / SUS (225~325HB) | | | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30~45HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (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) |
| **2030-0800** | **R1.5** | 16,000 | 800 | 0.12 | 0.3 | 13,300 | 580 | 0.12 | 0.3 | 10,700 | 420 | 0.12 | 0.3 |
| **2040-1000** | **R2** | 12,000 | 840 | 0.16 | 0.4 | 10,000 | 560 | 0.16 | 0.4 | 8,000 | 400 | 0.16 | 0.4 |
| **2060-1400** | **R3** | 8,000 | 960 | 0.24 | 0.6 | 6,700 | 670 | 0.24 | 0.6 | 5,400 | 480 | 0.24 | 0.6 |
| **2080-1600** | **R4** | 6,000 | 1,050 | 0.32 | 0.8 | 5,000 | 700 | 0.32 | 0.8 | 4,000 | 520 | 0.32 | 0.8 |
| **2100-1800** | **R5** | 4,800 | 1,100 | 0.4 | 1 | 4,000 | 730 | 0.4 | 1 | 3,200 | 540 | 0.4 | 1 |
| **2120-2000** | **R6** | 4,000 | 1,130 | 0.48 | 1.2 | 3,400 | 810 | 0.48 | 1.2 | 2,700 | 590 | 0.48 | 1.2 |

| WORK MATERIAL | | HARDENED STEELS SKD61 / SKT (45~50HRC) | | | | HARDENED STEELS SKD61 / 11 (50~60HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (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) |
| **2030-0800** | **R1.5** | 6,400 | 230 | 0.12 | 0.3 | 4,800 | 90 | 0.12 | 0.3 |
| **2040-1000** | **R2** | 4,800 | 230 | 0.16 | 0.4 | 3,600 | 100 | 0.16 | 0.4 |
| **2060-1400** | **R3** | 3,200 | 250 | 0.24 | 0.6 | 2,400 | 110 | 0.24 | 0.6 |
| **2080-1600** | **R4** | 2,400 | 260 | 0.32 | 0.8 | 1,800 | 110 | 0.32 | 0.8 |
| **2100-1800** | **R5** | 2,000 | 300 | 0.4 | 1 | 1,500 | 120 | 0.4 | 1 |
| **2120-2000** | **R6** | 1,600 | 320 | 0.48 | 1.2 | 1,200 | 140 | 0.48 | 1.2 |




Cutting Amount (mm)
$a_p$ = 0.04D (Max 0.5 mm)
$a_e$ = 0.1D
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Note:
・Decrease both spindle speed and feed rate proportionally in case of chattering.
・Set spindle speed, feed rate, and radial depth (ae) in accordance with the required surface quality.
・Adjust milling parameters according to the operating environment when milling a work piece over 60HRC.
・Recommend air blow or oil mist.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

## Size R0.05～R6

# CSEB

Super MG | UT COAT | Shank Dia 0/-0.005

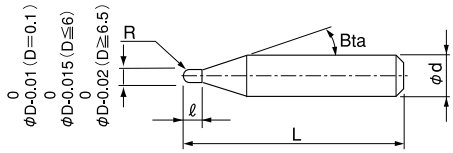
Additional 1 model

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | | | ○ | ○ | | |

## Features

**The optimized geometry offers durability when roughing, yet gives excellent surface quality for finishing.**
**UTCOAT with improved hardness, durability, lubricity and adhesion offers better wear resistance and surface roughness.**
**Broad application range from Copper and raw materials to Hardened Steels (55HRC).**



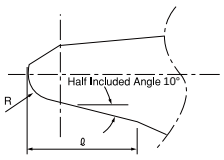

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

| Radius of Ball Nose | Diameter Tolerance | Radius Accuracy | Helix Angle | Number of Flutes |
|---|---|---|---|---|
| R0.05 | 0/-0.01 | ±0.002 | 0° | 2 Flutes * |
| R0.1 ～ R3 | 0/-0.015 | ±0.005 | 30° | |
| R3.25 ～ R6 | 0/-0.02 | ±0.007 | | |

* Only CSEB 1001-0020-6 has single flute.
R accuracy and diameter tolerance is the same as R0.1.

**ATTENTION**

CSEB 1001-0020-6 is a tapered ball end mill with single tapered flute of 10°(See the figure on right).




Total 78 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **CSEB 1001-0020-6** | R0.05 | 0.2 | 11° | 50 | 6 | 13,320 |
| **CSEB 2001-0010** | R0.05 | 0.1 | 11° | 50 | 4 | 12,120 |
| **CSEB 2002-0020-6** | R0.1 | 0.2 | 11° | 50 | 6 | 9,840 |
| **CSEB 2002-0030** | | 0.3 | | 50 | 4 | 8,520 |
| **CSEB 2003-0030** | R0.15 | 0.3 | 11° | 50 | 4 | 6,960 |
| **CSEB 2003-0030-6** | | 0.3 | | 50 | 6 | 8,400 |
| **CSEB 2003-0045** | | 0.45 | | 50 | 4 | 6,960 |
| **CSEB 2004-0040** | R0.2 | 0.4 | 11° | 50 | 4 | 4,680 |
| **CSEB 2004-0040-6** | | 0.4 | | 50 | 6 | 6,120 |
| **CSEB 2004-0060** | | 0.6 | | 50 | 4 | 4,680 |
| **CSEB 2005-0050** | R0.25 | 0.5 | 11° | 50 | 4 | 4,320 |
| **CSEB 2005-0050-6** | | 0.5 | | 50 | 6 | 5,760 |
| **CSEB 2005-0075** | | 0.75 | | 50 | 4 | 4,320 |
| **CSEB 2006-0060** | R0.3 | 0.6 | 11° | 50 | 4 | 4,200 |
| **CSEB 2006-0060-6** | | 0.6 | | 50 | 6 | 5,520 |
| **CSEB 2006-0090** | | 0.9 | | 50 | 4 | 4,200 |
| **CSEB 2007-0100** | R0.35 | 1 | 11° | 50 | 4 | 8,000 |
| **CSEB 2008-0080** | R0.4 | 0.8 | 11° | 50 | 4 | 4,200 |
| **CSEB 2008-0080-6** | | 0.8 | | 50 | 6 | 5,520 |
| **CSEB 2008-0120** | | 1.2 | | 50 | 4 | 4,200 |

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Ball
Long Neck Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CSEB 2009-0130 | R0.45 | 1.3 | 11° | 50 | 4 | 8,000 |
| CSEB 2010-0100 | R0.5 | 1 | 11° | 50 | 4 | 3,840 |
| CSEB 2010-0100-6 | | 1 | | 50 | 6 | 5,160 |
| CSEB 2010-0150 | | 1.5 | | 50 | 4 | 3,840 |
| CSEB 2010-0250 | | 2.5 | | 50 | 4 | 3,840 |
| CSEB 2011-0160 | R0.55 | 1.6 | 11° | 50 | 4 | 9,280 |
| CSEB 2012-0180 | R0.6 | 1.8 | 11° | 50 | 4 | 5,400 |
| CSEB 2013-0190 | R0.65 | 1.9 | 11° | 50 | 4 | 9,280 |
| CSEB 2014-0210 | R0.7 | 2.1 | 11° | 50 | 4 | 5,400 |
| CSEB 2015-0150 | R0.75 | 1.5 | 11° | 50 | 4 | 4,680 |
| CSEB 2015-0150-6 | | 1.5 | | 50 | 6 | 6,000 |
| CSEB 2015-0200 | | 2 | | 50 | 4 | 4,680 |
| CSEB 2015-0225 | | 2.25 | | 50 | 4 | 4,680 |
| CSEB 2015-0400 | | 4 | | 50 | 4 | 4,680 |
| CSEB 2016-0240 | R0.8 | 2.4 | 11° | 50 | 4 | 5,400 |
| CSEB 2017-0250 | R0.85 | 2.5 | 11° | 50 | 4 | 9,280 |
| CSEB 2018-0270 | R0.9 | 2.7 | 11° | 50 | 4 | 8,000 |
| CSEB 2019-0280 | R0.95 | 2.8 | 11° | 50 | 4 | 9,280 |
| CSEB 2020-0200 | R1 | 2 | 11° | 50 | 4 | 3,480 |
| CSEB 2020-0200-6 | | 2 | | 60 | 6 | 4,680 |
| CSEB 2020-0300 | | 3 | | 60 | 4 | 3,480 |
| CSEB 2020-0600 | | 6 | | 60 | 4 | 3,480 |
| CSEB 2025-0250 | R1.25 | 2.5 | 11° | 50 | 4 | 5,950 |
| CSEB 2025-0250-6 | | 2.5 | | 60 | 6 | 7,200 |
| CSEB 2025-0375 | | 3.75 | | 50 | 4 | 5,950 |
| CSEB 2025-0600 | | 6 | | 60 | 4 | 5,950 |
| CSEB 2030-0300 | R1.5 | 3 | 11° | 50 | 6 | 4,200 |
| CSEB 2030-0450 | | 4.5 | | 70 | 6 | 4,200 |
| CSEB 2030-0800 | | 8 | | 70 | 6 | 4,200 |
| CSEB 2035-0520 | R1.75 | 5.2 | 11° | 70 | 6 | 7,800 |
| CSEB 2040-0400 | R2 | 4 | 11° | 50 | 6 | 4,800 |
| ※ CSEB 2040-0600-4 | | 6 | — | 70 | 4 | 4,300 |
| CSEB 2040-0600 | | 6 | 11° | 70 | 6 | 4,800 |
| CSEB 2040-0800 | | 8 | | 70 | 6 | 4,800 |
| CSEB 2045-0670 | R2.25 | 6.7 | 11° | 70 | 6 | 10,610 |
| CSEB 2050-0500 | R2.5 | 5 | 11° | 50 | 6 | 5,710 |
| CSEB 2050-0750 | | 7.5 | | 80 | 6 | 5,760 |
| CSEB 2050-0800 | | 8 | | 80 | 6 | 5,760 |
| CSEB 2050-1200 | | 12 | | 80 | 6 | 5,760 |
| CSEB 2055-0820 | R2.75 | 8.2 | 11° | 80 | 6 | 11,660 |
| CSEB 2060-0600 | R3 | 6 | — | 50 | 6 | 5,940 |
| CSEB 2060-0900 | | 9 | | 80 | 6 | 6,000 |
| CSEB 2060-1200 | | 12 | | 80 | 6 | 6,000 |
| CSEB 2065-0970 | R3.25 | 9.7 | 11° | 90 | 8 | 13,200 |
| CSEB 2070-1050 | R3.5 | 10.5 | 11° | 90 | 8 | 10,560 |
| CSEB 2075-1120 | R3.75 | 11.2 | 11° | 90 | 8 | 13,200 |
| CSEB 2080-0800 | R4 | 8 | — | 60 | 8 | 9,270 |
| CSEB 2080-1200 | | 12 | | 90 | 8 | 9,360 |
| CSEB 2080-1400 | | 14 | | 90 | 8 | 9,360 |
| CSEB 2085-1270 | R4.25 | 12.7 | 11° | 100 | 10 | 14,630 |
| CSEB 2090-1350 | R4.5 | 13.5 | 11° | 100 | 10 | 14,630 |
| CSEB 2100-1000 | R5 | 10 | — | 70 | 10 | 12,110 |
| CSEB 2100-1500 | | 15 | | 100 | 10 | 12,240 |
| CSEB 2100-1800 | | 18 | | 100 | 10 | 12,240 |
| CSEB 2110-1650 | R5.5 | 16.5 | 11° | 110 | 12 | 24,420 |
| CSEB 2120-1200 | R6 | 12 | — | 75 | 12 | 20,580 |
| CSEB 2120-1800 | | 18 | | 110 | 12 | 20,790 |
| CSEB 2120-2200 | | 22 | | 110 | 12 | 20,790 |

※Additional model

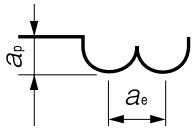
## Milling Conditions for CSEB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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) |
| 1001-0020-6 | R0.05 | 0.2 | 30,000 | 30 | 0.002 or below | 0.02 | 30,000 | 30 | 0.002 or below | 0.02 | 30,000 | 30 | 0.002 or below | 0.02 | 30,000 | 30 | 0.002 or below | 0.02 |
| 2001-0010 | | 0.1 | 30,000 | 200 | 0.004 or below | 0.04 | 30,000 | 200 | 0.004 or below | 0.04 | 30,000 | 200 | 0.004 or below | 0.04 | 30,000 | 200 | 0.004 or below | 0.04 |
| 2002-0020-6 | R0.1 | 0.2 | 60,000 | 350 | 0.008 | 0.024 | 60,000 | 350 | 0.008 | 0.016 | 60,000 | 300 | 0.008 | 0.024 | 60,000 | 300 | 0.006 | 0.018 |
| 2002-0030 | | 0.3 | 60,000 | 350 | 0.008 | 0.024 | 60,000 | 350 | 0.008 | 0.016 | 60,000 | 300 | 0.008 | 0.024 | 60,000 | 300 | 0.006 | 0.018 |
| 2003-0030(-6) | R0.15 | 0.3 | 43,000 | 500 | 0.012 | 0.036 | 43,000 | 500 | 0.012 | 0.024 | 54,000 | 450 | 0.012 | 0.036 | 43,000 | 450 | 0.008 | 0.024 |
| 2003-0045 | | 0.45 | 43,000 | 500 | 0.012 | 0.036 | 43,000 | 500 | 0.012 | 0.024 | 54,000 | 450 | 0.012 | 0.036 | 43,000 | 450 | 0.008 | 0.024 |
| 2004-0040(-6) | R0.2 | 0.4 | 35,000 | 1,200 | 0.03 | 0.09 | 35,000 | 1,200 | 0.02 | 0.04 | 50,000 | 650 | 0.025 | 0.075 | 35,000 | 650 | 0.015 | 0.045 |
| 2004-0060 | | 0.6 | 35,000 | 1,200 | 0.03 | 0.09 | 35,000 | 1,200 | 0.02 | 0.04 | 50,000 | 650 | 0.025 | 0.075 | 35,000 | 650 | 0.015 | 0.045 |
| 2005-0050(-6) | R0.25 | 0.5 | 34,000 | 1,300 | 0.035 | 0.105 | 34,000 | 1,300 | 0.03 | 0.06 | 45,000 | 900 | 0.03 | 0.09 | 32,000 | 900 | 0.02 | 0.06 |
| 2005-0075 | | 0.75 | 34,000 | 1,300 | 0.035 | 0.105 | 34,000 | 1,300 | 0.03 | 0.06 | 45,000 | 900 | 0.03 | 0.09 | 32,000 | 900 | 0.02 | 0.06 |
| 2006-0060(-6) | R0.3 | 0.6 | 33,000 | 1,500 | 0.05 | 0.15 | 33,000 | 1,500 | 0.04 | 0.08 | 40,000 | 1,300 | 0.045 | 0.09 | 30,000 | 1,300 | 0.04 | 0.06 |
| 2006-0090 | | 0.9 | 33,000 | 1,500 | 0.05 | 0.15 | 33,000 | 1,500 | 0.04 | 0.08 | 40,000 | 1,300 | 0.045 | 0.09 | 30,000 | 1,300 | 0.04 | 0.06 |
| 2007-0100 | R0.35 | 1 | 32,000 | 1,800 | 0.07 | 0.21 | 32,000 | 1,600 | 0.05 | 0.1 | 38,000 | 1,600 | 0.06 | 0.12 | 28,000 | 1,600 | 0.05 | 0.075 |
| 2008-0080(-6) | R0.4 | 0.8 | 30,000 | 2,200 | 0.1 | 0.3 | 30,000 | 1,800 | 0.06 | 0.12 | 35,000 | 1,800 | 0.07 | 0.14 | 25,000 | 1,700 | 0.07 | 0.1 |
| 2008-0120 | | 1.2 | 30,000 | 2,200 | 0.1 | 0.3 | 30,000 | 1,800 | 0.06 | 0.12 | 35,000 | 1,800 | 0.07 | 0.14 | 25,000 | 1,700 | 0.07 | 0.1 |
| 2009-0130 | R0.45 | 1.3 | 30,000 | 2,100 | 0.11 | 0.33 | 30,000 | 1,600 | 0.07 | 0.14 | 33,000 | 1,700 | 0.08 | 0.16 | 24,000 | 1,600 | 0.08 | 0.12 |
| 2010-0100(-6) | R0.5 | 1 | 30,000 | 2,000 | 0.12 | 0.36 | 30,000 | 1,600 | 0.08 | 0.16 | 30,000 | 1,600 | 0.09 | 0.18 | 22,000 | 1,600 | 0.09 | 0.13 |
| 2010-0150 | | 1.5 | 30,000 | 2,000 | 0.12 | 0.36 | 30,000 | 1,600 | 0.08 | 0.16 | 30,000 | 1,500 | 0.09 | 0.18 | 22,000 | 1,600 | 0.09 | 0.13 |
| 2010-0250 | | 2.5 | 30,000 | 1,700 | 0.09 | 0.27 | 24,000 | 1,400 | 0.06 | 0.12 | 30,000 | 1,300 | 0.075 | 0.15 | 21,500 | 1,300 | 0.075 | 0.1 |
| 2011-0160 | R0.55 | 1.6 | 30,000 | 2,000 | 0.12 | 0.36 | 30,000 | 1,600 | 0.08 | 0.16 | 30,000 | 1,600 | 0.09 | 0.18 | 20,000 | 1,600 | 0.09 | 0.13 |
| 2012-0180 | R0.6 | 1.8 | 30,000 | 2,000 | 0.13 | 0.39 | 30,000 | 1,600 | 0.09 | 0.18 | 30,000 | 1,600 | 0.1 | 0.2 | 18,000 | 1,600 | 0.1 | 0.15 |
| 2013-0190 | R0.65 | 1.9 | 30,000 | 2,000 | 0.13 | 0.39 | 30,000 | 1,600 | 0.09 | 0.18 | 30,000 | 1,700 | 0.1 | 0.2 | 18,000 | 1,500 | 0.1 | 0.15 |
| 2014-0210 | R0.7 | 2.1 | 30,000 | 2,000 | 0.14 | 0.42 | 30,000 | 1,500 | 0.1 | 0.2 | 30,000 | 1,700 | 0.11 | 0.2 | 18,000 | 1,500 | 0.11 | 0.16 |
| 2015-0150(-6) | R0.75 | 1.5 | 30,000 | 2,000 | 0.15 | 0.45 | 30,000 | 1,600 | 0.12 | 0.24 | 30,000 | 1,700 | 0.12 | 0.24 | 18,000 | 1,500 | 0.12 | 0.18 |
| 2015-0200 | | 2 | 30,000 | 2,000 | 0.15 | 0.45 | 30,000 | 1,600 | 0.12 | 0.24 | 30,000 | 1,700 | 0.12 | 0.24 | 18,000 | 1,500 | 0.12 | 0.18 |
| 2015-0225 | | 2.25 | 30,000 | 2,000 | 0.15 | 0.45 | 30,000 | 1,600 | 0.12 | 0.24 | 30,000 | 1,700 | 0.12 | 0.24 | 18,000 | 1,500 | 0.12 | 0.18 |
| 2015-0400 | | 4 | 30,000 | 1,800 | 0.12 | 0.36 | 23,000 | 1,200 | 0.08 | 0.16 | 30,000 | 1,400 | 0.1 | 0.2 | 15,000 | 1,200 | 0.09 | 0.13 |
| 2016-0240 | R0.8 | 2.4 | 30,000 | 2,000 | 0.16 | 0.48 | 30,000 | 1,600 | 0.12 | 0.24 | 30,000 | 1,800 | 0.12 | 0.36 | 18,000 | 1,400 | 0.1 | 0.2 |
| 2017-0250 | R0.85 | 2.5 | 30,000 | 2,000 | 0.17 | 0.51 | 30,000 | 1,700 | 0.14 | 0.28 | 30,000 | 1,800 | 0.14 | 0.42 | 18,000 | 1,400 | 0.12 | 0.24 |
| 2018-0270 | R0.9 | 2.7 | 30,000 | 2,000 | 0.18 | 0.54 | 30,000 | 1,800 | 0.16 | 0.32 | 30,000 | 1,900 | 0.16 | 0.48 | 16,000 | 1,300 | 0.14 | 0.28 |
| 2019-0280 | R0.95 | 2.8 | 30,000 | 2,000 | 0.19 | 0.57 | 30,000 | 1,900 | 0.18 | 0.36 | 30,000 | 1,900 | 0.18 | 0.54 | 16,000 | 1,300 | 0.16 | 0.32 |
| 2020-0200(-6) | R1 | 2 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.21 | 0.42 | 30,000 | 2,000 | 0.2 | 0.6 | 16,000 | 1,300 | 0.17 | 0.5 |
| 2020-0300 | | 3 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.21 | 0.42 | 30,000 | 2,000 | 0.2 | 0.6 | 16,000 | 1,300 | 0.17 | 0.5 |
| 2020-0600 | | 6 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.14 | 0.42 | 30,000 | 2,000 | 0.13 | 0.45 | 10,800 | 850 | 0.1 | 0.4 |

## Milling Conditions for CSEB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (～325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30～45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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) |
| **2025-0250(-6)** | | 2.5 | 27,000 | 2,300 | 0.28 | 0.75 | 27,000 | 2,300 | 0.25 | 0.5 | 27,000 | 2,300 | 0.25 | 0.75 | 13,000 | 1,100 | 0.21 | 0.63 |
| **2025-0375** | **R1.25** | 3.75 | 27,000 | 2,300 | 0.28 | 0.75 | 27,000 | 2,300 | 0.25 | 0.5 | 27,000 | 2,300 | 0.25 | 0.75 | 13,000 | 1,100 | 0.21 | 0.63 |
| **2025-0600** | | 6 | 25,000 | 2,100 | 0.26 | 0.67 | 25,000 | 2,100 | 0.23 | 0.46 | 24,000 | 2,000 | 0.2 | 0.65 | 11,000 | 930 | 0.14 | 0.44 |
| **2030-0300** | | 3 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.3 | 0.9 | 14,000 | 1,400 | 0.25 | 0.76 |
| **2030-0450** | **R1.5** | 4.5 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.3 | 0.9 | 14,000 | 1,400 | 0.25 | 0.76 |
| **2030-0800** | | 8 | 22,000 | 2,300 | 0.28 | 0.7 | 22,000 | 2,300 | 0.28 | 0.7 | 20,000 | 2,000 | 0.2 | 0.65 | 10,700 | 1,000 | 0.18 | 0.54 |
| **2035-0520** | **R1.75** | 5.2 | 24,000 | 2,700 | 0.35 | 1 | 24,000 | 2,700 | 0.35 | 1 | 21,000 | 2,400 | 0.35 | 1 | 12,000 | 1,700 | 0.3 | 0.9 |
| **2040-0400** | | 4 | 24,000 | 2,900 | 0.4 | 1.2 | 24,000 | 2,900 | 0.4 | 1.2 | 18,000 | 2,400 | 0.4 | 1.2 | 11,000 | 2,000 | 0.34 | 1 |
| **2040-0600(-4)** | **R2** | 6 | 24,000 | 2,900 | 0.4 | 1.2 | 24,000 | 2,900 | 0.4 | 1.2 | 18,000 | 2,400 | 0.4 | 1.2 | 11,000 | 2,000 | 0.34 | 1 |
| **2040-0800** | | 8 | 24,000 | 2,900 | 0.4 | 1.2 | 24,000 | 2,900 | 0.4 | 1.2 | 18,000 | 2,400 | 0.4 | 1.2 | 11,000 | 2,000 | 0.34 | 1 |
| **2045-0670** | **R2.25** | 6.7 | 21,000 | 3,000 | 0.45 | 1.3 | 21,000 | 3,000 | 0.45 | 1.3 | 16,000 | 2,400 | 0.42 | 1.2 | 10,000 | 1,900 | 0.38 | 1.1 |
| **2050-0500** | | 5 | 18,000 | 3,000 | 0.5 | 1.5 | 18,000 | 3,000 | 0.5 | 1.5 | 13,000 | 2,400 | 0.45 | 1.4 | 9,000 | 1,800 | 0.42 | 1.2 |
| **2050-0750** | **R2.5** | 7.5 | 18,000 | 3,000 | 0.5 | 1.5 | 18,000 | 3,000 | 0.5 | 1.5 | 13,000 | 2,400 | 0.45 | 1.4 | 9,000 | 1,800 | 0.42 | 1.2 |
| **2050-0800** | | 8 | 18,000 | 3,000 | 0.5 | 1.5 | 18,000 | 3,000 | 0.5 | 1.5 | 13,000 | 2,400 | 0.45 | 1.4 | 9,000 | 1,800 | 0.42 | 1.2 |
| **2050-1200** | | 12 | 18,000 | 3,000 | 0.5 | 1.5 | 18,000 | 3,000 | 0.5 | 1.5 | 13,000 | 2,400 | 0.45 | 1.4 | 9,000 | 1,800 | 0.42 | 1.2 |
| **2055-0820** | **R2.75** | 8.2 | 17,000 | 3,000 | 0.55 | 1.6 | 17,000 | 3,000 | 0.55 | 1.6 | 12,000 | 2,400 | 0.5 | 1.5 | 8,500 | 1,800 | 0.45 | 1.3 |
| **2060-0600** | | 6 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 7,500 | 1,800 | 0.5 | 1.5 |
| **2060-0900** | **R3** | 9 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 7,500 | 1,800 | 0.5 | 1.5 |
| **2060-1200** | | 12 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 7,500 | 1,800 | 0.5 | 1.5 |
| **2065-0970** | **R3.25** | 9.7 | 15,000 | 3,100 | 0.65 | 1.95 | 15,000 | 3,100 | 0.65 | 1.95 | 10,000 | 2,200 | 0.59 | 1.8 | 7,000 | 1,800 | 0.54 | 1.6 |
| **2070-1050** | **R3.5** | 10.5 | 14,000 | 3,200 | 0.7 | 2.1 | 14,000 | 3,200 | 0.7 | 2.1 | 9,000 | 2,100 | 0.63 | 1.9 | 6,500 | 1,800 | 0.57 | 1.7 |
| **2075-1120** | **R3.75** | 11.2 | 13,000 | 3,300 | 0.75 | 2.25 | 13,000 | 3,300 | 0.75 | 2.25 | 8,200 | 2,000 | 0.67 | 2 | 6,000 | 1,800 | 0.6 | 1.8 |
| **2080-0800** | | 8 | 12,000 | 3,300 | 0.8 | 2.4 | 12,000 | 3,300 | 0.8 | 2.4 | 7,400 | 1,900 | 0.72 | 2.2 | 5,700 | 1,800 | 0.65 | 2 |
| **2080-1200** | **R4** | 12 | 12,000 | 3,300 | 0.8 | 2.4 | 12,000 | 3,300 | 0.8 | 2.4 | 7,400 | 1,900 | 0.72 | 2.2 | 5,700 | 1,800 | 0.65 | 2 |
| **2080-1400** | | 14 | 12,000 | 3,300 | 0.8 | 2.4 | 12,000 | 3,300 | 0.8 | 2.4 | 7,400 | 1,900 | 0.72 | 2.2 | 5,700 | 1,800 | 0.65 | 2 |
| **2085-1270** | **R4.25** | 12.7 | 12,000 | 3,300 | 0.85 | 2.55 | 12,000 | 3,300 | 0.85 | 2.55 | 6,800 | 1,800 | 0.75 | 2.3 | 5,400 | 1,700 | 0.7 | 2.1 |
| **2090-1350** | **R4.5** | 13.5 | 11,000 | 3,400 | 0.9 | 2.7 | 11,000 | 3,400 | 0.9 | 2.7 | 6,300 | 1,700 | 0.8 | 2.4 | 5,100 | 1,600 | 0.75 | 2.2 |
| **2100-1000** | | 10 | 10,000 | 3,500 | 1 | 3 | 10,000 | 3,500 | 1 | 3 | 5,200 | 1,650 | 0.9 | 2.7 | 4,600 | 1,500 | 0.85 | 2.5 |
| **2100-1500** | **R5** | 15 | 10,000 | 3,500 | 1 | 3 | 10,000 | 3,500 | 1 | 3 | 5,200 | 1,650 | 0.9 | 2.7 | 4,600 | 1,500 | 0.85 | 2.5 |
| **2100-1800** | | 18 | 10,000 | 3,500 | 1 | 3 | 10,000 | 3,500 | 1 | 3 | 5,200 | 1,650 | 0.9 | 2.7 | 4,600 | 1,500 | 0.85 | 2.5 |
| **2110-1650** | **R5.5** | 16.5 | 9,000 | 3,400 | 1.1 | 3.3 | 9,000 | 3,400 | 1.1 | 3.3 | 4,700 | 1,500 | 1 | 3 | 4,200 | 1,350 | 0.9 | 2.7 |
| **2120-1200** | | 12 | 8,400 | 3,300 | 1.2 | 3.6 | 8,400 | 3,300 | 1.2 | 3.6 | 4,300 | 1,350 | 1.1 | 3.2 | 3,800 | 1,250 | 1 | 3 |
| **2120-1800** | **R6** | 18 | 8,400 | 3,300 | 1.2 | 3.6 | 8,400 | 3,300 | 1.2 | 3.6 | 4,300 | 1,350 | 1.1 | 3.2 | 3,800 | 1,250 | 1 | 3 |
| **2120-2200** | | 22 | 8,400 | 3,300 | 1.2 | 3.6 | 8,400 | 3,300 | 1.2 | 3.6 | 4,300 | 1,350 | 1.1 | 3.2 | 3,800 | 1,250 | 1 | 3 |

Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
- Recommend wet coolant for Copper.

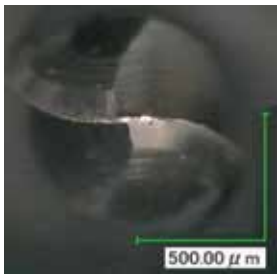



$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

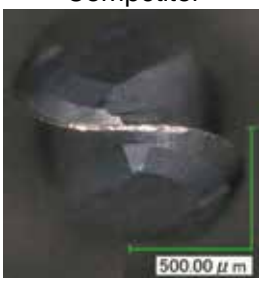
## Milling Example: STAVAX (52HRC) Roughing

◆Contribution of Helix Ball & Small Relief CSEB 2010-0150

**CSEB**




Competitor

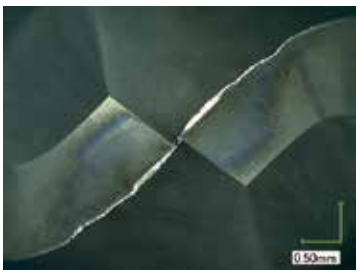



| | |
|---|---|
| Tool Overhang: 15 mm | Spindle Speed: 30,000 $min^{-1}$ |
| Feed Rate: 666 mm/min | Axial Depth: 0.05 mm |
| Radial Depth: 0.21 mm | Coolant: Air Blow (Nozzle) |
| Cycle Time: 30 min | Pocket Size: 20 × 20 × 0.5 mm |

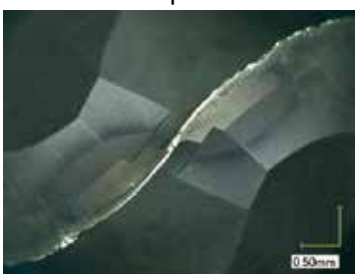
## Milling Example: STAVAX (30HRC) Roughing

◆Contribution of Helix Ball & Small Relief CSEB 2060-0900

**CSEB**




Competitor

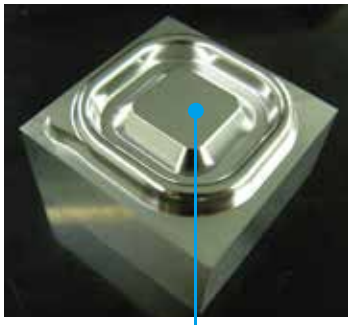



| | |
|---|---|
| Tool Overhang: 23 mm | Spindle Speed: 16,000 $min^{-1}$ |
| Feed Rate: 3,380 mm/min | Axial Depth: 0.6 mm |
| Radial Depth: 1.8 mm | Coolant: Water Soluble (Nozzle) |
| Cycle Time: 120 min | Milling Shape: Tapered Circle x 40 pockets |
| Pocket Size: R12 mm (top) x Depth 17 mm (Pocket tapered angle: 10°) | |

* Refer to page 579 for tool geometry.

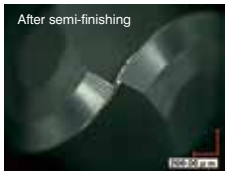
# Milling Example: HPM38 (53HRC) Plastic Mold

## ◆Optimized Ball Tip Effect



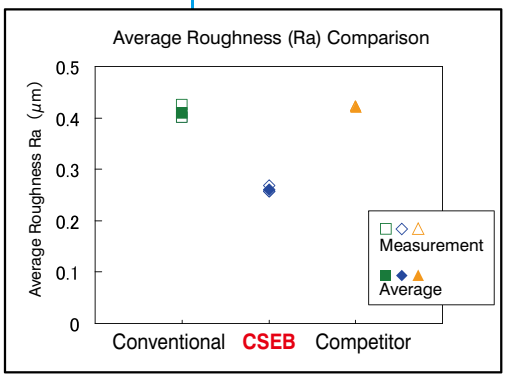
CSEB 2040-0600

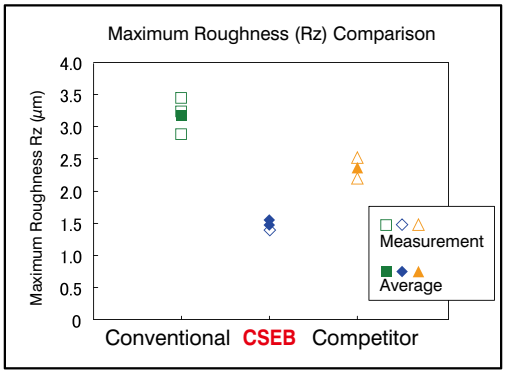
CSEB 2020-0300




CSEB 2010-0150

Work Size
50 mm × 50 mm × 30 mm




Optimized ball tip offers outstandingly nano-smooth surface on finishing.

| No | Milling Process | Tool (Radius of Ball Nose × Length of Cut) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth $a_p$ (mm) | Radial Depth $a_e$ (mm) | Overhang Length (mm) | Cycle Time (min) | Coolant |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | CSEB 2040-0600 (R2×6) | 11,000 | 2,000 | 0.34 | 1 | 15 | 0:31:21 | Air Blow |
| 2 | Semi-finishing | CSEB 2020-0300 (R1×3) | 16,000 | 1,300 | 0.17 | 0.5 | 13 | 0:03:10 | Air Blow |
| 3 | | | 16,000 | 1,300 | 0.1 | 0.1 | 13 | 0:16:47 | Air Blow |
| 4 | | | 16,000 | 1,300 | 0.01 | 0.1 | 13 | 0:37:00 | Oil Mist |
| 5 | Finishing | CSEB 2010-0150 (R0.5×1.5) | 22,000 | 1,300 | 0.04 | 0.18 | 12 | 0:05:06 | Oil Mist |
| 6 | | | 22,000 | 700 | 0.05 | 0.05 | 12 | 0:59:36 | Oil Mist |
| 7 | | | 22,000 | 700 | 0.01 | 0.05 | 12 | 0:30:43 | Oil Mist |

## Size R0.5～R6

# DCB

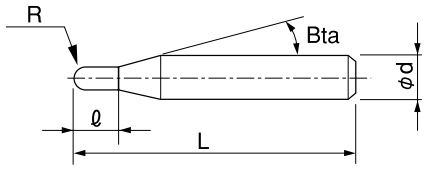
MG DIA 35° R ±0.01 Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |

## Features

**Diamond coated 2 Flute Ball End Mills for Graphite Electrodes.**
**New diamond coating, with a highly adhesive base layer, offers excellent wear resistance and longer tool life.**




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

Total 9 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **DCB 2010** | R0.5 | 5 | 16° | 60 | 4 | 16,000 |
| **DCB 2020** | R1 | 10 | 16° | 70 | 4 | 17,000 |
| **DCB 2030** | R1.5 | 15 | 16° | 80 | 4 | 21,000 |
| **DCB 2040** | R2 | 20 | — | 100 | 4 | 24,000 |
| **DCB 2050** | R2.5 | 20 | — | 100 | 5 | 28,000 |
| **DCB 2060** | R3 | 30 | — | 150 | 6 | 41,500 |
| **DCB 2080** | R4 | 40 | — | 150 | 8 | 45,000 |
| **DCB 2100** | R5 | 50 | — | 180 | 10 | 57,500 |
| **DCB 2120** | R6 | 55 | — | 180 | 12 | 87,500 |

## Milling Conditions for DCB

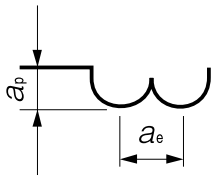
| WORK MATERIAL | | GRAPHITE | | | |
|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2010** | **R0.5** | 10,000 | 140 | 0.1 | 0.3 |
| **2020** | **R1** | 10,000 | 300 | 0.2 | 0.6 |
| **2030** | **R1.5** | 10,000 | 900 | 0.3 | 0.9 |
| **2040** | **R2** | 10,000 | 900 | 0.4 | 1.2 |
| **2050** | **R2.5** | 10,000 | 1,200 | 0.5 | 1.5 |
| **2060** | **R3** | 10,000 | 1,460 | 0.6 | 1.8 |
| **2080** | **R4** | 7,500 | 1,350 | 0.8 | 2.4 |
| **2100** | **R5** | 6,000 | 1,440 | 1 | 3 |
| **2120** | **R6** | 5,000 | 1,400 | 1.2 | 3.6 |

◆ High speed milling

| WORK MATERIAL | | GRAPHITE | | | |
|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2010** | **R0.5** | 50,000 | 700 | 0.1 | 0.3 |
| **2020** | **R1** | 45,000 | 1,350 | 0.2 | 0.6 |
| **2030** | **R1.5** | 30,000 | 2,700 | 0.3 | 0.9 |
| **2040** | **R2** | 22,500 | 2,025 | 0.4 | 1.2 |
| **2050** | **R2.5** | 18,000 | 2,160 | 0.5 | 1.5 |
| **2060** | **R3** | 15,000 | 2,190 | 0.6 | 1.8 |
| **2080** | **R4** | 11,500 | 2,300 | 0.8 | 2.4 |
| **2100** | **R5** | 9,000 | 2,340 | 1 | 3 |
| **2120** | **R6** | 7,500 | 2,250 | 1.2 | 3.6 |

Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

For 3D milling / Finishing
Milling Amount (mm)
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




**DCB Series**
**Aluminum:A7075**
**Milling Video**

**DCB Series**
**Graphite:TTK-5(80HS)**
**Milling Video**

Size **R0.2～R6**

# CGB2000

MG | 35° | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

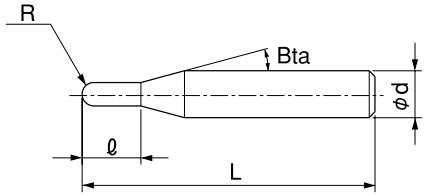
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | |

## Features

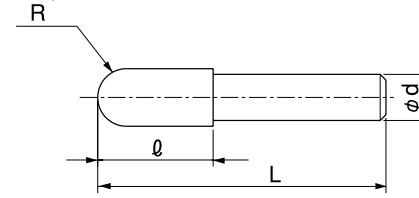
**Designed for milling Graphite.**
**The chosen carbide grade offers excellent resistance to wear and abrasion.**
**Refer to page 432 for 4 flute CGB.**

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece. Actual measurement is necessary when using longer length of cut than the written length.

Shape A




Shape B




Total 15 models

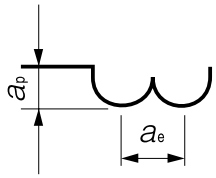
Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter ϕd | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|
| **CGB 2004** | R0.2 | 0.8 | 16° | 60 | 4 | A | 11,000 |
| **CGB 2006** | R0.3 | 1.2 | 16° | 60 | 4 | A | 11,000 |
| **CGB 2010** | R0.5 | 5 | 16° | 60 | 4 | A | 11,000 |
| **CGB 2015** | R0.75 | 5 | 16° | 60 | 4 | A | 11,000 |
| **CGB 2020** | R1 | 10 | 16° | 70 | 4 | A | 12,700 |
| **CGB 2025** | R1.25 | 10 | 16° | 70 | 4 | A | 12,700 |
| **CGB 2030** | R1.5 | 15 | 16° | 80 | 4 | A | 15,600 |
| **CGB 2040** | R2 | 20 | — | 100 | 4 | A | 18,600 |
| **CGB 2050** | R2.5 | 20 | — | 100 | 5 | A | 18,900 |
| **CGB 2060** | R3 | 30 | — | 150 | 6 | A | 21,420 |
| **CGB 2070** | R3.5 | 30 | — | 150 | 6 | B | 24,050 |
| **CGB 2080** | R4 | 40 | — | 150 | 8 | A | 27,170 |
| **CGB 2100** | R5 | 50 | — | 180 | 10 | A | 35,420 |
| **CGB 2110** | R5.5 | 50 | — | 180 | 10 | B | 38,060 |
| **CGB 2120** | R6 | 55 | — | 200 | 12 | A | 41,470 |

## Milling Conditions for CGB（2 Flutes）

| WORK MATERIAL | | GRAPHITE | | | |
|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2004** | **R0.2** | 15,000 | 60～90 | 0.12 | 0.28 |
| **2006** | **R0.3** | 15,000 | 90～130 | 0.18 | 0.42 |
| **2010** | **R0.5** | 15,000 | 150～220 | 0.3 | 0.7 |
| **2015** | **R0.75** | 15,000 | 240～360 | 0.45 | 1.05 |
| **2020** | **R1** | 15,000 | 300～450 | 0.6 | 1.4 |
| **2025** | **R1.25** | 15,000 | 550～800 | 0.75 | 1.75 |
| **2030** | **R1.5** | 15,000 | 900～1,350 | 0.9 | 2.1 |
| **2040** | **R2** | 15,000 | 900～1,350 | 1.2 | 2.8 |
| **2050** | **R2.5** | 15,000 | 1,200～1,800 | 1.5 | 3.5 |
| **2060** | **R3** | 15,000 | 1,500～2,200 | 1.8 | 4.2 |
| **2070** | **R3.5** | 9,100 | 1,500～2,200 | 2.1 | 4.9 |
| **2080** | **R4** | 8,000 | 1,500～2,200 | 2.4 | 5.6 |
| **2100** | **R5** | 6,500 | 1,500～2,200 | 3 | 7 |
| **2110** | **R5.5** | 6,000 | 1,500～2,200 | 3.3 | 7.7 |
| **2120** | **R6** | 5,300 | 1,500～2,200 | 3.6 | 8.4 |

For 3D milling / Finishing
Milling Amount（mm）
$a_p$ = 0.3D
$a_e$ = 0.7D
$a_p$ : Axial Depth（mm）
$a_e$ : Radial Depth（mm）
D : Outside Diameter（mm）




Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

## Size R0.3～R6

# CFB

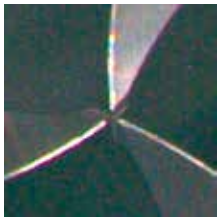
Super MG | UT COAT | 30° | R ±0.005 (R0.3～R1.5) | R ±0.007 (R2～R3) | R ±0.01 (R4～R6) | Shank Dia 0/-0.005 | Variable Pitch

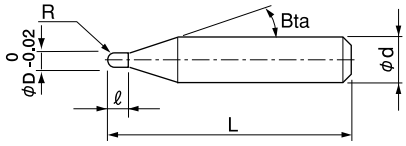
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | ○ | | ◎ | ◎ | | |

## Features

**3 flute design offers high feed milling, reducing cycle times when roughing.**
**Capable of deep milling that raises machine efficiency, even with complicated shapes that require slow feeds. Variable pitch design minimizes tool chattering.**
**Broad range of applications from Copper and Raw Materials to Hardened Steels (55HRC).**
**The original design features help to promote excellent chip evacuation and surface finishing on tools over R0.75 mm.**
**Diameter Tolerance: 0/-0.02**






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

Total 14 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| CFB 3006-0090 | R0.3 | 0.9 | 16° | 50 | 4 | 6,890 |
| CFB 3008-0120 | R0.4 | 1.2 | 16° | 50 | 4 | 6,720 |
| CFB 3010-0150 | R0.5 | 1.5 | 16° | 50 | 4 | 6,230 |
| CFB 3015-0225 | R0.75 | 2.25 | 16° | 50 | 4 | 6,890 |
| CFB 3020-0300 | R1 | 3 | 16° | 50 | 4 | 6,720 |
| CFB 3030-0450 | R1.5 | 4.5 | 16° | 60 | 6 | 6,890 |
| CFB 3040-0600-4 | R2 | 6 | — | 70 | 4 | 6,560 |
| CFB 3040-0600 | | | 16° | 70 | 6 | 6,890 |
| CFB 3050-0750 | R2.5 | 7.5 | 16° | 80 | 6 | 7,790 |
| CFB 3060-0900 | R3 | 9 | — | 80 | 6 | 8,610 |
| CFB 3080-1200 | R4 | 12 | — | 90 | 8 | 12,300 |
| CFB 3080-1200LS | | | | 120 | 8 | 13,940 |
| CFB 3100-1500 | R5 | 15 | — | 100 | 10 | 16,320 |
| CFB 3120-1800 | R6 | 18 | — | 110 | 12 | 20,660 |

# Milling Conditions for CFB

◆Roughing

| WORK MATERIAL | | COPPER / ALUMINUM ALLOYS C1100 / A5052 / A7075 (～225HB) | | | | ALLOY STEELS / PREHARDENED STEELS S45C / S50C / SKD / NAK (～45HRC) | | | | HARDENED STEELS STAVAX / SKD61 (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coolant | | DRY(Unsuitable for Aluminum Alloys) / WET | | | | DRY / WET | | | | DRY | | | |
| Model Number | Radius of Ball Nose (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) |
| **3006-0090** | **R0.3** | 30,000 | 1,000 | 0.03 | 0.13 | 30,000 | 1,000 | 0.03 | 0.13 | 30,000 | 700 | 0.03 | 0.13 |
| **3008-0120** | **R0.4** | 30,000 | 1,250 | 0.04 | 0.17 | 30,000 | 1,250 | 0.04 | 0.17 | 30,000 | 850 | 0.04 | 0.17 |
| **3010-0150** | **R0.5** | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,000 | 0.05 | 0.21 |
| **3015-0225** | **R0.75** | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 1,700 | 0.075 | 0.32 |
| **3020-0300** | **R1** | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 2,500 | 0.2 | 0.6 |
| **3030-0450** | **R1.5** | 24,000 | 4,000 | 0.3 | 0.9 | 24,000 | 4,000 | 0.3 | 0.9 | 21,600 | 2,700 | 0.3 | 0.9 |
| **3040-0600** | **R2** | 18,000 | 4,000 | 0.4 | 1.2 | 18,000 | 4,000 | 0.4 | 1.2 | 16,200 | 2,700 | 0.4 | 1.2 |
| **3050-0750** | **R2.5** | 15,000 | 4,000 | 0.5 | 1.5 | 15,000 | 4,000 | 0.5 | 1.5 | 13,500 | 2,700 | 0.5 | 1.5 |
| **3060-0900** | **R3** | 12,000 | 4,000 | 0.6 | 1.8 | 12,000 | 4,000 | 0.6 | 1.8 | 10,800 | 2,700 | 0.6 | 1.8 |
| **3080-1200(LS)** | **R4** | 9,000 | 4,000 | 0.8 | 2.4 | 9,000 | 4,000 | 0.8 | 2.4 | 8,100 | 2,700 | 0.75 | 2.1 |
| **3100-1500** | **R5** | 7,200 | 4,000 | 1 | 3 | 7,200 | 4,000 | 1 | 3 | 6,500 | 2,700 | 0.85 | 2.5 |
| **3120-1800** | **R6** | 6,000 | 4,000 | 1.2 | 3.6 | 6,000 | 4,000 | 1.2 | 3.6 | 5,400 | 2,700 | 0.95 | 3 |

| WORK MATERIAL | | TITANIUM ALLOYS / STAINLESS STEELS Ti-6A l-4V / SUS | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Coolant | | DRY(Unsuitable for Aluminum Alloys)/ WET | | | | WET | | | |
| Model Number | Radius of Ball Nose (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) |
| **3006-0090** | **R0.3** | 20,000 | 1,000 | 0.015 | 0.09 | 10,000 | 250 | 0.015 | 0.09 |
| **3008-0120** | **R0.4** | 20,000 | 1,250 | 0.02 | 0.12 | 10,000 | 310 | 0.02 | 0.12 |
| **3010-0150** | **R0.5** | 20,000 | 1,500 | 0.025 | 0.15 | 10,000 | 375 | 0.025 | 0.15 |
| **3015-0225** | **R0.75** | 20,000 | 2,500 | 0.035 | 0.22 | 10,000 | 625 | 0.035 | 0.22 |
| **3020-0300** | **R1** | 24,000 | 4,000 | 0.1 | 0.4 | 12,000 | 1,000 | 0.1 | 0.4 |
| **3030-0450** | **R1.5** | 16,000 | 4,000 | 0.15 | 0.65 | 8,000 | 1,000 | 0.15 | 0.65 |
| **3040-0600** | **R2** | 12,000 | 4,000 | 0.2 | 0.85 | 6,000 | 1,000 | 0.2 | 0.85 |
| **3050-0750** | **R2.5** | 10,000 | 4,000 | 0.25 | 1 | 5,000 | 1,000 | 0.25 | 1 |
| **3060-0900** | **R3** | 8,000 | 4,000 | 0.3 | 1.3 | 4,000 | 1,000 | 0.3 | 1.3 |
| **3080-1200(LS)** | **R4** | 6,000 | 4,000 | 0.4 | 1.7 | 3,000 | 900 | 0.35 | 1.6 |
| **3100-1500** | **R5** | 4,800 | 4,000 | 0.5 | 2.1 | 2,400 | 800 | 0.4 | 1.9 |
| **3120-1800** | **R6** | 4,000 | 4,000 | 0.6 | 2.6 | 2,000 | 800 | 0.45 | 2.2 |

Apply when a deep tool setting causes the toolholder to extend beyond the full shank diameter and over the taper angle.
Use the table below to adjust the parameters when compensating for extended overhang on the straight type design.

| WORK MATERIAL | COPPER / CARBON STEELS / ALUMINUM ALLOYS S45C, S50C, A5052, A7075 (～225HB) | | | | ALLOY STEELS / PREHARDENED STEELS SKD / NAK (～45HRC) | | | | HARDENED STEELS STAVAX / SKD61 (45～55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Overhang Length | Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth |
| ～3D | ×1 | ×1～1.5(※) | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 |
| 4D | ×0.9 | ×0.9～1.2(※) | ×1 | ×1 | ×0.9 | ×0.9 | ×1 | ×1 | ×0.9 | ×0.9 | ×1 | ×1 |
| 5D | ×0.75 | ×0.75 | ×1 | ×1 | ×0.75 | ×0.75 | ×0.9 | ×0.9 | ×0.75 | ×0.75 | ×0.85 | ×0.9 |
| 6D | ×0.6 | ×0.6 | ×1 | ×1 | ×0.6 | ×0.6 | ×0.85 | ×0.9 | ×0.6 | ×0.6 | ×0.8 | ×0.85 |
| 7D | ×0.45 | ×0.4 | ×0.95 | ×0.95 | ×0.45 | ×0.4 | ×0.8 | ×0.85 | ×0.45 | ×0.4 | ×0.7 | ×0.8 |
| 8D | ×0.35 | ×0.3 | ×0.9 | ×0.9 | ×0.35 | ×0.3 | ×0.7 | ×0.8 | ×0.35 | ×0.3 | ×0.6 | ×0.75 |

| WORK MATERIAL | TITANIUM ALLOYS / STAINLESS STEELS Ti-6A l-4V / SUS | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|
| Overhang Length | Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth | Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth |
| ～3D | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 | ×1 |
| 4D | ×0.9 | ×0.9 | ×1 | ×1 | ×0.9 | ×0.9 | ×1 | ×1 |
| 5D | ×0.75 | ×0.75 | ×0.95 | ×0.95 | ×0.75 | ×0.75 | ×0.85 | ×0.9 |
| 6D | ×0.6 | ×0.6 | ×0.9 | ×0.9 | ×0.6 | ×0.6 | ×0.8 | ×0.85 |
| 7D | ×0.45 | ×0.4 | ×0.85 | ×0.9 | ×0.45 | ×0.4 | ×0.7 | ×0.8 |
| 8D | ×0.35 | ×0.3 | ×0.85 | ×0.85 | ×0.35 | ×0.3 | ×0.6 | ×0.75 |

(※)For high efficiency milling, set the feed rate higher. For improved surface finish and/or longer tool life, reduce the feed rate.

## Milling Conditions for CFB

◆Finishing (overhang length ~6D)

| WORK MATERIAL | | COPPER / CARBON STEELS / ALUMINUM ALLOYS S45C / S50C / A5052 / A7075 (~225HB) | | | | ALLOY STEELS / HARDENED STEELS SKD / NAK (~45HRC) | | | | HARDENED STEELS STAVAX / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coolant | | WET | | | | DRY / OIL MIST / WET | | | | DRY / OIL MIST | | | |
| Model Number | Radius of Ball Nose (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) |
| **3020-0300** | **R1** | 53,000 | 4,000 | 0.05 | 0.04 | 45,000 | 3,400 | 0.05 | 0.04 | 36,800 | 2,200 | 0.05 | 0.04 |
| **3030-0450** | **R1.5** | 41,200 | 4,200 | 0.06 | 0.06 | 35,000 | 3,500 | 0.06 | 0.06 | 28,600 | 2,300 | 0.06 | 0.06 |
| **3040-0600** | **R2** | 29,400 | 4,400 | 0.08 | 0.08 | 24,000 | 3,700 | 0.08 | 0.08 | 20,400 | 2,400 | 0.08 | 0.08 |
| **3060-0900** | **R3** | 17,600 | 4,600 | 0.1 | 0.12 | 14,000 | 3,900 | 0.1 | 0.12 | 12,300 | 2,600 | 0.1 | 0.12 |
| **3080-1200** | **R4** | 14,600 | 4,600 | 0.1 | 0.16 | 12,400 | 3,900 | 0.1 | 0.16 | 10,200 | 2,600 | 0.1 | 0.16 |
| **3100-1500** | **R5** | 11,700 | 4,700 | 0.1 | 0.2 | 9,900 | 4,000 | 0.1 | 0.2 | 8,200 | 2,600 | 0.1 | 0.2 |
| **3120-1800** | **R6** | 8,800 | 4,800 | 0.1 | 0.24 | 7,400 | 4,000 | 0.1 | 0.24 | 6,200 | 2,700 | 0.1 | 0.24 |

| WORK MATERIAL | | TITANIUM ALLOYS / STAINLESS STEELS Ti-6A l-4V / SUS | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Coolant | | WET | | | | WET | | | |
| Model Number | Radius of Ball Nose (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) |
| **3020-0300** | **R1** | 44,200 | 2,700 | 0.05 | 0.04 | 22,100 | 1,100 | 0.05 | 0.04 |
| **3030-0450** | **R1.5** | 34,400 | 2,800 | 0.06 | 0.06 | 17,200 | 1,100 | 0.06 | 0.06 |
| **3040-0600** | **R2** | 24,600 | 3,000 | 0.08 | 0.08 | 12,300 | 1,200 | 0.08 | 0.08 |
| **3060-0900** | **R3** | 14,800 | 3,200 | 0.1 | 0.12 | 7,400 | 1,300 | 0.1 | 0.12 |
| **3080-1200** | **R4** | 12,300 | 3,200 | 0.1 | 0.16 | 6,200 | 1,300 | 0.1 | 0.16 |
| **3100-1500** | **R5** | 9,900 | 3,200 | 0.1 | 0.2 | 5,000 | 1,300 | 0.1 | 0.2 |
| **3120-1800** | **R6** | 7,500 | 3,300 | 0.1 | 0.24 | 3,800 | 1,400 | 0.1 | 0.24 |

*When finishing with an overhang of over 6 x D, fine adjustments are recommended.

## Milling Conditions for CFB

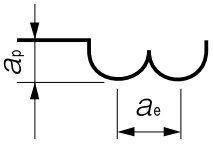
◆Deep and high efficiency roughing（3xD overhang for straight type）

This parameter is effective in using the machine that has low acceleration and applying complex milling path that repeats accelerating/braking frequently.

| WORK MATERIAL | | COPPER / CARBON STEELS / ALUMINUM ALLOYS S45C / S50C / A5052 / A7075 (～225HB) | | | | ALLOY STEELS / HARDENED STEELS SKD / NAK (～45HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Coolant | | DRY（Unsuitable for Aluminum Alloys）/ WET | | | | DRY / WET | | | |
| Model Number | Radius of Ball Nose (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) |
| **3020-0300** | **R1** | 30,000 | 2,500 | 0.4 | 0.8 | 30,000 | 2,500 | 0.4 | 0.8 |
| **3030-0450** | **R1.5** | 20,000 | 2,500 | 0.6 | 1.2 | 20,000 | 2,500 | 0.6 | 1.2 |
| **3040-0600** | **R2** | 15,000 | 2,500 | 0.8 | 1.6 | 15,000 | 2,500 | 0.8 | 1.6 |
| **3060-0900** | **R3** | 10,000 | 2,500 | 1.2 | 2.4 | 10,000 | 2,500 | 1.2 | 2.4 |
| **3080-1200** | **R4** | 7,100 | 2,350 | 1.6 | 3.2 | 7,100 | 2,350 | 1.6 | 3.2 |
| **3100-1500** | **R5** | 5,400 | 2,250 | 2 | 4 | 5,400 | 2,250 | 2 | 4 |
| **3120-1800** | **R6** | 4,500 | 2,250 | 2.4 | 4.8 | 4,500 | 2,250 | 2.4 | 4.8 |

| WORK MATERIAL | | HARDENED STEELS STAVAX / SKD61 (45～55HRC) | | | | TITANIUM ALLOYS / STAINLESS STEELS Ti-6A l-4V / SUS | | | |
|---|---|---|---|---|---|---|---|---|---|
| Coolant | | DRY | | | | WET | | | |
| Model Number | Radius of Ball Nose (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) |
| **3020-0300** | **R1** | 24,000 | 1,500 | 0.4 | 0.8 | 19,200 | 2,000 | 0.2 | 0.6 |
| **3030-0450** | **R1.5** | 16,000 | 1,500 | 0.6 | 1.2 | 12,800 | 2,000 | 0.3 | 0.9 |
| **3040-0600** | **R2** | 12,000 | 1,500 | 0.8 | 1.6 | 9,600 | 2,000 | 0.4 | 1.2 |
| **3060-0900** | **R3** | 8,000 | 1,500 | 1.2 | 2.4 | 6,400 | 2,000 | 0.6 | 1.8 |
| **3080-1200** | **R4** | 5,600 | 1,400 | 1.5 | 3 | 4,800 | 2,000 | 0.8 | 2.4 |
| **3100-1500** | **R5** | 4,300 | 1,300 | 1.7 | 3.5 | 3,900 | 2,000 | 1 | 3 |
| **3120-1800** | **R6** | 3,550 | 1,300 | 1.9 | 4.2 | 3,200 | 2,000 | 1.2 | 3.6 |

$a_p$ : Axial Depth（mm）
$a_e$ : Radial Depth（mm）




Note:
- Fix the work piece firmly, and use a machine that has high rigidity and generates a low level of vibration especially under high efficienct deep milling condition in roughing process.
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- Decrease both spindle speed and feed rate 10% for slope milling.
- Decrease both spindle speed and feed rate to meet required precision and to prevent the shank making contact with the work piece.
- DRY: air blow, WET: water soluble or oil coolant.
- A long overhang may cause tool deflection, leaving uncut material.

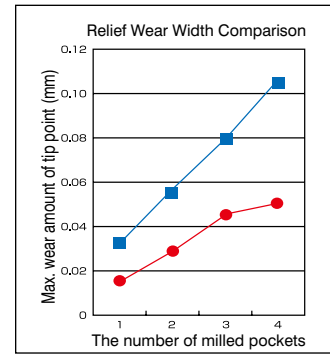
**CFB Series SKD61(47HRC) Milling Video**

## CFB combines roughing and finishing all in one tool.

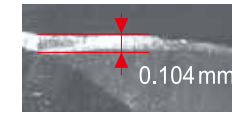
## Milling Example: Wear Comparison

Work Material: S50C Annealed Materials
Tool: CFB 3060-0900 (R3, Length of Cut 9 mm)
Competitor's 3 Flute Ball (R3, Length of Cut 9 mm)

| | Roughing | Semi-finishing | Finishing |
|---|---|---|---|
| Spindle Speed | 12,000 $min^{-1}$ | 12,000 $min^{-1}$ | 30,000 $min^{-1}$ |
| Feed Rate | 6,000 mm/min | 6,000 mm/min | 4,000 mm/min |
| Axial Depth $a_p$ | 0.6 mm | 0.7 mm | 0.12 mm |
| Radial Depth $a_e$ | 3 mm | 0.7 mm | 0.12 mm |
| Cycle Time | 5 min | 2 min | 17 min |
| Coolant | Air Blow | | |
| Pocket Size | 55 mm x 50 mm x Depth 23 mm | | |
| Cycle Time/Pocket | 24 min/pocket (4 pockets: 96 min) | | |




Competitor



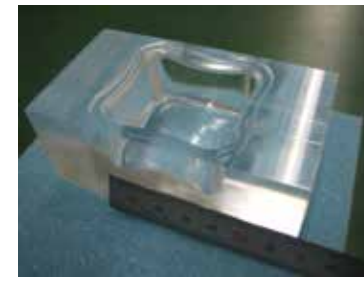

CFB

Relief Wear Width
CFB : 0.050 mm
Competitor : 0.104 mm
2 x More Tool Life!

## Milling Example: Acrylic Milling

Work Material: Acrylic
Tool: CFB 3060-0900 (R3, Length of Cut 9 mm)

| | Roughing | Semi-finishing | Finishing |
|---|---|---|---|
| Spindle Speed | 12,000 $min^{-1}$ | 12,000 $min^{-1}$ | 30,000 $min^{-1}$ |
| Feed Rate | 6,000 mm/min | 6,000 mm/min | 4,000 mm/min |
| Axial Depth $a_p$ | 0.6 mm | 0.7 mm | 0.12 mm |
| Radial Depth $a_e$ | 3.0 mm | 0.7 mm | 0.12 mm |
| Cycle Time | 5 min | 2 min | 17 min |
| Coolant | Water Soluble | | |
| Pocket Size | 55 mm x 50 mm x Depth 23 mm | | |
| Cycle Time | 24 min | | |



Mirror Surface Finish! Outstanding Transparency!

Size **R0.3～R6**

# DLC-CFB

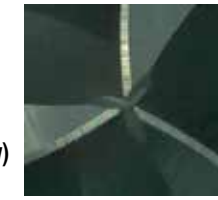
Super MG | DLC | 30° | R ±0.005 (R0.3～R1.5) | R ±0.007 (R2～R3) | R ±0.01 (R4～R6) | Shank Dia 0/-0.005 | Variable Pitch

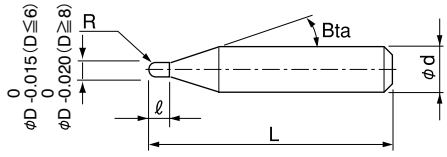
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ☆ | | ○ | ○ | | | | | |

## Features

**Achieves dramatically higher feed rates with 3 flutes, shortening roughing time.**
**DLC coating offers excellent welding and wear resistance.**
**Offers highly efficient milling even for a slow-moving shape, with deep cut milling.**
**3 flute variable pitch design reduces chattering.**
**The 3 slots at the tip offers chip evacuation and improved surface finish. (Except R0.75 or below)**






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

Total 14 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| DLC-CFB 3006-0090 | R0.3 | 0.9 | 16° | 50 | 4 | 7,220 |
| DLC-CFB 3008-0120 | R0.4 | 1.2 | 16° | 50 | 4 | 7,040 |
| DLC-CFB 3010-0150 | R0.5 | 1.5 | 16° | 50 | 4 | 6,540 |
| DLC-CFB 3015-0225 | R0.75 | 2.25 | 16° | 50 | 4 | 7,220 |
| DLC-CFB 3020-0300 | R1 | 3 | 16° | 50 | 4 | 7,040 |
| DLC-CFB 3030-0450 | R1.5 | 4.5 | 16° | 60 | 6 | 7,220 |
| DLC-CFB 3040-0600-4 | R2 | 6 | — | 70 | 4 | 6,880 |
| DLC-CFB 3040-0600 | | | 16° | 70 | 6 | 7,220 |
| DLC-CFB 3050-0750 | R2.5 | 7.5 | 16° | 80 | 6 | 8,170 |
| DLC-CFB 3060-0900 | R3 | 9 | — | 80 | 6 | 9,030 |
| DLC-CFB 3080-1200 | R4 | 12 | — | 90 | 8 | 12,900 |
| DLC-CFB 3080-1200LS | | | | 120 | 8 | 14,600 |
| DLC-CFB 3100-1500 | R5 | 15 | — | 100 | 10 | 17,100 |
| DLC-CFB 3120-1800 | R6 | 18 | — | 110 | 12 | 21,600 |

# Milling Conditions for DLC-CFB

## ◆Roughing

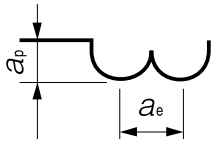
| WORK MATERIAL | | ALUMINUM ALLOYS A5052 etc. | | | | ALUMINUM ALLOYS A7075 etc. | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **3006-0090** | **R0.3** | 30,000 | 1,200 | 0.03 | 0.13 | 30,000 | 1,000 | 0.03 | 0.13 |
| **3008-0120** | **R0.4** | 30,000 | 1,500 | 0.04 | 0.17 | 30,000 | 1,250 | 0.04 | 0.17 |
| **3010-0150** | **R0.5** | 30,000 | 1,800 | 0.05 | 0.21 | 30,000 | 1,500 | 0.05 | 0.21 |
| **3015-0225** | **R0.75** | 30,000 | 3,000 | 0.075 | 0.32 | 30,000 | 2,500 | 0.075 | 0.32 |
| **3020-0300** | **R1** | 30,000 | 3,840 | 0.2 | 0.6 | 30,000 | 3,200 | 0.2 | 0.6 |
| **3030-0450** | **R1.5** | 24,000 | 4,800 | 0.3 | 0.9 | 24,000 | 4,000 | 0.3 | 0.9 |
| **3040-0600(-4)** | **R2** | 18,000 | 4,800 | 0.4 | 1.2 | 18,000 | 4,000 | 0.4 | 1.2 |
| **3050-0750** | **R2.5** | 15,000 | 4,800 | 0.5 | 1.5 | 15,000 | 4,000 | 0.5 | 1.5 |
| **3060-0900** | **R3** | 12,000 | 4,800 | 0.6 | 1.8 | 12,000 | 4,000 | 0.6 | 1.8 |
| **3080-1200(LS)** | **R4** | 9,000 | 4,800 | 0.8 | 2.4 | 9,000 | 4,000 | 0.8 | 2.4 |
| **3100-1500** | **R5** | 7,200 | 4,800 | 1 | 3 | 7,200 | 4,000 | 1 | 3 |
| **3120-1800** | **R6** | 6,000 | 4,800 | 1.2 | 3.6 | 6,000 | 4,000 | 1.2 | 3.6 |

Apply when a deep tool setting causes the tool holder to extend beyond the full shank diameter and over the taper angle.
Use the table below to adjust the parameters when compensating for extended overhang on the straight type design.

| WORK MATERIAL | ALUMINUM ALLOYS A5052, A7075 | | | |
|---|---|---|---|---|
| Overhang Length | Spindle Speed | Feed Rate | $a_p$ Axial Depth | $a_e$ Radial Depth |
| ~3D | ×1 | ×1~1.5(※) | ×1 | ×1 |
| 4D | ×0.9 | ×0.9~1.2(※) | ×1 | ×1 |
| 5D | ×0.75 | ×0.75 | ×1 | ×1 |
| 6D | ×0.6 | ×0.6 | ×1 | ×1 |
| 7D | ×0.45 | ×0.4 | ×0.95 | ×0.95 |
| 8D | ×0.35 | ×0.3 | ×0.9 | ×0.9 |

(※)For high efficiency milling, set the feed rate higher. For improved surface finish and/or longer tool life, reduce the feed rate.

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)



## Milling Conditions for DLC-CFB

### ◆Finishing (overhang length ~6D)

| WORK MATERIAL | | ALUMINUM ALLOYS A5052 | | | | ALUMINUM ALLOYS A7075 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (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) |
| **3020-0300** | **R1** | 53,000 | 4,800 | 0.05 | 0.04 | 53,000 | 4,000 | 0.05 | 0.04 |
| **3030-0450** | **R1.5** | 42,100 | 5,040 | 0.06 | 0.06 | 42,100 | 4,200 | 0.06 | 0.06 |
| **3040-0600** | **R2** | 29,400 | 5,280 | 0.08 | 0.08 | 29,400 | 4,400 | 0.08 | 0.08 |
| **3060-0900** | **R3** | 17,600 | 5,520 | 0.1 | 0.12 | 17,600 | 4,600 | 0.1 | 0.12 |
| **3080-1200** | **R4** | 14,600 | 5,520 | 0.1 | 0.2 | 14,600 | 4,600 | 0.1 | 0.2 |
| **3100-1500** | **R5** | 11,700 | 5,640 | 0.1 | 0.2 | 11,700 | 4,700 | 0.1 | 0.2 |
| **3120-1800** | **R6** | 8,800 | 5,760 | 0.1 | 0.24 | 8,800 | 4,800 | 0.1 | 0.24 |

Adjustments are recommended when finishing with an overhang of over 6 x D.

### ◆Deep and high efficiency roughing (overhang length ~3D for straight type)

This parameter is effective in using the machine that has low acceleration and applying complex milling path that repeats accelerating/braking frequently.

| WORK MATERIAL | | ALUMINUM ALLOYS A5052 | | | | ALUMINUM ALLOYS A7075 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (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) |
| **3020-0300** | **R1** | 30,000 | 3,000 | 0.4 | 0.8 | 30,000 | 2,500 | 0.4 | 0.8 |
| **3030-0450** | **R1.5** | 20,000 | 3,000 | 0.6 | 1.2 | 20,000 | 2,500 | 0.6 | 1.2 |
| **3040-0600** | **R2** | 15,000 | 3,000 | 0.8 | 1.6 | 15,000 | 2,500 | 0.8 | 1.6 |
| **3060-0900** | **R3** | 10,000 | 3,000 | 1.2 | 2.4 | 10,000 | 2,500 | 1.2 | 2.4 |
| **3080-1200** | **R4** | 7,100 | 2,820 | 1.6 | 3.2 | 7,100 | 2,350 | 1.6 | 3.2 |
| **3100-1500** | **R5** | 5,400 | 2,700 | 2 | 4 | 5,400 | 2,250 | 2 | 4 |
| **3120-1800** | **R6** | 4,500 | 2,700 | 2.4 | 4.8 | 4,500 | 2,250 | 2.4 | 4.8 |

Note:
- Fix the work piece firmly, and use a machine that has high rigidity and generates a low level of vibration especially under high efficienct deep milling condition in roughing process.
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- Decrease both spindle speed and feed rate 10% for slope milling.
- Decrease both spindle speed and feed rate to meet required precision and to prevent the shank making contact with the work piece.
- Recommend water soluble or oil coolant.
- A long overhang may cause tool deflection, leaving uncut material.

## Mold Milling Example for Plastic Container
## DLC-CFB R4 × Length of Cut 12

A5052

Work Size：130 x 105 x 95 mm
Pocket Size：φ 80.5 x Depth 25 mm
Coolant：Water Soluble（Through Spindle）

Tool after milling

**More tool life left**

| No. | Milling Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Allowance (mm) | Milling Spot | Cycle Time (h:min) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | DLC-CFB 3080-1200 | 8,100 | 4,320 | 0.8 | 2.4 | 0.01 | Pocket & Half Pocket | 1:05 |
| 2 | Finishing | | | | 0.0001 (Cusp Height) | 0.05 | 0 | Pocket | 2:58 |
| | | | | | | | | Total | 4:03 |

## Size R1～R6

# HFB

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

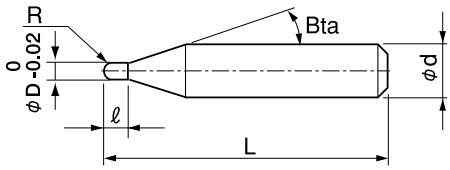
Patented in Japan, China, Korea, Taiwan, Germany, Switzerland, and Liechtenstein

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | ◎ | ◎ | ◎ | | | | | | | | | | |

## Features

**Dramatically improved the milling efficiency. Maximum 27 times higher chip evacuation compared to conventional tool.**
**New ball tip design offers polish-less bottom surface finishing.**
**Affordable pricing.**
**Diameter Tolerance: 0/-0.02**




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

Total 8 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **HFB 4020-0300** | R1 | 3 | 16° | 50 | 4 | 6,720 |
| **HFB 4020-0300-6** | R1 | 3 | 16° | 50 | 6 | 7,790 |
| **HFB 4030-0450** | R1.5 | 4.5 | 16° | 60 | 6 | 6,890 |
| **HFB 4040-0600** | R2 | 6 | 16° | 70 | 6 | 6,890 |
| **HFB 4060-0900** | R3 | 9 | — | 80 | 6 | 8,610 |
| **HFB 4080-1200** | R4 | 12 | — | 90 | 8 | 12,300 |
| **HFB 4100-1500** | R5 | 15 | — | 100 | 10 | 16,320 |
| **HFB 4120-1800** | R6 | 18 | — | 110 | 12 | 20,660 |

## Size R1～R6

### HFB Short Shank

# HFB-S

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

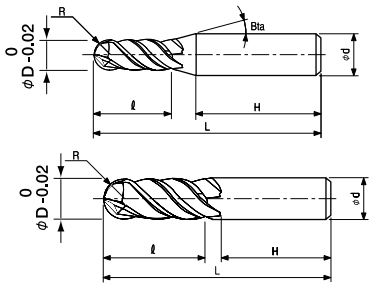
Patented in Japan, China, Korea, Taiwan, Germany, Switzerland, and Liechtenstein

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | ◎ | ◎ | ◎ | | | | | | | | | | |

## Features

**Compatible with shrink-fit toolholder systems for high efficiency.**
**A shorter overhang offers higher feed rates and pecision.**
**Diameter Tolerance: 0/-0.02**




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

Total 7 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shank Length H | Price ¥ |
|---|---|---|---|---|---|---|---|
| **HFB 4020-0300S** | R1 | 3 | 16° | 40 | 4 | 31.0 | 6,720 |
| **HFB 4030-0450S** | R1.5 | 4.5 | 16° | 40 | 4 | 30.5 | 6,890 |
| **HFB 4040-0600S** | R2 | 6 | 16° | 45 | 6 | 32.5 | 6,890 |
| **HFB 4060-0900S** | R3 | 9 | — | 50 | 6 | 34.5 | 8,610 |
| **HFB 4080-1200S** | R4 | 12 | — | 60 | 8 | 40.5 | 12,300 |
| **HFB 4100-1500S** | R5 | 15 | — | 60 | 10 | 35.5 | 16,320 |
| **HFB 4120-1800S** | R6 | 18 | — | 60 | 12 | 31.5 | 20,660 |

## Milling Conditions for HFB / HFB-S

◆Roughing

| WORK MATERIAL | | PREHARDENED STEELS NAK80 (35~45HRC) Coolant: Water Soluble / Air Blow / Oil Mist | | | | HARDENED STEELS STAVAX / SKD61 (45~55HRC) Coolant: Air Blow / Oil Mist | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (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) |
| **4020-0300** | **R1** | 20,000 | 1,500 | 0.5 | 0.8 | 16,000 | 1,500 | 0.6 | 0.9 |
| **4030-0450** | **R1.5** | 16,000 | 2,000 | 0.6 | 0.9 | 10,500 | 1,500 | 0.9 | 1.35 |
| **4040-0600** | **R2** | 15,000 | 3,000 | 0.4 | 0.8 | 9,000 | 3,000 | 0.7 | 1.4 |
| **4060-0900** | **R3** | 9,000 | 2,500 | 0.5 | 1 | 8,000 | 3,500 | 0.6 | 1.8 |
| **4080-1200** | **R4** | CFB Series are Recommended | | | | 6,200 | 3,000 | 0.75 | 2.1 |
| **4100-1500** | **R5** | | | | | 4,500 | 2,700 | 0.85 | 2.5 |
| **4120-1800** | **R6** | | | | | 3,750 | 2,700 | 0.95 | 3 |

| WORK MATERIAL | | HARDENED STEELS YXR33 / SKD11 (55~60HRC) Coolant: Air Blow / Oil Mist | | | | HARDENED STEELS HAP10 / SKD11 / YXR7 (60~65HRC) Coolant: Air Blow / Oil Mist | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (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) |
| **4020-0300** | **R1** | 10,000 | 1,500 | 0.4 | 0.8 | 8,500 | 1,200 | 0.3 | 0.7 |
| **4030-0450** | **R1.5** | 6,500 | 1,500 | 0.6 | 1.2 | 5,500 | 1,200 | 0.5 | 1.1 |
| **4040-0600** | **R2** | 5,500 | 1,750 | 0.6 | 1.2 | 6,200 | 2,000 | 0.45 | 1 |
| **4060-0900** | **R3** | 4,500 | 1,750 | 0.6 | 1.5 | 5,000 | 2,000 | 0.45 | 1.2 |
| **4080-1200** | **R4** | 3,750 | 1,500 | 0.7 | 1.75 | 4,500 | 1,800 | 0.5 | 1.4 |
| **4100-1500** | **R5** | 3,000 | 1,500 | 0.75 | 2 | 3,600 | 1,800 | 0.6 | 1.6 |
| **4120-1800** | **R6** | 2,500 | 1,500 | 0.9 | 2.4 | 3,000 | 1,800 | 0.7 | 1.8 |

| WORK MATERIAL | | HARDENED STEELS HAP72 (65~70HRC) Coolant: Air Blow / Oil Mist | | | |
|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4020-0300** | **R1** | 10,500 | 750 | 0.2 | 0.6 |
| **4030-0450** | **R1.5** | 7,000 | 750 | 0.25 | 0.8 |
| **4040-0600** | **R2** | 7,500 | 1,200 | 0.2 | 0.6 |
| **4060-0900** | **R3** | 5,000 | 1,500 | 0.3 | 0.9 |
| **4080-1200** | **R4** | 4,000 | 1,500 | 0.3 | 1 |
| **4100-1500** | **R5** | 3,000 | 1,500 | 0.3 | 1.2 |
| **4120-1800** | **R6** | 2,500 | 1,300 | 0.3 | 1.4 |

## Milling Conditions for HFB / HFB-S

Please adjust milling parameter according to overhang length, referring to the following table.



### Radius of Ball Nose R1（φ4 shank), R1.5

| Overhang Length | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| φD×5 or below | ×1 | ×1 | ×1 | ×1 |
| ～φD×6 | ×0.9 | ×0.9 | ×0.95 | ×0.95 |
| ～φD×7 | ×0.8 | ×0.8 | ×0.9 | ×0.95 |
| ～φD×8 | ×0.7 | ×0.7 | ×0.85 | ×0.9 |
| ～φD×9 | ×0.65 | ×0.6 | ×0.8 | ×0.9 |
| ～φD×10 | ×0.55 | ×0.5 | ×0.75 | ×0.85 |

### Radius of Ball Nose R1（φ6 shank）

| Overhang Length | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| φD×6 | ×1 | ×1 | ×1 | ×1 |
| ～φD×7 | ×0.85 | ×0.9 | ×0.95 | ×0.95 |
| ～φD×8 | ×0.7 | ×0.8 | ×0.9 | ×0.9 |
| ～φD×9 | ×0.55 | ×0.75 | ×0.85 | ×0.9 |
| ～φD×10 | ×0.4 | ×0.65 | ×0.8 | ×0.85 |

### Radius of Ball Nose R1.5（Short shank）

| Overhang Length | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| φD×5 or below | ×1 | ×1 | ×1 | ×1 |
| ～φD×6 | ×0.55 | ×0.3 | ×0.4 | ×0.55 |

### Radius of Ball Nose R2 or above

| Overhang Length | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
|---|---|---|---|---|
| φD×3 or below | ×1 | ×1 | ×1 | ×1 |
| ～φD×3.5 | ×1 | ×0.85 | ×0.85 | ×0.9 |
| ～φD×4 | ×1 | ×0.8 | ×0.7 | ×0.8 |
| ～φD×4.5 | ×0.85 | ×0.55 | ×0.6 | ×0.75 |
| ～φD×5 | ×0.7 | ×0.35 | ×0.6 | ×0.75 |
| ～φD×5.5 | ×0.55 | ×0.25 | ×0.55 | ×0.7 |
| ～φD×6 | ×0.4 | ×0.15 | ×0.5 | ×0.7 |

* Refer to next page for finishing condition.

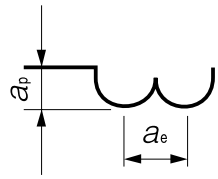
**HFB Series SKD11(60HRC) Milling Video**

## Milling Conditions for HFB / HFB-S

◆Finishing (overhang length ~6D)

| WORK MATERIAL | | PREHARDENED STEELS / HARDENED STEELS (35~60HRC) Coolant: Oil Mist | | | |
|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4020-0300** | **R1** | 26,000 | 2,000 | 0.02 | 0.06 |
| **4030-0450** | **R1.5** | 25,000 | 1,800 | 0.03 | 0.07 |
| **4040-0600** | **R2** | 22,500 | 1,500 | 0.04 | 0.08 |
| **4060-0900** | **R3** | 15,000 | 1,000 | 0.06 | 0.12 |
| **4080-1200** | **R4** | 11,250 | 750 | 0.08 | 0.16 |
| **4100-1500** | **R5** | 9,000 | 600 | 0.1 | 0.2 |
| **4120-1800** | **R6** | 7,500 | 500 | 0.12 | 0.24 |

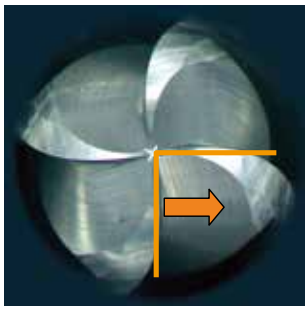
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)



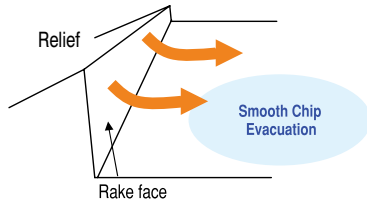

Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
・Adjustments are recommended when finishing with an overhang of over 6xD.
・Recommend air blow or oil mist. For materials under 45HRC, recommend water soluble coolant.

## Feature 1 Special Design Achieves Outstanding Chip Evacuation

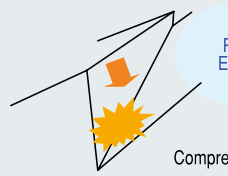
HFB Design



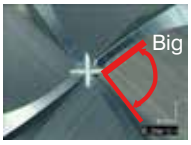
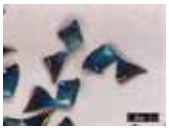
Flat (Non-rolled up) chip shape shows smooth chip evacuation.




Conventional Design



Smooth chip evacuation achieves more stable milling.

| | HFB | Competitor A | Competitor B |
|---|---|---|---|
| Tip Point |   | | |
| Milling Surface | | | |
| Chip Condition |  | | |

| | |
|---|---|
| Tool | R2 |
| Work Material | YXR33 (58HRC) |
| Spindle Speed | 6,000 min$^{-1}$ |
| Feed Rate | 2,400 mm/min<br>(Slotting : 1,200 mm/min) |
| Axial Depth $a_p$ | 1 mm (0.25D) |
| Radial Depth $a_e$ | 1 mm (0.25D) |
| Overhang Length | 15 mm |
| Coolant | Air Blow (Through Spindle) |
| Pocket Size | 100 mm × 20 mm × 6 mm<br>(X × Y × Z) |
| Cycle Time | 28.2 min |

D : Outside Diameter

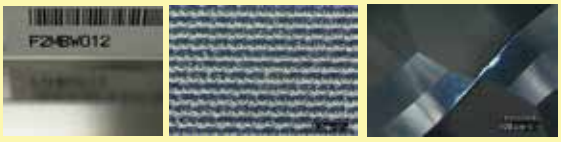
The large pocket design of the HFB promotes better chip evacuation and longer tool life when compared to a conventional design which shows premature damage.

## Feature 2 Polish-less Milling by 4 Tip Grooves

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

HFB R3
Max Roughness
Rz: 0.9 μm

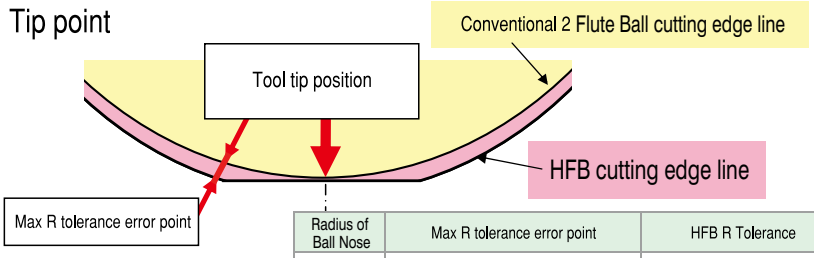
Conventional
2 Flutes
Max Roughness
Rz: 6.43 μm



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

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

Tip point




| Radius of Ball Nose | Max R tolerance error point | HFB R Tolerance |
|---|---|---|
| R2・R3 | + 5 μm or below | ± 7 μm |
| R4・R5 | + 7 μm or below | ± 10 μm |
| R6 | + 10 μm or below | |

4 Tip Point Grooves

Smooth chip evacuation reduces damage at the tip.

Size **R2～R10**

# CGB4000

MG | 35° | R ±0.01 | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

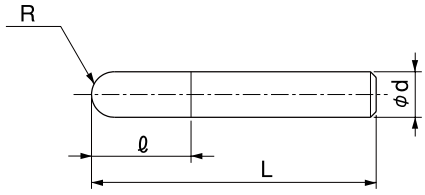
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ○ | | | | |

## Features

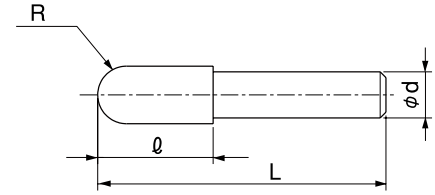
**Designed for milling Graphite.**
**The chosen carbide grade offers excellent wear resistance.**
**Refer to page 414 for 2 flute CGB.**

Actual measurement is necessary when using longer length of cut than the written length.

Shape A




Shape B




Total 9 models

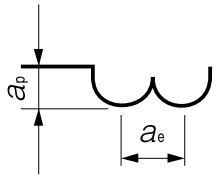
Unit（mm）

| Model Number | Radius of Ball Nose R | Length of Cut ℓ | Overall Length L | Shank Diameter φd | Shape | Price ¥ |
|---|---|---|---|---|---|---|
| **CGB 4040** | R2 | 20 | 100 | 4 | A | 21,900 |
| **CGB 4050** | R2.5 | 20 | 100 | 5 | A | 22,200 |
| **CGB 4060** | R3 | 30 | 150 | 6 | A | 25,200 |
| **CGB 4070** | R3.5 | 30 | 150 | 6 | B | 28,250 |
| **CGB 4080** | R4 | 40 | 150 | 8 | A | 31,900 |
| **CGB 4100** | R5 | 50 | 180 | 10 | A | 39,380 |
| **CGB 4120** | R6 | 55 | 200 | 12 | A | 46,090 |
| **CGB 4160** | R8 | 60 | 200 | 16 | A | 65,010 |
| **CGB 4200** | R10 | 60 | 250 | 20 | A | 98,560 |

## Milling Conditions for CGB（4 Flutes）

| WORK MATERIAL | | GRAPHITE | | | |
|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **4040** | **R2** | 15,000 | 1,350～1,600 | 1.2 | 2.8 |
| **4050** | **R2.5** | 15,000 | 1,350～1,600 | 1.5 | 3.5 |
| **4060** | **R3** | 15,000 | 1,900～2,300 | 1.8 | 4.2 |
| **4070** | **R3.5** | 9,000 | 1,900～2,300 | 2.1 | 4.9 |
| **4080** | **R4** | 8,000 | 1,900～2,300 | 2.4 | 5.6 |
| **4100** | **R5** | 6,500 | 2,000～2,500 | 3 | 7 |
| **4120** | **R6** | 5,300 | 2,000～2,500 | 3.6 | 8.4 |
| **4160** | **R8** | 4,000 | 2,000～2,500 | 4.8 | 11.2 |
| **4200** | **R10** | 3,200 | 2,000～2,500 | 6 | 14 |

For 3D milling / Finishing
Milling Amount（mm）
$a_p$ = 0.3D
$a_e$ = 0.7D
$a_p$：Axial Depth（mm）
$a_e$：Radial Depth（mm）
D ：Outside Diameter（mm）




Note:
・Use a milling machine dedicated for Graphite.
・Recommend air blow for Graphite.

## Size R0.1～R1

# UPDLB

Binderless PCD | 0° | R ±0.005 | Shank Dia 0/-0.005

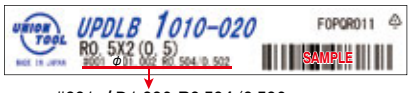
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | | | | | | ☆ | ◎ |

## Features

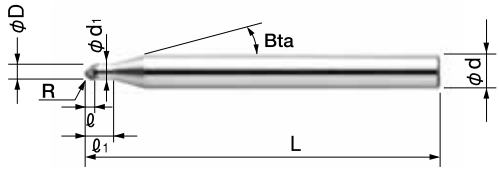
**Long Neck Ball type End Mills for finishing of Cemented Carbide and Hard Brittle Materials.**
**Provides excellent machined surface quality due to the sharp cutting edge and optimized edge treatment.**
**Maintains excellent dimensional accuracy for a long time due to the high contour accuracy of the cutting edge and the excellent wear resistance of diamonds.**

Label Sample




#001 φD1.002 R0.504/0.502

Diameter and Ball R accuracy measurements are printed on the label to support high precision milling.




Be sure to confirm the interference between the inclined work piece and the shank part by actual measurement.

Total 5 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **UPDLB 1002-004** | R0.1 | 0.4 | 0.1 | 0.18 | 16° | 40 | 4 | Open price |
| **UPDLB 1004-008** | R0.2 | 0.8 | 0.2 | 0.38 | 16° | 40 | 4 | Open price |
| **UPDLB 1006-010** | R0.3 | 1 | 0.3 | 0.58 | 16° | 40 | 4 | Open price |
| **UPDLB 1010-020** | R0.5 | 2 | 0.5 | 0.95 | 16° | 40 | 4 | Open price |
| **UPDLB 1020-030** | R1 | 3 | 1 | 1.95 | 16° | 40 | 4 | Open price |

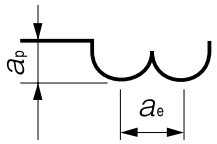
# Milling Conditions for UPDLB

For finishing of bottom surface

| WORK MATERIAL | | | CEMENTED CARBIDE | | | |
|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **1002-004** | **R0.1** | 0.4 | 40,000 | 100 | 0.001 | 0.001 |
| **1004-008** | **R0.2** | 0.8 | 40,000 | 150 | 0.001 | 0.001 |
| **1006-010** | **R0.3** | 1 | 40,000 | 200 | 0.001 | 0.001 |
| **1010-020** | **R0.5** | 2 | 40,000 | 400 | 0.001 | 0.003 |
| **1020-030** | **R1** | 3 | 40,000 | 600 | 0.001 | 0.005 |

For Profile milling

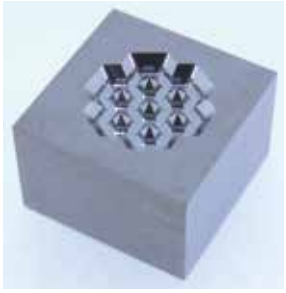
| WORK MATERIAL | | | CEMENTED CARBIDE | | | |
|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **1002-004** | **R0.1** | 0.4 | 40,000 | 100 | 0.001 | 0.001 |
| **1004-008** | **R0.2** | 0.8 | 40,000 | 150 | 0.002 | 0.001 |
| **1006-010** | **R0.3** | 1 | 40,000 | 200 | 0.003 | 0.001 |
| **1010-020** | **R0.5** | 2 | 40,000 | 400 | 0.005 | 0.003 |
| **1020-030** | **R1** | 3 | 40,000 | 600 | 0.01 | 0.005 |




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Note:
- Use a machine with high accuracy for stable cutting.
- Non-water soluble coolant recommended. Supply as a mist or external coolant. Take fire prevention precautions to avoid fire hazards caused by sparks igniting during machinig or tool breakage.
- Shorten overhang as much as possible.
- Adjust cutting conditions as necessary as machine spec and other conditions may vary.
- These cutting parameters show reference value. Adjust the cutting conditions to the desired machined surface finish.

## UPDLB Milling Example for Finishing UDCBF / UPDLB R0.5
## Cemented Carbide VF-20 (92.5HRA)



Milling Area : 10.2 × 10.2× Depth 1.4 mm
Work Size : 20 × 20 × 10 mm

After Finishing

| Milling Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Allowance (mm) | Coolant | Cycle Time |
|---|---|---|---|---|---|---|---|---|
| Roughing | UDCBF 2010-0070 (R0.5 x Length of Cut 0.7) | 30,000 | 300 | 0.05 | 0.25 | 0.005 | Air Blow | 30 min |
| Semi-finishing | | 30,000 | 300 | 0.001 (Cusp Height) | 0.06321 | 0.005 | | 12 min |
| Finishing | UPDLB 1010-020 (R0.5 x Effective Length 2) | 40,000 | 400 | 0.0035 | 0.00495 | 0 | Oil Mist | 1 h 30 min |

## Size R0.05～R3

# HGLB

Super MG | HMG COAT | 30° | R ±0.002 (R0.05～R0.075) | R ±0.003 (R0.1～R2) | R ±0.005 (R2.5～R3) | Shank Dia 0/-0.004 | Back Taper Geometry

Additional 61 models

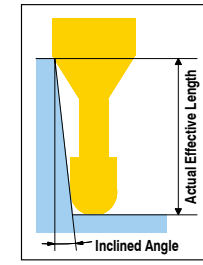
～ Except for R0.4 or below. ℓ1 / D ≦ 10

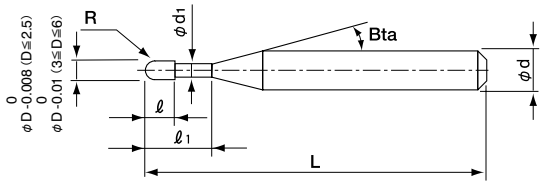
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | ○ | ◎ | ◎ | ◎ | | | | | | | | | | |

## Features

**Developed to achieve long tool life and high precision milling on hard materials.**
**A combination of the new "HMGCOAT" and new carbide material offer a higher wear resistance compared to conventional end mills.**
**Also new design with improved breakage resistance offers high precision diameter tolerance, radius accuracy and shank diameter tolerance.**




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

## High Precision Diameter Tolerance / Radius Accuracy / Shank Diameter Tolerance

### HSLB Tolerance

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.03 ～ R0.075 | 0/-0.01 | ±0.002 | 0/-0.005 (h5) |
| R0.1 ～ R3 | 0/-0.015 | ±0.005 | |

### HGLB Tolerance

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.05 ～ R0.075 | 0/-0.008 | ± 0.002 | 0/-0.004 (h4) |
| R0.1 ～ R1.25 | | ±0.003 | |
| R1.5 ～ R2 | 0/-0.01 | | |
| R2.5 ～ R3 | | ±0.005 | |

**Shank diameter tolerance h4!**

Total 155 models

Unit (mm)

| | Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| ※ | HGLB 2001-002 | R0.05 | 0.2 | 0.08 | 0.095 | 16° | 45 | 4 | 12,360 | 0.22 | 0.24 | 0.26 | 0.28 | 0.31 |
| ※ | HGLB 2001-003 | | 0.3 | | | | 45 | 4 | 12,360 | 0.33 | 0.36 | 0.38 | 0.40 | 0.44 |
| ※ | HGLB 2001-005 | | 0.5 | | | | 45 | 4 | 13,440 | 0.55 | 0.58 | 0.61 | 0.64 | 0.68 |
| ※ | HGLB 20015-003 | R0.075 | 0.3 | 0.12 | 0.14 | 16° | 45 | 4 | 14,400 | 0.35 | 0.37 | 0.39 | 0.41 | 0.44 |
| ※ | HGLB 20015-005 | | 0.5 | | | | 45 | 4 | 15,240 | 0.56 | 0.59 | 0.62 | 0.64 | 0.69 |
| ※ | HGLB 20015-0075 | | 0.75 | | | | 45 | 4 | 16,020 | 0.83 | 0.86 | 0.90 | 0.93 | 1.00 |
| ※ | HGLB 20015-010 | | 1 | | | | 45 | 4 | 16,020 | 1.09 | 1.13 | 1.17 | 1.21 | 1.30 |
| | HGLB 2002-003 | R0.1 | 0.3 | 0.16 | 0.19 | 16° | 45 | 4 | 8,640 | 0.42 | 0.44 | 0.46 | 0.48 | 0.52 |
| | HGLB 2002-005 | | 0.5 | | | | 45 | 4 | 8,640 | 0.63 | 0.66 | 0.68 | 0.71 | 0.76 |
| ※ | HGLB 2002-0075 | | 0.75 | | | | 45 | 4 | 8,640 | 0.89 | 0.93 | 0.96 | 0.99 | 1.07 |
| | HGLB 2002-010 | | 1 | | | | 45 | 4 | 8,640 | 1.15 | 1.20 | 1.24 | 1.28 | 1.37 |
| | HGLB 2002-015 | | 1.5 | | | | 45 | 4 | 9,360 | 1.66 | 1.72 | 1.78 | 1.84 | 1.97 |
| ※ | HGLB 2002-020 | | 2 | | | | 45 | 4 | 10,440 | 2.18 | 2.25 | 2.33 | 2.41 | 2.58 |
| | HGLB 2003-005 | R0.15 | 0.5 | 0.24 | 0.29 | 16° | 45 | 4 | 8,520 | 0.63 | 0.65 | 0.68 | 0.70 | 0.75 |
| | HGLB 2003-0075 | | 0.75 | | | | 45 | 4 | 8,520 | 0.89 | 0.92 | 0.96 | 0.99 | 1.05 |
| | HGLB 2003-010 | | 1 | | | | 45 | 4 | 8,520 | 1.15 | 1.19 | 1.23 | 1.27 | 1.36 |
| | HGLB 2003-015 | | 1.5 | | | | 45 | 4 | 9,120 | 1.66 | 1.72 | 1.77 | 1.83 | 1.96 |
| | HGLB 2003-020 | | 2 | | | | 45 | 4 | 9,120 | 2.18 | 2.25 | 2.32 | 2.40 | 2.57 |
| ※ | HGLB 2003-025 | | 2.5 | | | | 45 | 4 | 9,360 | 2.70 | 2.78 | 2.87 | 2.97 | 3.18 |
| | HGLB 2003-030 | | 3 | | | | 45 | 4 | 9,360 | 3.21 | 3.32 | 3.42 | 3.54 | 3.80 |
| | HGLB 2004-005 | R0.2 | 0.5 | 0.32 | 0.39 | 16° | 45 | 4 | 5,880 | 0.63 | 0.65 | 0.67 | 0.70 | 0.74 |
| | HGLB 2004-0075 | | 0.75 | | | | 45 | 4 | 5,880 | 0.89 | 0.92 | 0.95 | 0.98 | 1.04 |
| | HGLB 2004-010 | | 1 | | | | 45 | 4 | 5,880 | 1.15 | 1.19 | 1.23 | 1.26 | 1.35 |
| ※ | HGLB 2004-010-6 | | 1 | | | | 50 | 6 | 8,640 | 1.15 | 1.19 | 1.23 | 1.26 | 1.35 |
| | HGLB 2004-0125 | | 1.25 | | | | 45 | 4 | 6,000 | 1.40 | 1.45 | 1.49 | 1.54 | 1.64 |
| | HGLB 2004-015 | | 1.5 | | | | 45 | 4 | 6,000 | 1.66 | 1.71 | 1.77 | 1.82 | 1.95 |
| ※ | HGLB 2004-015-6 | | 1.5 | | | | 50 | 6 | 8,740 | 1.66 | 1.71 | 1.77 | 1.82 | 1.95 |
| | HGLB 2004-020 | | 2 | | | | 45 | 4 | 6,120 | 2.18 | 2.25 | 2.32 | 2.39 | 2.56 |
| ※ | HGLB 2004-020-6 | | 2 | | | | 50 | 6 | 9,000 | 2.18 | 2.25 | 2.32 | 2.39 | 2.56 |
| | HGLB 2004-025 | | 2.5 | | | | 45 | 4 | 6,360 | 2.70 | 2.78 | 2.87 | 2.96 | 3.17 |
| ※ | HGLB 2004-025-6 | | 2.5 | | | | 50 | 6 | 9,240 | 2.70 | 2.78 | 2.87 | 2.96 | 3.17 |
| | HGLB 2004-030 | | 3 | | | | 45 | 4 | 6,720 | 3.21 | 3.31 | 3.42 | 3.53 | 3.79 |
| ※ | HGLB 2004-030-6 | | 3 | | | | 50 | 6 | 9,850 | 3.21 | 3.31 | 3.42 | 3.53 | 3.79 |
| ※ | HGLB 2004-035 | | 3.5 | | | | 45 | 4 | 7,320 | 3.73 | 3.84 | 3.97 | 4.10 | 4.40 |
| | HGLB 2004-040 | | 4 | | | | 45 | 4 | 7,320 | 4.24 | 4.38 | 4.52 | 4.67 | 5.01 |
| | HGLB 2005-010 | R0.25 | 1 | 0.4 | 0.49 | 16° | 45 | 4 | 5,880 | 1.15 | 1.19 | 1.22 | 1.26 | 1.34 |
| | HGLB 2005-015 | | 1.5 | | | | 45 | 4 | 5,880 | 1.65 | 1.71 | 1.76 | 1.82 | 1.94 |
| | HGLB 2005-020 | | 2 | | | | 45 | 4 | 5,880 | 2.18 | 2.24 | 2.31 | 2.39 | 2.55 |
| | HGLB 2005-025 | | 2.5 | | | | 45 | 4 | 5,880 | 2.69 | 2.78 | 2.86 | 2.96 | 3.16 |
| | HGLB 2005-030 | | 3 | | | | 45 | 4 | 5,880 | 3.21 | 3.31 | 3.41 | 3.53 | 3.77 |
| ※ | HGLB 2005-035 | | 3.5 | | | | 45 | 4 | 5,880 | 3.73 | 3.84 | 3.96 | 4.09 | 4.39 |
| | HGLB 2005-040 | | 4 | | | | 45 | 4 | 5,880 | 4.24 | 4.37 | 4.51 | 4.66 | 5.00 |
| ※ | HGLB 2005-045 | | 4.5 | | | | 45 | 4 | 6,000 | 4.76 | 4.91 | 5.06 | 5.23 | 5.61 |
| | HGLB 2005-050 | | 5 | | | | 45 | 4 | 6,000 | 5.27 | 5.44 | 5.61 | 5.80 | 6.22 |
| | HGLB 2005-060 | | 6 | | | | 45 | 4 | 6,120 | 6.30 | 6.50 | 6.71 | 6.94 | 7.45 |

※Additional model

Next Page ➡

Unit (mm)

| | Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| | HGLB 2006-010 | R0.3 | 1 | 0.48 | 0.59 | 16° | 45 | 4 | 5,040 | 1.14 | 1.18 | 1.22 | 1.25 | 1.33 |
| | HGLB 2006-015 | | 1.5 | | | | 45 | 4 | 4,560 | 1.65 | 1.71 | 1.76 | 1.81 | 1.93 |
| ※ | HGLB 2006-015-6 | | 1.5 | | | | 50 | 6 | 6,890 | 1.65 | 1.71 | 1.76 | 1.81 | 1.93 |
| | HGLB 2006-020 | | 2 | | | | 45 | 4 | 4,560 | 2.17 | 2.24 | 2.31 | 2.38 | 2.54 |
| ※ | HGLB 2006-020-6 | | 2 | | | | 50 | 6 | 6,960 | 2.17 | 2.24 | 2.31 | 2.38 | 2.54 |
| | HGLB 2006-025 | | 2.5 | | | | 45 | 4 | 4,680 | 2.69 | 2.77 | 2.86 | 2.95 | 3.15 |
| ※ | HGLB 2006-025-6 | | 2.5 | | | | 50 | 6 | 6,890 | 2.69 | 2.77 | 2.86 | 2.95 | 3.15 |
| | HGLB 2006-030 | | 3 | | | | 45 | 4 | 4,680 | 3.21 | 3.31 | 3.41 | 3.52 | 3.76 |
| ※ | HGLB 2006-030-6 | | 3 | | | | 50 | 6 | 7,080 | 3.21 | 3.31 | 3.41 | 3.52 | 3.76 |
| ※ | HGLB 2006-035 | | 3.5 | | | | 45 | 4 | 4,800 | 3.72 | 3.84 | 3.96 | 4.09 | 4.38 |
| | HGLB 2006-040 | | 4 | | | | 45 | 4 | 4,800 | 4.24 | 4.37 | 4.51 | 4.66 | 4.99 |
| ※ | HGLB 2006-045 | | 4.5 | | | | 45 | 4 | 4,800 | 4.76 | 4.90 | 5.06 | 5.23 | 5.60 |
| | HGLB 2006-050 | | 5 | | | | 45 | 4 | 4,800 | 5.27 | 5.44 | 5.61 | 5.80 | 6.21 |
| ※ | HGLB 2006-055 | | 5.5 | | | | 45 | 4 | 4,800 | 5.79 | 5.97 | 6.16 | 6.37 | 6.82 |
| | HGLB 2006-060 | | 6 | | | | 45 | 4 | 4,800 | 6.30 | 6.50 | 6.71 | 6.93 | 7.43 |
| | HGLB 2006-080 | | 8 | | | | 45 | 4 | 6,360 | 8.37 | 8.63 | 8.91 | 9.21 | 9.88 |
| ※ | HGLB 2006-100 | | 10 | | | | 45 | 4 | 6,480 | 10.43 | 10.76 | 11.11 | 11.49 | 12.33 |
| | HGLB 2008-020 | R0.4 | 2 | 0.64 | 0.79 | 16° | 45 | 4 | 4,560 | 2.17 | 2.23 | 2.30 | 2.37 | 2.52 |
| ※ | HGLB 2008-025 | | 2.5 | | | | 45 | 4 | 4,800 | 2.69 | 2.77 | 2.85 | 2.94 | 3.13 |
| ※ | HGLB 2008-030 | | 3 | | | | 45 | 4 | 4,800 | 3.21 | 3.30 | 3.40 | 3.50 | 3.74 |
| | HGLB 2008-040 | | 4 | | | | 45 | 4 | 4,800 | 4.24 | 4.36 | 4.50 | 4.64 | 4.97 |
| ※ | HGLB 2008-050 | | 5 | | | | 45 | 4 | 4,800 | 5.27 | 5.43 | 5.60 | 5.78 | 6.19 |
| | HGLB 2008-060 | | 6 | | | | 45 | 4 | 4,800 | 6.30 | 6.49 | 6.70 | 6.92 | 7.41 |
| ※ | HGLB 2008-070 | | 7 | | | | 45 | 4 | 4,800 | 7.33 | 7.56 | 7.80 | 8.06 | 8.64 |
| | HGLB 2008-080 | | 8 | | | | 45 | 4 | 4,800 | 8.36 | 8.62 | 8.90 | 9.20 | 9.86 |
| | HGLB 2010-020 | R0.5 | 2 | 0.8 | 0.98 | 16° | 45 | 4 | 3,840 | 2.18 | 2.24 | 2.30 | 2.36 | 2.51 |
| ※ | HGLB 2010-020-6 | | 2 | | | | 50 | 6 | 6,120 | 2.18 | 2.24 | 2.30 | 2.36 | 2.51 |
| | HGLB 2010-025 | | 2.5 | | | | 45 | 4 | 3,840 | 2.70 | 2.77 | 2.85 | 2.93 | 3.12 |
| | HGLB 2010-030 | | 3 | | | | 45 | 4 | 3,840 | 3.21 | 3.30 | 3.40 | 3.50 | 3.73 |
| ※ | HGLB 2010-030-6 | | 3 | | | | 50 | 6 | 6,120 | 3.21 | 3.30 | 3.40 | 3.50 | 3.73 |
| | HGLB 2010-040 | | 4 | | | | 45 | 4 | 4,320 | 4.24 | 4.37 | 4.50 | 4.64 | 4.96 |
| ※ | HGLB 2010-040-6 | | 4 | | | | 50 | 6 | 6,720 | 4.24 | 4.37 | 4.50 | 4.64 | 4.96 |
| | HGLB 2010-050 | | 5 | | | | 45 | 4 | 4,320 | 5.28 | 5.43 | 5.60 | 5.78 | 6.18 |
| ※ | HGLB 2010-050-6 | | 5 | | | | 50 | 6 | 6,720 | 5.28 | 5.43 | 5.60 | 5.78 | 6.18 |
| | HGLB 2010-060 | | 6 | | | | 45 | 4 | 4,680 | 6.31 | 6.50 | 6.70 | 6.92 | 7.40 |
| ※ | HGLB 2010-060-6 | | 6 | | | | 50 | 6 | 7,080 | 6.31 | 6.50 | 6.70 | 6.92 | 7.40 |
| ※ | HGLB 2010-070 | | 7 | | | | 45 | 4 | 4,680 | 7.34 | 7.56 | 7.80 | 8.06 | 8.63 |
| ※ | HGLB 2010-070-6 | | 7 | | | | 50 | 6 | 7,080 | 7.34 | 7.56 | 7.80 | 8.06 | 8.63 |
| | HGLB 2010-080 | | 8 | | | | 45 | 4 | 4,680 | 8.37 | 8.63 | 8.90 | 9.20 | 9.85 |
| ※ | HGLB 2010-080-6 | | 8 | | | | 50 | 6 | 7,080 | 8.37 | 8.63 | 8.90 | 9.20 | 9.85 |
| | HGLB 2010-100 | | 10 | | | | 45 | 4 | 4,680 | 10.43 | 10.76 | 11.10 | 11.47 | 12.30 |
| ※ | HGLB 2010-100-6 | | 10 | | | | 50 | 6 | 7,080 | 10.43 | 10.76 | 11.10 | 11.47 | 12.30 |
| | HGLB 2010-120 | | 12 | | | | 45 | 4 | 4,680 | 12.50 | 12.89 | 13.30 | 13.75 | 14.75 |
| | HGLB 2010-140 | | 14 | | | | 45 | 4 | 5,400 | 14.56 | 15.02 | 15.51 | 16.03 | 17.19 |
| ※ | HGLB 2010-160 | | 16 | | | | 50 | 4 | 6,360 | 16.62 | 17.15 | 17.71 | 18.31 | 19.64 |

※Additional model

Unit (mm)

| | Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| | HGLB 2015-030 | R0.75 | 3 | 1.2 | 1.47 | 16° | 45 | 4 | 4,440 | 3.10 | 3.18 | 3.26 | 3.35 | 3.55 |
| ※ | HGLB 2015-030-6 | | 3 | | | | 50 | 6 | 7,130 | 3.10 | 3.18 | 3.26 | 3.35 | 3.55 |
| | HGLB 2015-040 | | 4 | | | | 45 | 4 | 4,440 | 4.13 | 4.24 | 4.36 | 4.49 | 4.77 |
| | HGLB 2015-060 | | 6 | | | | 45 | 4 | 4,440 | 6.19 | 6.37 | 6.56 | 6.76 | 7.22 |
| ※ | HGLB 2015-060-6 | | 6 | | | | 50 | 6 | 7,200 | 6.19 | 6.37 | 6.56 | 6.76 | 7.22 |
| | HGLB 2015-080 | | 8 | | | | 45 | 4 | 4,680 | 8.25 | 8.50 | 8.76 | 9.04 | 9.67 |
| ※ | HGLB 2015-080-6 | | 8 | | | | 50 | 6 | 7,200 | 8.25 | 8.50 | 8.76 | 9.04 | 9.67 |
| | HGLB 2015-100 | | 10 | | | | 45 | 4 | 5,040 | 10.32 | 10.63 | 10.96 | 11.32 | 12.11 |
| ※ | HGLB 2015-100-6 | | 10 | | | | 50 | 6 | 7,200 | 10.32 | 10.63 | 10.96 | 11.32 | 12.11 |
| | HGLB 2015-120 | | 12 | | | | 45 | 4 | 5,400 | 12.38 | 12.76 | 13.16 | 13.60 | 14.56 |
| ※ | HGLB 2015-120-6 | | 12 | | | | 50 | 6 | 8,130 | 12.38 | 12.76 | 13.16 | 13.60 | 14.56 |
| | HGLB 2015-140 | | 14 | | | | 45 | 4 | 5,400 | 14.44 | 14.89 | 15.36 | 15.87 | 17.01 |
| ※ | HGLB 2015-160 | | 16 | | | | 50 | 4 | 5,400 | 16.50 | 17.02 | 17.57 | 18.15 | 19.46 |
| ※ | HGLB 2015-200 | | 20 | | | | 60 | 4 | 5,400 | 20.63 | 21.28 | 21.97 | 22.71 | 24.35 |
| | HGLB 2020-030 | R1 | 3 | 1.6 | 1.98 | 16° | 45 | 4 | 3,840 | 3.07 | 3.14 | 3.21 | 3.29 | 3.47 |
| ※ | HGLB 2020-030-6 | | 3 | | | | 50 | 6 | 6,120 | 3.07 | 3.14 | 3.21 | 3.29 | 3.47 |
| | HGLB 2020-040 | | 4 | | | | 45 | 4 | 3,840 | 4.10 | 4.20 | 4.31 | 4.43 | 4.70 |
| | HGLB 2020-040-6 | | 4 | | | | 50 | 6 | 6,120 | 4.10 | 4.20 | 4.31 | 4.43 | 4.70 |
| | HGLB 2020-060 | | 6 | | | | 45 | 4 | 4,320 | 6.16 | 6.33 | 6.51 | 6.71 | 7.14 |
| | HGLB 2020-060-6 | | 6 | | | | 50 | 6 | 6,600 | 6.16 | 6.33 | 6.51 | 6.71 | 7.14 |
| | HGLB 2020-080 | | 8 | | | | 45 | 4 | 4,680 | 8.23 | 8.46 | 8.72 | 8.99 | 9.59 |
| | HGLB 2020-080-6 | | 8 | | | | 50 | 6 | 7,080 | 8.23 | 8.46 | 8.72 | 8.99 | 9.59 |
| | HGLB 2020-100 | | 10 | | | | 45 | 4 | 4,680 | 10.29 | 10.59 | 10.92 | 11.26 | 12.04 |
| | HGLB 2020-100-6 | | 10 | | | | 50 | 6 | 7,080 | 10.29 | 10.59 | 10.92 | 11.26 | 12.04 |
| | HGLB 2020-120 | | 12 | | | | 45 | 4 | 4,680 | 12.35 | 12.72 | 13.12 | 13.54 | 14.48 |
| | HGLB 2020-120-6 | | 12 | | | | 50 | 6 | 7,080 | 12.35 | 12.72 | 13.12 | 13.54 | 14.48 |
| | HGLB 2020-140 | | 14 | | | | 45 | 4 | 4,680 | 14.41 | 14.85 | 15.32 | 15.82 | 16.93 |
| | HGLB 2020-160 | | 16 | | | | 45 | 4 | 4,680 | 16.48 | 16.98 | 17.52 | 18.10 | 19.38 |
| | HGLB 2020-200 | | 20 | | | | 60 | 4 | 4,680 | 20.60 | 21.24 | 21.92 | 22.65 | No Interference |
| ※ | HGLB 2020-250 | | 25 | | | | 60 | 4 | 6,480 | 25.76 | 26.56 | 27.42 | 28.34 | No Interference |
| ※ | HGLB 2020-300 | | 30 | | | | 70 | 4 | 7,320 | 30.92 | 31.89 | 32.93 | No Interference | No Interference |
| | HGLB 2030-060 | R1.5 | 6 | 2.4 | 2.95 | 16° | 60 | 6 | 4,680 | 6.20 | 6.35 | 6.52 | 6.69 | 7.09 |
| | HGLB 2030-080 | | 8 | | | | 60 | 6 | 4,680 | 8.26 | 8.48 | 8.72 | 8.97 | 9.54 |
| | HGLB 2030-100 | | 10 | | | | 60 | 6 | 5,400 | 10.32 | 10.61 | 10.92 | 11.25 | 11.99 |
| | HGLB 2030-120 | | 12 | | | | 60 | 6 | 5,640 | 12.38 | 12.74 | 13.12 | 13.53 | 14.43 |
| | HGLB 2030-140 | | 14 | | | | 60 | 6 | 6,240 | 14.45 | 14.87 | 15.32 | 15.80 | 16.88 |
| | HGLB 2030-160 | | 16 | | | | 60 | 6 | 6,240 | 16.51 | 17.00 | 17.52 | 18.08 | 19.33 |
| ※ | HGLB 2030-180 | | 18 | | | | 60 | 6 | 6,280 | 18.57 | 19.13 | 19.72 | 20.36 | 21.78 |
| | HGLB 2030-200 | | 20 | | | | 70 | 6 | 6,000 | 20.64 | 21.26 | 21.92 | 22.64 | 24.22 |
| ※ | HGLB 2030-220 | | 22 | | | | 70 | 6 | 6,040 | 22.70 | 23.39 | 24.12 | 24.91 | 26.67 |
| | HGLB 2030-250 | | 25 | | | | 70 | 6 | 6,000 | 25.79 | 26.58 | 27.43 | 28.33 | 30.34 |
| ※ | HGLB 2030-270 | | 27 | | | | 70 | 6 | 6,040 | 27.86 | 28.71 | 29.63 | 30.61 | No Interference |
| | HGLB 2030-300 | | 30 | | | | 70 | 6 | 6,840 | 30.95 | 31.91 | 32.93 | 34.02 | No Interference |

※Additional model

Unit (mm)

| | Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| | **HGLB 2040-080** | R2 | 8 | 3.2 | 3.95 | 16° | 70 | 6 | 4,800 | 8.24 | 8.45 | 8.67 | 8.90 | 9.43 |
| | **HGLB 2040-100** | | 10 | | | | 70 | 6 | 4,800 | 10.31 | 10.58 | 10.87 | 11.18 | 11.88 |
| | **HGLB 2040-120** | | 12 | | | | 70 | 6 | 6,240 | 12.37 | 12.71 | 13.07 | 13.46 | 14.32 |
| | **HGLB 2040-140** | | 14 | | | | 70 | 6 | 6,240 | 14.43 | 14.84 | 15.27 | 15.74 | 16.77 |
| | **HGLB 2040-160** | | 16 | | | | 70 | 6 | 6,240 | 16.49 | 16.97 | 17.47 | 18.01 | 19.22 |
| ※ | **HGLB 2040-180** | | 18 | | | | 70 | 6 | 6,380 | 18.56 | 19.10 | 19.67 | 20.29 | No Interference |
| | **HGLB 2040-200** | | 20 | | | | 70 | 6 | 6,240 | 20.62 | 21.23 | 21.87 | 22.57 | No Interference |
| ※ | **HGLB 2040-220** | | 22 | | | | 70 | 6 | 6,380 | 22.68 | 23.36 | 24.08 | 24.85 | No Interference |
| | **HGLB 2040-250** | | 25 | | | | 70 | 6 | 6,240 | 25.78 | 26.55 | 27.38 | 28.26 | No Interference |
| ※ | **HGLB 2040-270** | | 27 | | | | 70 | 6 | 6,380 | 27.84 | 28.68 | 29.58 | 30.54 | No Interference |
| | **HGLB 2040-300** | | 30 | | | | 70 | 6 | 6,240 | 30.93 | 31.87 | 32.88 | No Interference | No Interference |
| | **HGLB 2040-350** | | 35 | | | | 80 | 6 | 7,200 | 36.09 | 37.20 | 38.38 | No Interference | No Interference |
| ※ | **HGLB 2040-400** | | 40 | | | | 90 | 6 | 8,040 | 41.25 | 42.52 | No Interference | No Interference | No Interference |
| | **HGLB 2060-100** | R3 | 10 | 4.8 | 5.95 | — | 80 | 6 | 7,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| | **HGLB 2060-150** | | 15 | | | | 80 | 6 | 7,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| ※ | **HGLB 2060-180** | | 18 | | | | 80 | 6 | 7,890 | No Interference | No Interference | No Interference | No Interference | No Interference |
| | **HGLB 2060-200** | | 20 | | | | 80 | 6 | 7,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| | **HGLB 2060-250** | | 25 | | | | 80 | 6 | 7,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| | **HGLB 2060-300** | | 30 | | | | 80 | 6 | 8,040 | No Interference | No Interference | No Interference | No Interference | No Interference |
| ※ | **HGLB 2060-350** | | 35 | | | | 80 | 6 | 8,040 | No Interference | No Interference | No Interference | No Interference | No Interference |
| ※ | **HGLB 2060-400** | | 40 | | | | 90 | 6 | 8,760 | No Interference | No Interference | No Interference | No Interference | No Interference |
| ※ | **HGLB 2060-500** | | 50 | | | | 120 | 6 | 9,480 | No Interference | No Interference | No Interference | No Interference | No Interference |

※Additional model

# Milling Conditions for HGLB

| 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) | Effective Length (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) |
| **2001-002** | R0.05 | 0.2 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 150 | 0.003 | 0.006 | 40,000 | 120 | 0.002 | 0.004 |
| **2001-003** | | 0.3 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 150 | 0.003 | 0.006 | 40,000 | 120 | 0.002 | 0.004 |
| **2001-005** | | 0.5 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 200 | 0.005 | 0.01 | 48,000 | 150 | 0.003 | 0.006 | 40,000 | 120 | 0.002 | 0.004 |
| **20015-003** | R0.075 | 0.3 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 170 | 0.005 | 0.01 | 40,000 | 135 | 0.003 | 0.006 |
| **20015-005** | | 0.5 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 170 | 0.005 | 0.01 | 40,000 | 135 | 0.003 | 0.006 |
| **20015-0075** | | 0.75 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 230 | 0.007 | 0.014 | 48,000 | 170 | 0.005 | 0.01 | 40,000 | 135 | 0.003 | 0.006 |
| **20015-010** | | 1 | 38,400 | 160 | 0.005 | 0.01 | 38,400 | 160 | 0.005 | 0.01 | 38,400 | 120 | 0.003 | 0.007 | 32,000 | 90 | 0.002 | 0.004 |
| **2002-003** | R0.1 | 0.3 | 44,000 | 250 | 0.01 | 0.03 | 42,000 | 250 | 0.01 | 0.03 | 40,000 | 200 | 0.008 | 0.024 | 36,000 | 150 | 0.006 | 0.018 |
| **2002-005** | | 0.5 | 44,000 | 250 | 0.01 | 0.03 | 42,000 | 250 | 0.01 | 0.03 | 40,000 | 200 | 0.008 | 0.024 | 36,000 | 150 | 0.006 | 0.018 |
| **2002-0075** | | 0.75 | 44,000 | 250 | 0.01 | 0.03 | 42,000 | 250 | 0.01 | 0.03 | 40,000 | 200 | 0.008 | 0.024 | 36,000 | 150 | 0.006 | 0.018 |
| **2002-010** | | 1 | 44,000 | 250 | 0.01 | 0.03 | 42,000 | 250 | 0.01 | 0.03 | 40,000 | 200 | 0.008 | 0.024 | 36,000 | 150 | 0.006 | 0.018 |
| **2002-015** | | 1.5 | 35,200 | 175 | 0.008 | 0.023 | 33,600 | 175 | 0.008 | 0.023 | 32,000 | 140 | 0.006 | 0.018 | 28,800 | 100 | 0.004 | 0.012 |
| **2002-020** | | 2 | 35,200 | 120 | 0.003 | 0.008 | 33,600 | 100 | 0.003 | 0.008 | 32,000 | 90 | 0.003 | 0.008 | 28,800 | 70 | 0.002 | 0.006 |
| **2003-005** | R0.15 | 0.5 | 44,000 | 400 | 0.01 | 0.03 | 42,000 | 350 | 0.01 | 0.03 | 40,000 | 300 | 0.01 | 0.03 | 36,000 | 250 | 0.008 | 0.024 |
| **2003-0075** | | 0.75 | 44,000 | 400 | 0.01 | 0.03 | 42,000 | 350 | 0.01 | 0.03 | 40,000 | 300 | 0.01 | 0.03 | 36,000 | 250 | 0.008 | 0.024 |
| **2003-010** | | 1 | 44,000 | 400 | 0.01 | 0.03 | 42,000 | 350 | 0.01 | 0.03 | 40,000 | 300 | 0.01 | 0.03 | 36,000 | 250 | 0.008 | 0.024 |
| **2003-015** | | 1.5 | 44,000 | 400 | 0.01 | 0.03 | 42,000 | 350 | 0.01 | 0.03 | 40,000 | 300 | 0.01 | 0.03 | 36,000 | 250 | 0.008 | 0.024 |
| **2003-020** | | 2 | 35,200 | 280 | 0.008 | 0.023 | 33,600 | 245 | 0.008 | 0.023 | 32,000 | 210 | 0.008 | 0.023 | 28,800 | 175 | 0.006 | 0.018 |
| **2003-025** | | 2.5 | 35,200 | 185 | 0.006 | 0.017 | 33,600 | 165 | 0.006 | 0.017 | 32,000 | 150 | 0.006 | 0.017 | 28,800 | 115 | 0.005 | 0.014 |
| **2003-030** | | 3 | 35,200 | 140 | 0.004 | 0.01 | 33,600 | 125 | 0.004 | 0.01 | 32,000 | 110 | 0.004 | 0.01 | 28,800 | 85 | 0.003 | 0.009 |
| **2004-005** | R0.2 | 0.5 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-0075** | | 0.75 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-010** | | 1 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-0125** | | 1.25 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-015** | | 1.5 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-020** | | 2 | 44,000 | 600 | 0.015 | 0.045 | 42,000 | 550 | 0.015 | 0.045 | 40,000 | 500 | 0.013 | 0.036 | 36,000 | 350 | 0.01 | 0.027 |
| **2004-025** | | 2.5 | 35,200 | 420 | 0.011 | 0.034 | 33,600 | 385 | 0.011 | 0.034 | 32,000 | 350 | 0.01 | 0.027 | 28,800 | 250 | 0.008 | 0.02 |
| **2004-030** | | 3 | 35,200 | 330 | 0.008 | 0.024 | 33,600 | 310 | 0.008 | 0.024 | 32,000 | 280 | 0.008 | 0.022 | 28,000 | 200 | 0.006 | 0.016 |
| **2004-035** | | 3.5 | 35,200 | 300 | 0.007 | 0.022 | 31,900 | 280 | 0.007 | 0.022 | 30,400 | 250 | 0.007 | 0.02 | 26,600 | 175 | 0.005 | 0.014 |
| **2004-040** | | 4 | 35,200 | 270 | 0.006 | 0.019 | 30,240 | 250 | 0.006 | 0.019 | 28,800 | 220 | 0.006 | 0.018 | 25,200 | 150 | 0.004 | 0.012 |
| **2005-010** | R0.25 | 1 | 44,000 | 900 | 0.02 | 0.065 | 40,000 | 800 | 0.015 | 0.05 | 36,000 | 600 | 0.015 | 0.05 | 30,000 | 400 | 0.015 | 0.03 |
| **2005-015** | | 1.5 | 44,000 | 900 | 0.02 | 0.065 | 40,000 | 800 | 0.015 | 0.05 | 36,000 | 600 | 0.015 | 0.05 | 30,000 | 400 | 0.015 | 0.03 |
| **2005-020** | | 2 | 44,000 | 900 | 0.02 | 0.065 | 40,000 | 800 | 0.015 | 0.05 | 36,000 | 600 | 0.015 | 0.05 | 30,000 | 400 | 0.015 | 0.03 |
| **2005-025** | | 2.5 | 44,000 | 900 | 0.02 | 0.065 | 40,000 | 800 | 0.015 | 0.05 | 36,000 | 600 | 0.015 | 0.05 | 30,000 | 400 | 0.015 | 0.03 |
| **2005-030** | | 3 | 32,700 | 450 | 0.01 | 0.04 | 31,500 | 400 | 0.01 | 0.03 | 30,000 | 300 | 0.008 | 0.03 | 24,000 | 200 | 0.007 | 0.015 |
| **2005-035** | | 3.5 | 32,700 | 450 | 0.01 | 0.04 | 31,500 | 400 | 0.01 | 0.03 | 30,000 | 300 | 0.008 | 0.03 | 24,000 | 200 | 0.007 | 0.015 |
| **2005-040** | | 4 | 32,700 | 450 | 0.01 | 0.04 | 31,500 | 400 | 0.01 | 0.03 | 30,000 | 300 | 0.008 | 0.03 | 24,000 | 200 | 0.007 | 0.015 |
| **2005-045** | | 4.5 | 29,430 | 405 | 0.008 | 0.03 | 28,350 | 360 | 0.008 | 0.025 | 27,000 | 270 | 0.006 | 0.025 | 21,600 | 180 | 0.005 | 0.013 |
| **2005-050** | | 5 | 26,160 | 360 | 0.005 | 0.02 | 25,200 | 320 | 0.005 | 0.02 | 24,000 | 240 | 0.004 | 0.02 | 19,200 | 160 | 0.003 | 0.01 |
| **2005-060** | | 6 | 26,160 | 360 | 0.005 | 0.02 | 25,200 | 320 | 0.005 | 0.02 | 24,000 | 240 | 0.004 | 0.02 | 19,200 | 160 | 0.003 | 0.01 |

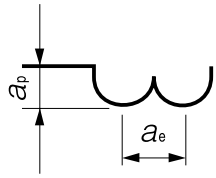
## Milling Conditions for HGLB

| 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) | Effective Length (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) |
| **2006-010** | | 1 | 40,000 | 1,400 | 0.045 | 0.15 | 36,000 | 1,500 | 0.03 | 0.13 | 32,000 | 1,000 | 0.02 | 0.1 | 25,000 | 600 | 0.02 | 0.1 |
| **2006-015** | | 1.5 | 40,000 | 1,400 | 0.03 | 0.13 | 36,000 | 1,300 | 0.03 | 0.13 | 32,000 | 1,000 | 0.02 | 0.1 | 25,000 | 600 | 0.02 | 0.1 |
| **2006-020** | | 2 | 40,000 | 1,400 | 0.03 | 0.13 | 36,000 | 1,300 | 0.03 | 0.13 | 32,000 | 1,000 | 0.02 | 0.1 | 25,000 | 600 | 0.02 | 0.1 |
| **2006-025** | | 2.5 | 40,000 | 1,200 | 0.025 | 0.1 | 36,000 | 1,100 | 0.025 | 0.1 | 32,000 | 900 | 0.02 | 0.1 | 25,000 | 500 | 0.02 | 0.1 |
| **2006-030** | | 3 | 40,000 | 1,200 | 0.025 | 0.1 | 36,000 | 1,100 | 0.025 | 0.1 | 32,000 | 900 | 0.02 | 0.1 | 25,000 | 500 | 0.02 | 0.1 |
| **2006-035** | | 3.5 | 40,000 | 1,100 | 0.023 | 0.09 | 34,000 | 950 | 0.023 | 0.09 | 32,000 | 800 | 0.018 | 0.09 | 25,000 | 450 | 0.015 | 0.09 |
| **2006-040** | **R0.3** | 4 | 40,000 | 1,000 | 0.02 | 0.08 | 32,000 | 800 | 0.02 | 0.08 | 32,000 | 700 | 0.015 | 0.07 | 25,000 | 400 | 0.01 | 0.075 |
| **2006-045** | | 4.5 | 32,000 | 600 | 0.01 | 0.07 | 28,000 | 600 | 0.01 | 0.05 | 25,600 | 500 | 0.01 | 0.05 | 20,000 | 300 | 0.005 | 0.05 |
| **2006-050** | | 5 | 32,000 | 600 | 0.01 | 0.07 | 28,000 | 600 | 0.01 | 0.05 | 25,600 | 500 | 0.01 | 0.05 | 20,000 | 300 | 0.005 | 0.05 |
| **2006-055** | | 5.5 | 32,000 | 600 | 0.01 | 0.07 | 28,000 | 600 | 0.01 | 0.05 | 25,600 | 500 | 0.01 | 0.05 | 20,000 | 300 | 0.005 | 0.05 |
| **2006-060** | | 6 | 32,000 | 600 | 0.01 | 0.07 | 28,000 | 600 | 0.01 | 0.05 | 25,600 | 500 | 0.01 | 0.05 | 20,000 | 300 | 0.005 | 0.05 |
| **2006-080** | | 8 | 25,600 | 480 | 0.008 | 0.02 | 22,400 | 480 | 0.008 | 0.02 | 20,480 | 350 | 0.007 | 0.02 | 16,000 | 210 | 0.004 | 0.01 |
| **2006-100** | | 10 | 20,480 | 390 | 0.006 | 0.02 | 17,920 | 390 | 0.006 | 0.02 | 16,400 | 250 | 0.005 | 0.02 | 12,800 | 150 | 0.003 | 0.01 |
| **2008-020** | | 2 | 35,000 | 1,600 | 0.06 | 0.21 | 30,000 | 1,600 | 0.04 | 0.17 | 26,000 | 1,350 | 0.04 | 0.15 | 20,000 | 700 | 0.02 | 0.12 |
| **2008-025** | | 2.5 | 35,000 | 1,600 | 0.06 | 0.21 | 30,000 | 1,600 | 0.04 | 0.17 | 26,000 | 1,350 | 0.04 | 0.15 | 20,000 | 700 | 0.02 | 0.12 |
| **2008-030** | | 3 | 35,000 | 1,600 | 0.06 | 0.21 | 30,000 | 1,600 | 0.04 | 0.17 | 26,000 | 1,350 | 0.04 | 0.15 | 20,000 | 700 | 0.02 | 0.12 |
| **2008-040** | **R0.4** | 4 | 35,000 | 1,600 | 0.06 | 0.21 | 30,000 | 1,600 | 0.04 | 0.17 | 26,000 | 1,350 | 0.04 | 0.15 | 20,000 | 700 | 0.02 | 0.12 |
| **2008-050** | | 5 | 31,500 | 1,300 | 0.04 | 0.17 | 27,500 | 1,300 | 0.03 | 0.15 | 23,400 | 1,000 | 0.03 | 0.11 | 18,000 | 530 | 0.015 | 0.09 |
| **2008-060** | | 6 | 28,000 | 1,000 | 0.02 | 0.12 | 25,000 | 1,000 | 0.02 | 0.12 | 20,800 | 675 | 0.02 | 0.075 | 16,000 | 350 | 0.01 | 0.06 |
| **2008-070** | | 7 | 25,200 | 900 | 0.02 | 0.11 | 22,500 | 900 | 0.02 | 0.11 | 18,700 | 600 | 0.018 | 0.068 | 14,400 | 330 | 0.009 | 0.05 |
| **2008-080** | | 8 | 22,400 | 800 | 0.02 | 0.1 | 20,000 | 800 | 0.02 | 0.1 | 16,640 | 540 | 0.016 | 0.06 | 12,800 | 300 | 0.008 | 0.048 |
| **2010-020** | | 2 | 30,000 | 1,750 | 0.2 | 0.4 | 24,000 | 2,000 | 0.1 | 0.3 | 21,000 | 1,750 | 0.05 | 0.2 | 16,000 | 875 | 0.05 | 0.2 |
| **2010-025** | | 2.5 | 30,000 | 1,750 | 0.2 | 0.4 | 24,000 | 2,000 | 0.1 | 0.3 | 21,000 | 1,750 | 0.05 | 0.2 | 16,000 | 875 | 0.05 | 0.2 |
| **2010-030** | | 3 | 30,000 | 1,750 | 0.1 | 0.3 | 24,000 | 2,000 | 0.1 | 0.2 | 21,000 | 1,750 | 0.03 | 0.17 | 16,000 | 875 | 0.03 | 0.17 |
| **2010-040** | | 4 | 30,000 | 1,750 | 0.1 | 0.3 | 24,000 | 2,000 | 0.1 | 0.2 | 21,000 | 1,750 | 0.03 | 0.17 | 16,000 | 875 | 0.03 | 0.17 |
| **2010-050** | | 5 | 30,000 | 1,750 | 0.1 | 0.3 | 24,000 | 2,000 | 0.1 | 0.2 | 21,000 | 1,750 | 0.03 | 0.17 | 16,000 | 875 | 0.03 | 0.17 |
| **2010-060** | **R0.5** | 6 | 30,000 | 1,150 | 0.06 | 0.23 | 21,500 | 1,250 | 0.03 | 0.17 | 19,700 | 1,050 | 0.025 | 0.15 | 14,500 | 525 | 0.025 | 0.15 |
| **2010-070** | | 7 | 27,000 | 980 | 0.04 | 0.19 | 20,000 | 920 | 0.02 | 0.15 | 19,000 | 770 | 0.02 | 0.14 | 14,200 | 380 | 0.02 | 0.14 |
| **2010-080** | | 8 | 24,000 | 800 | 0.025 | 0.155 | 18,500 | 580 | 0.015 | 0.12 | 18,400 | 480 | 0.015 | 0.12 | 13,800 | 240 | 0.015 | 0.12 |
| **2010-100** | | 10 | 22,000 | 600 | 0.018 | 0.13 | 14,800 | 430 | 0.01 | 0.09 | 14,700 | 360 | 0.01 | 0.09 | 14,700 | 360 | 0.01 | 0.09 |
| **2010-120** | | 12 | 14,150 | 320 | 0.015 | 0.12 | 13,400 | 380 | 0.008 | 0.08 | 13,300 | 290 | 0.008 | 0.08 | 13,300 | 290 | 0.008 | 0.08 |
| **2010-140** | | 14 | 13,500 | 280 | 0.012 | 0.1 | 12,000 | 350 | 0.007 | 0.08 | 12,000 | 220 | 0.007 | 0.08 | 12,000 | 220 | 0.007 | 0.08 |
| **2010-160** | | 16 | 12,150 | 250 | 0.011 | 0.09 | 10,800 | 320 | 0.006 | 0.07 | 10,800 | 200 | 0.006 | 0.07 | 10,800 | 200 | 0.006 | 0.07 |
| **2015-030** | | 3 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| **2015-040** | | 4 | 30,000 | 2,450 | 0.25 | 0.55 | 17,000 | 2,000 | 0.12 | 0.4 | 15,000 | 1,750 | 0.06 | 0.29 | 11,250 | 875 | 0.06 | 0.29 |
| **2015-060** | | 6 | 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 |
| **2015-080** | | 8 | 23,500 | 1,300 | 0.1 | 0.37 | 15,000 | 1,250 | 0.045 | 0.25 | 14,000 | 1,050 | 0.03 | 0.21 | 10,500 | 525 | 0.03 | 0.21 |
| **2015-100** | **R0.75** | 10 | 23,500 | 1,300 | 0.1 | 0.37 | 15,000 | 1,250 | 0.045 | 0.25 | 14,000 | 1,050 | 0.03 | 0.21 | 10,500 | 525 | 0.03 | 0.21 |
| **2015-120** | | 12 | 13,100 | 480 | 0.03 | 0.21 | 13,000 | 580 | 0.02 | 0.17 | 13,000 | 480 | 0.02 | 0.17 | 9,750 | 240 | 0.02 | 0.17 |
| **2015-140** | | 14 | 11,200 | 400 | 0.025 | 0.19 | 10,900 | 490 | 0.015 | 0.145 | 10,900 | 390 | 0.015 | 0.145 | 8,200 | 190 | 0.015 | 0.145 |
| **2015-160** | | 16 | 10,000 | 360 | 0.023 | 0.17 | 9,800 | 440 | 0.014 | 0.13 | 9,800 | 350 | 0.014 | 0.13 | 7,380 | 170 | 0.014 | 0.13 |
| **2015-200** | | 20 | 8,900 | 320 | 0.02 | 0.15 | 8,700 | 390 | 0.012 | 0.12 | 8,700 | 310 | 0.012 | 0.12 | 6,560 | 150 | 0.012 | 0.12 |

# Milling Conditions for HGLB

| 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) | Effective Length (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) |
| **2020-030** | R1 | 3 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 14,700 | 2,100 | 0.15 | 0.35 | 12,250 | 1,800 | 0.08 | 0.35 |
| **2020-040** | | 4 | 28,000 | 2,900 | 0.3 | 0.7 | 14,000 | 2,100 | 0.15 | 0.5 | 14,700 | 2,100 | 0.15 | 0.35 | 12,250 | 1,800 | 0.08 | 0.35 |
| **2020-060** | | 6 | 28,000 | 2,900 | 0.2 | 0.6 | 14,000 | 2,100 | 0.1 | 0.4 | 14,700 | 2,100 | 0.15 | 0.3 | 12,250 | 1,800 | 0.06 | 0.3 |
| **2020-080** | | 8 | 28,000 | 2,900 | 0.2 | 0.6 | 14,000 | 2,100 | 0.1 | 0.4 | 14,700 | 2,100 | 0.15 | 0.3 | 12,250 | 1,800 | 0.06 | 0.3 |
| **2020-100** | | 10 | 28,000 | 2,900 | 0.2 | 0.6 | 14,000 | 2,100 | 0.1 | 0.4 | 14,700 | 2,100 | 0.15 | 0.3 | 12,250 | 1,800 | 0.06 | 0.3 |
| **2020-120** | | 12 | 19,500 | 1,350 | 0.12 | 0.45 | 12,400 | 1,350 | 0.06 | 0.34 | 13,800 | 1,320 | 0.09 | 0.27 | 11,500 | 1,100 | 0.045 | 0.27 |
| **2020-140** | | 14 | 19,500 | 1,350 | 0.12 | 0.45 | 12,400 | 1,350 | 0.06 | 0.34 | 13,800 | 1,320 | 0.09 | 0.27 | 11,500 | 1,100 | 0.045 | 0.27 |
| **2020-160** | | 16 | 10,800 | 500 | 0.05 | 0.3 | 10,800 | 600 | 0.03 | 0.24 | 12,840 | 588 | 0.06 | 0.24 | 10,700 | 490 | 0.03 | 0.24 |
| **2020-200** | | 20 | 10,800 | 500 | 0.035 | 0.25 | 10,800 | 450 | 0.02 | 0.19 | 10,270 | 440 | 0.04 | 0.19 | 8,560 | 370 | 0.02 | 0.19 |
| **2020-250** | | 25 | 9,720 | 450 | 0.032 | 0.23 | 9,720 | 410 | 0.018 | 0.17 | 9,250 | 400 | 0.036 | 0.17 | 7,700 | 330 | 0.018 | 0.17 |
| **2020-300** | | 30 | 8,650 | 400 | 0.028 | 0.2 | 8,650 | 360 | 0.016 | 0.15 | 8,200 | 350 | 0.032 | 0.15 | 6,850 | 300 | 0.016 | 0.15 |
| **2030-060** | R1.5 | 6 | 21,000 | 3,000 | 0.4 | 1 | 13,250 | 2,740 | 0.29 | 0.7 | 11,040 | 2,280 | 0.24 | 0.55 | 9,200 | 1,900 | 0.12 | 0.55 |
| **2030-080** | | 8 | 21,000 | 3,000 | 0.4 | 1 | 13,250 | 2,740 | 0.29 | 0.7 | 11,040 | 2,280 | 0.24 | 0.55 | 9,200 | 1,900 | 0.12 | 0.55 |
| **2030-100** | | 10 | 21,000 | 3,000 | 0.3 | 0.9 | 13,250 | 2,740 | 0.24 | 0.65 | 11,040 | 2,280 | 0.2 | 0.5 | 9,200 | 1,900 | 0.1 | 0.5 |
| **2030-120** | | 12 | 21,000 | 3,000 | 0.3 | 0.9 | 13,250 | 2,740 | 0.24 | 0.65 | 11,040 | 2,280 | 0.2 | 0.5 | 9,200 | 1,900 | 0.1 | 0.5 |
| **2030-140** | | 14 | 21,000 | 3,000 | 0.3 | 0.9 | 13,250 | 2,740 | 0.24 | 0.65 | 11,040 | 2,280 | 0.2 | 0.5 | 9,200 | 1,900 | 0.1 | 0.5 |
| **2030-160** | | 16 | 21,000 | 3,000 | 0.3 | 0.9 | 13,250 | 2,740 | 0.24 | 0.65 | 11,040 | 2,280 | 0.2 | 0.5 | 9,200 | 1,900 | 0.1 | 0.5 |
| **2030-180** | | 18 | 17,750 | 2,300 | 0.24 | 0.8 | 12,800 | 2,200 | 0.21 | 0.58 | 10,680 | 1,830 | 0.18 | 0.48 | 8,900 | 1,525 | 0.088 | 0.48 |
| **2030-200** | | 20 | 14,500 | 1,600 | 0.18 | 0.7 | 12,380 | 1,660 | 0.18 | 0.5 | 10,320 | 1,380 | 0.15 | 0.45 | 8,600 | 1,150 | 0.075 | 0.45 |
| **2030-220** | | 22 | 13,000 | 1,440 | 0.16 | 0.63 | 11,950 | 1,200 | 0.15 | 0.44 | 9,960 | 1,000 | 0.13 | 0.42 | 8,300 | 830 | 0.063 | 0.42 |
| **2030-250** | | 25 | 11,600 | 1,280 | 0.14 | 0.56 | 11,520 | 730 | 0.12 | 0.38 | 9,600 | 610 | 0.1 | 0.38 | 8,000 | 510 | 0.05 | 0.38 |
| **2030-270** | | 27 | 10,500 | 1,150 | 0.13 | 0.51 | 9,850 | 630 | 0.1 | 0.34 | 8,200 | 530 | 0.08 | 0.34 | 6,850 | 440 | 0.04 | 0.34 |
| **2030-300** | | 30 | 9,280 | 1,020 | 0.11 | 0.45 | 8,200 | 530 | 0.07 | 0.29 | 6,840 | 440 | 0.06 | 0.29 | 5,700 | 370 | 0.03 | 0.29 |
| **2040-080** | R2 | 8 | 18,000 | 3,200 | 0.5 | 1.3 | 11,380 | 2,880 | 0.36 | 0.95 | 9,480 | 2,400 | 0.3 | 0.75 | 7,900 | 2,000 | 0.15 | 0.75 |
| **2040-100** | | 10 | 18,000 | 3,200 | 0.5 | 1.3 | 11,380 | 2,880 | 0.36 | 0.95 | 9,480 | 2,400 | 0.3 | 0.75 | 7,900 | 2,000 | 0.15 | 0.75 |
| **2040-120** | | 12 | 18,000 | 3,200 | 0.4 | 1.2 | 11,380 | 2,880 | 0.31 | 0.85 | 9,480 | 2,400 | 0.26 | 0.7 | 7,900 | 2,000 | 0.13 | 0.7 |
| **2040-140** | | 14 | 18,000 | 3,200 | 0.4 | 1.2 | 11,380 | 2,880 | 0.31 | 0.85 | 9,480 | 2,400 | 0.26 | 0.7 | 7,900 | 2,000 | 0.13 | 0.7 |
| **2040-160** | | 16 | 18,000 | 3,200 | 0.4 | 1.2 | 11,380 | 2,880 | 0.31 | 0.85 | 9,480 | 2,400 | 0.26 | 0.7 | 7,900 | 2,000 | 0.13 | 0.7 |
| **2040-180** | | 18 | 18,000 | 3,200 | 0.4 | 1.2 | 11,380 | 2,880 | 0.31 | 0.85 | 9,480 | 2,400 | 0.26 | 0.7 | 7,900 | 2,000 | 0.13 | 0.7 |
| **2040-200** | | 20 | 18,000 | 3,200 | 0.4 | 1.2 | 10,730 | 1,800 | 0.21 | 0.7 | 8,940 | 1,500 | 0.18 | 0.55 | 7,450 | 1,250 | 0.09 | 0.55 |
| **2040-220** | | 22 | 15,250 | 2,250 | 0.33 | 1.1 | 10,730 | 1,800 | 0.21 | 0.7 | 8,940 | 1,500 | 0.18 | 0.55 | 7,450 | 1,250 | 0.09 | 0.55 |
| **2040-250** | | 25 | 12,500 | 1,250 | 0.25 | 0.95 | 10,730 | 1,800 | 0.21 | 0.7 | 8,940 | 1,500 | 0.18 | 0.55 | 7,450 | 1,250 | 0.09 | 0.55 |
| **2040-270** | | 27 | 11,500 | 1,150 | 0.23 | 0.9 | 10,400 | 1,250 | 0.18 | 0.58 | 8,670 | 1,050 | 0.15 | 0.5 | 7,250 | 890 | 0.075 | 0.5 |
| **2040-300** | | 30 | 10,630 | 1,000 | 0.2 | 0.76 | 10,080 | 780 | 0.15 | 0.45 | 8,400 | 650 | 0.12 | 0.45 | 7,000 | 540 | 0.06 | 0.45 |
| **2040-350** | | 35 | 9,030 | 800 | 0.16 | 0.61 | 8,640 | 730 | 0.13 | 0.43 | 7,200 | 610 | 0.11 | 0.43 | 6,000 | 510 | 0.055 | 0.43 |
| **2040-400** | | 40 | 8,300 | 700 | 0.14 | 0.54 | 8,000 | 700 | 0.12 | 0.42 | 6,650 | 590 | 0.11 | 0.42 | 5,500 | 500 | 0.05 | 0.42 |
| **2060-100** | R3 | 10 | 14,400 | 3,200 | 0.5 | 1.5 | 9,140 | 2,880 | 0.38 | 1.05 | 7,620 | 2,400 | 0.32 | 0.88 | 6,350 | 2,000 | 0.16 | 0.88 |
| **2060-150** | | 15 | 14,400 | 3,200 | 0.5 | 1.5 | 9,140 | 2,880 | 0.38 | 1.05 | 7,620 | 2,400 | 0.32 | 0.88 | 6,350 | 2,000 | 0.16 | 0.88 |
| **2060-180** | | 18 | 14,400 | 3,200 | 0.5 | 1.5 | 9,140 | 2,880 | 0.38 | 1.05 | 7,620 | 2,400 | 0.32 | 0.88 | 6,350 | 2,000 | 0.16 | 0.88 |
| **2060-200** | | 20 | 14,400 | 3,200 | 0.5 | 1.5 | 9,000 | 2,300 | 0.32 | 0.95 | 7,620 | 2,400 | 0.32 | 0.88 | 6,350 | 2,000 | 0.16 | 0.88 |
| **2060-250** | | 25 | 14,400 | 3,200 | 0.5 | 1.5 | 8,100 | 2,000 | 0.3 | 0.95 | 7,500 | 1,920 | 0.27 | 0.805 | 6,250 | 1,600 | 0.135 | 0.805 |
| **2060-300** | | 30 | 14,400 | 3,200 | 0.5 | 1.5 | 7,700 | 1,800 | 0.26 | 0.88 | 7,440 | 1,500 | 0.22 | 0.73 | 6,200 | 1,250 | 0.11 | 0.73 |
| **2060-350** | | 35 | 9,200 | 2,050 | 0.32 | 1 | 6,200 | 1,450 | 0.21 | 0.71 | 6,000 | 1,200 | 0.18 | 0.59 | 5,000 | 1,000 | 0.09 | 0.59 |
| **2060-400** | | 40 | 7,000 | 1,050 | 0.2 | 0.8 | 5,600 | 1,000 | 0.19 | 0.64 | 4,800 | 950 | 0.14 | 0.47 | 4,000 | 810 | 0.07 | 0.47 |
| **2060-500** | | 50 | 5,600 | 850 | 0.16 | 0.6 | 4,500 | 810 | 0.15 | 0.52 | 3,900 | 780 | 0.12 | 0.38 | 3,200 | 650 | 0.06 | 0.38 |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)



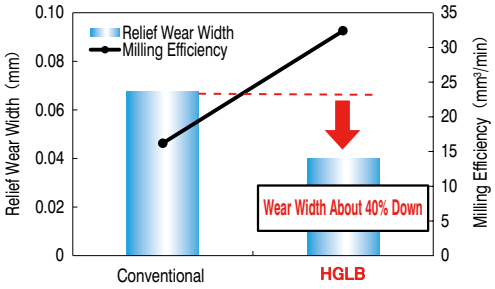

Note:
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
- Every coolant offers stable milling.

## Wear Comparison HGLB R1 × Effective Length 6 HAP72 (69HRC)

Tools after milling

Conventional

HGLB




**HGLB mills twice as efficient as the conventional tool.**

| Tool | Conventional | HGLB 2020-060 |
|---|---|---|
| Spindle Speed | 9,200 $min^{-1}$ | 12,250 $min^{-1}$ |
| Feed Rate | 900 mm/min | 1,800 mm/min |
| Axial Depth $a_p$ | 0.06 mm | |
| Radial Depth $a_e$ | 0.3 mm | |
| Coolant | Air Blow (Through Spindle) | |
| Milling Shape | Square Pocket (20 x 15 x Depth 2 mm) × 2 Pockets | |
| Cycle Time | 76 min | 50 min |

Milling Efficiency ($mm^3$/min) = Feed Rate × $a_p$ × $a_e$

* Refer to page 581 for tool geometry, and page 582 for milling examples.

## Size R0.05～R3

# HSLB

Super MG | HARD MAX | Shank Dia 0/-0.005 | Back Taper Geometry

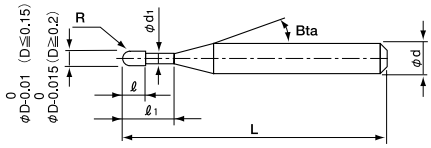
～Except for R0.45 ℓ1 / D≦10

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | |

## Features

**High efficiency, long tool life and excellent surface finish on material 40HRC or harder.**
**HARDMAX coat offers heat resistance, durability and lubricity at a high level.**
**Every coolant offers stable milling.**
**Ball tip radius point is designed with a negative rake angle that minimizes wear and improves the target dimensions.**
**The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.**




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

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Helix Angle |
|---|---|---|---|
| R0.05～R0.075 | 0/-0.01 | ±0.002 | 0° |
| R0.1～R3 | 0/-0.015 | ±0.005 | 30° |

Total 325 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HSLB 2001-002** | R0.05 | 0.2 | 0.08 | 0.095 | 11° | 45 | 4 | 11,630 | 0.21 | 0.23 | 0.25 | 0.27 | 0.31 |
| **HSLB 2001-003** | | 0.3 | | | | 45 | 4 | 11,630 | 0.32 | 0.35 | 0.37 | 0.40 | 0.45 |
| **HSLB 2001-005** | | 0.5 | | | | 45 | 4 | 12,540 | 0.54 | 0.57 | 0.61 | 0.64 | 0.72 |
| **HSLB 20015-003** | R0.075 | 0.3 | 0.12 | 0.135 | 11° | 45 | 4 | 13,450 | 0.36 | 0.38 | 0.40 | 0.42 | 0.47 |
| **HSLB 20015-005** | | 0.5 | | | | 45 | 4 | 14,250 | 0.57 | 0.60 | 0.63 | 0.67 | 0.75 |
| **HSLB 20015-010** | | 1 | | | | 45 | 4 | 14,820 | 1.10 | 1.15 | 1.21 | 1.27 | 1.43 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2002-003 | R0.1 | 0.3 | 0.16 | 0.19 | 16° | 45 | 4 | 8,090 | 0.39 | 0.42 | 0.44 | 0.46 | 0.50 |
| HSLB 2002-005 | | 0.5 | | | | 45 | 4 | 8,090 | 0.61 | 0.64 | 0.66 | 0.69 | 0.74 |
| HSLB 2002-005-6 | | 0.5 | | | | 50 | 6 | 11,290 | 0.61 | 0.64 | 0.66 | 0.69 | 0.74 |
| HSLB 2002-0075 | | 0.75 | | | | 45 | 4 | 8,090 | 0.87 | 0.91 | 0.95 | 0.98 | 1.05 |
| HSLB 2002-010 | | 1 | | | | 45 | 4 | 8,090 | 1.13 | 1.18 | 1.22 | 1.26 | 1.35 |
| HSLB 2002-010-6 | | 1 | | | | 50 | 6 | 11,290 | 1.13 | 1.18 | 1.22 | 1.26 | 1.35 |
| HSLB 2002-0125 | | 1.25 | | | | 45 | 4 | 8,780 | 1.38 | 1.44 | 1.49 | 1.54 | 1.65 |
| HSLB 2002-015 | | 1.5 | | | | 45 | 4 | 8,780 | 1.64 | 1.71 | 1.76 | 1.82 | 1.96 |
| HSLB 2002-015-6 | | 1.5 | | | | 50 | 6 | 12,250 | 1.64 | 1.71 | 1.76 | 1.82 | 1.96 |
| HSLB 2002-0175 | | 1.75 | | | | 45 | 4 | 9,690 | 1.90 | 1.97 | 2.04 | 2.11 | 2.26 |
| HSLB 2002-020 | | 2 | | | | 45 | 4 | 9,690 | 2.16 | 2.24 | 2.31 | 2.39 | 2.57 |
| HSLB 2002-020-6 | | 2 | | | | 50 | 6 | 13,520 | 2.16 | 2.24 | 2.31 | 2.39 | 2.57 |
| HSLB 2002-0225 | | 2.25 | | | | 45 | 4 | 10,600 | 2.42 | 2.51 | 2.59 | 2.68 | 2.87 |
| HSLB 2002-025 | | 2.5 | | | | 45 | 4 | 10,600 | 2.68 | 2.77 | 2.86 | 2.96 | 3.18 |
| HSLB 2002-030 | | 3 | | | | 45 | 4 | 11,400 | 3.20 | 3.30 | 3.41 | 3.53 | 3.79 |
| HSLB 2003-005 | R0.15 | 0.5 | 0.24 | 0.29 | 16° | 45 | 4 | 7,980 | 0.60 | 0.63 | 0.66 | 0.68 | 0.73 |
| HSLB 2003-006 | | 0.6 | | | | 45 | 4 | 7,980 | 0.71 | 0.74 | 0.77 | 0.80 | 0.85 |
| HSLB 2003-0075 | | 0.75 | | | | 45 | 4 | 7,980 | 0.87 | 0.91 | 0.94 | 0.97 | 1.04 |
| HSLB 2003-010 | | 1 | | | | 45 | 4 | 7,980 | 1.13 | 1.18 | 1.22 | 1.26 | 1.34 |
| HSLB 2003-010-6 | | 1 | | | | 50 | 6 | 10,830 | 1.13 | 1.18 | 1.22 | 1.26 | 1.34 |
| HSLB 2003-0125 | | 1.25 | | | | 45 | 4 | 8,550 | 1.38 | 1.43 | 1.48 | 1.53 | 1.64 |
| HSLB 2003-015 | | 1.5 | | | | 45 | 4 | 8,550 | 1.64 | 1.70 | 1.76 | 1.82 | 1.94 |
| HSLB 2003-015-6 | | 1.5 | | | | 50 | 6 | 11,860 | 1.64 | 1.70 | 1.76 | 1.82 | 1.94 |
| HSLB 2003-0175 | | 1.75 | | | | 45 | 4 | 8,550 | 1.90 | 1.97 | 2.03 | 2.10 | 2.25 |
| HSLB 2003-020 | | 2 | | | | 45 | 4 | 8,550 | 2.16 | 2.24 | 2.31 | 2.38 | 2.56 |
| HSLB 2003-020-6 | | 2 | | | | 50 | 6 | 11,860 | 2.16 | 2.24 | 2.31 | 2.38 | 2.56 |
| HSLB 2003-0225 | | 2.25 | | | | 45 | 4 | 8,780 | 2.42 | 2.50 | 2.58 | 2.67 | 2.86 |
| HSLB 2003-025 | | 2.5 | | | | 45 | 4 | 8,780 | 2.68 | 2.77 | 2.86 | 2.95 | 3.17 |
| HSLB 2003-030 | | 3 | | | | 45 | 4 | 8,780 | 3.20 | 3.30 | 3.41 | 3.52 | 3.78 |
| HSLB 2003-040 | | 4 | | | | 45 | 4 | 9,120 | 4.23 | 4.37 | 4.51 | 4.66 | 5.00 |
| HSLB 2003-050 | | 5 | | | | 45 | 4 | 10,260 | 5.26 | 5.43 | 5.61 | 5.80 | 6.23 |
| HSLB 2004-005 | R0.2 | 0.5 | 0.32 | 0.39 | 16° | 45 | 4 | 5,470 | 0.60 | 0.63 | 0.65 | 0.68 | 0.72 |
| HSLB 2004-0075 | | 0.75 | | | | 45 | 4 | 5,470 | 0.86 | 0.90 | 0.93 | 0.96 | 1.03 |
| HSLB 2004-010 | | 1 | | | | 45 | 4 | 5,470 | 1.13 | 1.17 | 1.21 | 1.25 | 1.33 |
| HSLB 2004-010-6 | | 1 | | | | 50 | 6 | 7,980 | 1.13 | 1.17 | 1.21 | 1.25 | 1.33 |
| HSLB 2004-0125 | | 1.25 | | | | 45 | 4 | 5,590 | 1.37 | 1.43 | 1.48 | 1.52 | 1.63 |
| HSLB 2004-015 | | 1.5 | | | | 45 | 4 | 5,590 | 1.64 | 1.70 | 1.75 | 1.81 | 1.93 |
| HSLB 2004-015-6 | | 1.5 | | | | 50 | 6 | 8,090 | 1.64 | 1.70 | 1.75 | 1.81 | 1.93 |
| HSLB 2004-0175 | | 1.75 | | | | 45 | 4 | 5,700 | 1.90 | 1.97 | 2.03 | 2.09 | 2.24 |
| HSLB 2004-020 | | 2 | | | | 45 | 4 | 5,700 | 2.16 | 2.23 | 2.30 | 2.38 | 2.55 |
| HSLB 2004-020-6 | | 2 | | | | 50 | 6 | 8,320 | 2.16 | 2.23 | 2.30 | 2.38 | 2.55 |
| HSLB 2004-0225 | | 2.25 | | | | 45 | 4 | 5,930 | 2.42 | 2.50 | 2.58 | 2.66 | 2.85 |
| HSLB 2004-025 | | 2.5 | | | | 45 | 4 | 5,930 | 2.68 | 2.76 | 2.85 | 2.95 | 3.16 |
| HSLB 2004-025-6 | | 2.5 | | | | 50 | 6 | 8,550 | 2.68 | 2.76 | 2.85 | 2.95 | 3.16 |
| HSLB 2004-030 | | 3 | | | | 45 | 4 | 6,270 | 3.20 | 3.30 | 3.40 | 3.52 | 3.77 |
| HSLB 2004-030-6 | | 3 | | | | 50 | 6 | 9,120 | 3.20 | 3.30 | 3.40 | 3.52 | 3.77 |
| HSLB 2004-035 | | 3.5 | | | | 45 | 4 | 6,840 | 3.71 | 3.83 | 3.95 | 4.09 | 4.38 |
| HSLB 2004-040 | | 4 | | | | 45 | 4 | 6,840 | 4.23 | 4.36 | 4.50 | 4.66 | 4.99 |
| HSLB 2004-040-6 | | 4 | | | | 50 | 6 | 9,300 | 4.23 | 4.36 | 4.50 | 4.66 | 4.99 |
| HSLB 2004-045 | | 4.5 | | | | 45 | 4 | 7,180 | 4.74 | 4.89 | 5.05 | 5.22 | 5.61 |
| HSLB 2004-050 | | 5 | | | | 45 | 4 | 7,180 | 5.26 | 5.43 | 5.60 | 5.79 | 6.22 |
| HSLB 2004-060 | | 6 | | | | 45 | 4 | 8,320 | 6.29 | 6.49 | 6.70 | 6.93 | 7.44 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2005-010 | | 1 | | | | 45 | 4 | 5,470 | 1.12 | 1.17 | 1.21 | 1.24 | 1.32 |
| HSLB 2005-0125 | | 1.25 | | | | 45 | 4 | 5,470 | 1.37 | 1.43 | 1.47 | 1.52 | 1.62 |
| HSLB 2005-015 | | 1.5 | | | | 45 | 4 | 5,470 | 1.63 | 1.70 | 1.75 | 1.80 | 1.92 |
| HSLB 2005-015-6 | | 1.5 | | | | 50 | 6 | 7,980 | 1.63 | 1.70 | 1.75 | 1.80 | 1.92 |
| HSLB 2005-0175 | | 1.75 | | | | 45 | 4 | 5,470 | 1.90 | 1.96 | 2.02 | 2.09 | 2.23 |
| HSLB 2005-020 | | 2 | | | | 45 | 4 | 5,470 | 2.16 | 2.23 | 2.30 | 2.37 | 2.54 |
| HSLB 2005-020-6 | | 2 | | | | 50 | 6 | 7,980 | 2.16 | 2.23 | 2.30 | 2.37 | 2.54 |
| HSLB 2005-0225 | | 2.25 | | | | 45 | 4 | 5,470 | 2.42 | 2.50 | 2.57 | 2.66 | 2.84 |
| HSLB 2005-025 | | 2.5 | | | | 45 | 4 | 5,470 | 2.68 | 2.76 | 2.85 | 2.94 | 3.15 |
| HSLB 2005-025-6 | | 2.5 | | | | 50 | 6 | 7,980 | 2.68 | 2.76 | 2.85 | 2.94 | 3.15 |
| HSLB 2005-030 | | 3 | | | | 45 | 4 | 5,470 | 3.20 | 3.29 | 3.40 | 3.51 | 3.76 |
| HSLB 2005-030-6 | R0.25 | 3 | 0.4 | 0.49 | 16° | 50 | 6 | 7,980 | 3.20 | 3.29 | 3.40 | 3.51 | 3.76 |
| HSLB 2005-035 | | 3.5 | | | | 45 | 4 | 5,470 | 3.71 | 3.83 | 3.95 | 4.08 | 4.37 |
| HSLB 2005-040 | | 4 | | | | 45 | 4 | 5,470 | 4.23 | 4.36 | 4.50 | 4.65 | 4.98 |
| HSLB 2005-040-6 | | 4 | | | | 50 | 6 | 7,980 | 4.23 | 4.36 | 4.50 | 4.65 | 4.98 |
| HSLB 2005-045 | | 4.5 | | | | 45 | 4 | 5,590 | 4.74 | 4.89 | 5.05 | 5.22 | 5.59 |
| HSLB 2005-050 | | 5 | | | | 45 | 4 | 5,590 | 5.26 | 5.42 | 5.60 | 5.79 | 6.21 |
| HSLB 2005-055 | | 5.5 | | | | 45 | 4 | 5,700 | 5.77 | 5.96 | 6.15 | 6.36 | 6.82 |
| HSLB 2005-060 | | 6 | | | | 45 | 4 | 5,700 | 6.29 | 6.49 | 6.70 | 6.93 | 7.43 |
| HSLB 2005-070 | | 7 | | | | 45 | 4 | 6,840 | 7.32 | 7.55 | 7.80 | 8.06 | 8.65 |
| HSLB 2005-080 | | 8 | | | | 45 | 4 | 6,840 | 8.35 | 8.62 | 8.90 | 9.20 | 9.88 |
| HSLB 2005-090 | | 9 | | | | 45 | 4 | 7,980 | 9.38 | 9.68 | 10.00 | 10.34 | 11.10 |
| HSLB 2005-100 | | 10 | | | | 50 | 4 | 8,500 | 10.42 | 10.75 | 11.10 | 11.48 | 12.32 |
| HSLB 2006-010 | | 1 | | | | 45 | 4 | 4,670 | 1.12 | 1.16 | 1.20 | 1.24 | 1.31 |
| HSLB 2006-0125 | | 1.25 | | | | 45 | 4 | 4,220 | 1.37 | 1.42 | 1.47 | 1.51 | 1.61 |
| HSLB 2006-015 | | 1.5 | | | | 45 | 4 | 4,220 | 1.63 | 1.69 | 1.74 | 1.80 | 1.91 |
| HSLB 2006-015-6 | | 1.5 | | | | 50 | 6 | 6,380 | 1.63 | 1.69 | 1.74 | 1.80 | 1.91 |
| HSLB 2006-0175 | | 1.75 | | | | 45 | 4 | 4,220 | 1.89 | 1.96 | 2.02 | 2.08 | 2.22 |
| HSLB 2006-020 | | 2 | | | | 45 | 4 | 4,220 | 2.15 | 2.23 | 2.29 | 2.36 | 2.52 |
| HSLB 2006-020-6 | | 2 | | | | 50 | 6 | 6,380 | 2.15 | 2.23 | 2.29 | 2.36 | 2.52 |
| HSLB 2006-0225 | | 2.25 | | | | 45 | 4 | 4,330 | 2.42 | 2.49 | 2.57 | 2.65 | 2.83 |
| HSLB 2006-025 | | 2.5 | | | | 45 | 4 | 4,330 | 2.67 | 2.76 | 2.84 | 2.93 | 3.14 |
| HSLB 2006-025-6 | | 2.5 | | | | 50 | 6 | 6,380 | 2.67 | 2.76 | 2.84 | 2.93 | 3.14 |
| HSLB 2006-030 | | 3 | | | | 45 | 4 | 4,330 | 3.19 | 3.29 | 3.39 | 3.50 | 3.75 |
| HSLB 2006-030-6 | | 3 | | | | 50 | 6 | 6,500 | 3.19 | 3.29 | 3.39 | 3.50 | 3.75 |
| HSLB 2006-035 | | 3.5 | | | | 45 | 4 | 4,450 | 3.71 | 3.82 | 3.94 | 4.07 | 4.36 |
| HSLB 2006-040 | | 4 | | | | 45 | 4 | 4,450 | 4.23 | 4.36 | 4.49 | 4.64 | 4.97 |
| HSLB 2006-040-6 | R0.3 | 4 | 0.48 | 0.59 | 16° | 50 | 6 | 6,730 | 4.23 | 4.36 | 4.49 | 4.64 | 4.97 |
| HSLB 2006-045 | | 4.5 | | | | 45 | 4 | 4,450 | 4.74 | 4.89 | 5.04 | 5.21 | 5.58 |
| HSLB 2006-050 | | 5 | | | | 45 | 4 | 4,450 | 5.26 | 5.42 | 5.59 | 5.78 | 6.20 |
| HSLB 2006-050-6 | | 5 | | | | 50 | 6 | 6,730 | 5.26 | 5.42 | 5.59 | 5.78 | 6.20 |
| HSLB 2006-055 | | 5.5 | | | | 45 | 4 | 4,450 | 5.77 | 5.95 | 6.14 | 6.35 | 6.81 |
| HSLB 2006-060 | | 6 | | | | 45 | 4 | 4,450 | 6.29 | 6.49 | 6.69 | 6.92 | 7.42 |
| HSLB 2006-060-6 | | 6 | | | | 50 | 6 | 6,730 | 6.29 | 6.49 | 6.69 | 6.92 | 7.42 |
| HSLB 2006-065 | | 6.5 | | | | 45 | 4 | 5,020 | 6.80 | 7.02 | 7.25 | 7.49 | 8.03 |
| HSLB 2006-070 | | 7 | | | | 45 | 4 | 5,020 | 7.32 | 7.55 | 7.80 | 8.06 | 8.64 |
| HSLB 2006-080 | | 8 | | | | 45 | 4 | 5,930 | 8.35 | 8.61 | 8.90 | 9.20 | 9.87 |
| HSLB 2006-080-6 | | 8 | | | | 50 | 6 | 8,550 | 8.35 | 8.61 | 8.90 | 9.20 | 9.87 |
| HSLB 2006-090 | | 9 | | | | 45 | 4 | 6,270 | 9.38 | 9.68 | 10.00 | 10.34 | 11.09 |
| HSLB 2006-100 | | 10 | | | | 50 | 4 | 6,040 | 10.41 | 10.74 | 11.10 | 11.47 | 12.31 |
| HSLB 2006-100-6 | | 10 | | | | 50 | 6 | 9,120 | 10.41 | 10.74 | 11.10 | 11.47 | 12.31 |
| HSLB 2006-120 | | 12 | | | | 50 | 4 | 6,840 | 12.48 | 12.87 | 13.30 | 13.75 | 14.76 |

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Long Neck Ball
Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2007-020 | R0.35 | 2 | 0.56 | 0.69 | 16° | 45 | 4 | 4,220 | 2.15 | 2.22 | 2.29 | 2.36 | 2.51 |
| HSLB 2007-040 | | 4 | | | | 45 | 4 | 4,450 | 4.22 | 4.35 | 4.49 | 4.63 | 4.96 |
| HSLB 2007-060 | | 6 | | | | 45 | 4 | 4,450 | 6.29 | 6.48 | 6.69 | 6.91 | 7.41 |
| HSLB 2007-080 | | 8 | | | | 45 | 4 | 4,450 | 8.35 | 8.61 | 8.89 | 9.19 | 9.86 |
| HSLB 2008-020 | R0.4 | 2 | 0.64 | 0.79 | 16° | 45 | 4 | 4,220 | 2.15 | 2.22 | 2.28 | 2.35 | 2.50 |
| HSLB 2008-020-6 | | 2 | | | | 50 | 6 | 6,380 | 2.15 | 2.22 | 2.28 | 2.35 | 2.50 |
| HSLB 2008-030 | | 3 | | | | 45 | 4 | 4,450 | 3.19 | 3.28 | 3.38 | 3.49 | 3.73 |
| HSLB 2008-030-6 | | 3 | | | | 50 | 6 | 6,730 | 3.19 | 3.28 | 3.38 | 3.49 | 3.73 |
| HSLB 2008-040 | | 4 | | | | 45 | 4 | 4,450 | 4.22 | 4.35 | 4.48 | 4.63 | 4.95 |
| HSLB 2008-040-6 | | 4 | | | | 50 | 6 | 6,730 | 4.22 | 4.35 | 4.48 | 4.63 | 4.95 |
| HSLB 2008-050 | | 5 | | | | 45 | 4 | 4,450 | 5.25 | 5.41 | 5.58 | 5.77 | 6.17 |
| HSLB 2008-060 | | 6 | | | | 45 | 4 | 4,450 | 6.29 | 6.48 | 6.68 | 6.91 | 7.40 |
| HSLB 2008-060-6 | | 6 | | | | 50 | 6 | 6,730 | 6.29 | 6.48 | 6.68 | 6.91 | 7.40 |
| HSLB 2008-070 | | 7 | | | | 45 | 4 | 4,450 | 7.32 | 7.54 | 7.79 | 8.04 | 8.62 |
| HSLB 2008-080 | | 8 | | | | 45 | 4 | 4,450 | 8.35 | 8.61 | 8.89 | 9.18 | 9.84 |
| HSLB 2008-080-6 | | 8 | | | | 50 | 6 | 6,730 | 8.35 | 8.61 | 8.89 | 9.18 | 9.84 |
| HSLB 2008-090 | | 9 | | | | 45 | 4 | 5,930 | 9.38 | 9.67 | 9.99 | 10.32 | 11.07 |
| HSLB 2008-100 | | 10 | | | | 50 | 4 | 5,930 | 10.41 | 10.74 | 11.09 | 11.46 | 12.29 |
| HSLB 2008-100-6 | | 10 | | | | 50 | 6 | 8,550 | 10.41 | 10.74 | 11.09 | 11.46 | 12.29 |
| HSLB 2008-120 | | 12 | | | | 50 | 4 | 7,300 | 12.47 | 12.87 | 13.29 | 13.74 | 14.74 |
| HSLB 2008-160 | | 16 | | | | 50 | 4 | 9,990 | 16.60 | 17.13 | 17.69 | 18.29 | 19.63 |
| HSLB 2009-020 | R0.45 | 2 | 0.72 | 0.89 | 16° | 45 | 4 | 4,220 | 2.15 | 2.22 | 2.28 | 2.34 | 2.49 |
| HSLB 2009-040 | | 4 | | | | 45 | 4 | 4,450 | 4.22 | 4.35 | 4.48 | 4.62 | 4.94 |
| HSLB 2009-060 | | 6 | | | | 45 | 4 | 4,450 | 6.28 | 6.48 | 6.68 | 6.90 | 7.39 |
| HSLB 2009-080 | | 8 | | | | 45 | 4 | 4,450 | 8.35 | 8.61 | 8.88 | 9.18 | 9.83 |
| HSLB 2009-100 | | 10 | | | | 45 | 4 | 5,930 | 10.41 | 10.73 | 11.08 | 11.45 | 12.28 |
| HSLB 2009-120 | | 12 | | | | 50 | 4 | 7,300 | 12.47 | 12.86 | 13.28 | 13.73 | 14.73 |
| HSLB 2009-140 | | 14 | | | | 50 | 4 | 8,460 | 14.54 | 14.99 | 15.48 | 16.01 | 17.18 |
| HSLB 2009-160 | | 16 | | | | 50 | 4 | 9,990 | 16.60 | 17.12 | 17.68 | 18.29 | 19.62 |
| HSLB 2009-180 | | 18 | | | | 55 | 4 | 9,990 | 18.66 | 19.25 | 19.89 | 20.56 | 22.07 |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HSLB 2010-020** | R0.5 | 2 | 0.8 | 0.98 | 16° | 45 | 4 | 3,530 | 2.16 | 2.22 | 2.28 | 2.35 | 2.49 |
| **HSLB 2010-025** | | 2.5 | | | | 45 | 4 | 3,530 | 2.68 | 2.76 | 2.83 | 2.92 | 3.11 |
| **HSLB 2010-030** | | 3 | | | | 45 | 4 | 3,530 | 3.20 | 3.29 | 3.38 | 3.49 | 3.72 |
| **HSLB 2010-030-6** | | 3 | | | | 50 | 6 | 5,590 | 3.20 | 3.29 | 3.38 | 3.49 | 3.72 |
| **HSLB 2010-040** | | 4 | | | | 45 | 4 | 3,990 | 4.23 | 4.35 | 4.49 | 4.63 | 4.94 |
| **HSLB 2010-040-6** | | 4 | | | | 50 | 6 | 6,160 | 4.23 | 4.35 | 4.49 | 4.63 | 4.94 |
| **HSLB 2010-050** | | 5 | | | | 45 | 4 | 3,990 | 5.26 | 5.42 | 5.59 | 5.77 | 6.16 |
| **HSLB 2010-050-6** | | 5 | | | | 50 | 6 | 6,160 | 5.26 | 5.42 | 5.59 | 5.77 | 6.16 |
| **HSLB 2010-060** | | 6 | | | | 45 | 4 | 4,330 | 6.29 | 6.48 | 6.69 | 6.90 | 7.39 |
| **HSLB 2010-060-6** | | 6 | | | | 50 | 6 | 6,500 | 6.29 | 6.48 | 6.69 | 6.90 | 7.39 |
| **HSLB 2010-070** | | 7 | | | | 45 | 4 | 4,330 | 7.32 | 7.55 | 7.79 | 8.04 | 8.61 |
| **HSLB 2010-070-6** | | 7 | | | | 50 | 6 | 6,500 | 7.32 | 7.55 | 7.79 | 8.04 | 8.61 |
| **HSLB 2010-080** | | 8 | | | | 45 | 4 | 4,330 | 8.36 | 8.61 | 8.89 | 9.18 | 9.84 |
| **HSLB 2010-080-6** | | 8 | | | | 50 | 6 | 6,500 | 8.36 | 8.61 | 8.89 | 9.18 | 9.84 |
| **HSLB 2010-090** | | 9 | | | | 45 | 4 | 4,330 | 9.39 | 9.68 | 9.99 | 10.32 | 11.06 |
| **HSLB 2010-100** | | 10 | | | | 45 | 4 | 4,330 | 10.42 | 10.74 | 11.09 | 11.46 | 12.28 |
| **HSLB 2010-100-6** | | 10 | | | | 50 | 6 | 6,500 | 10.42 | 10.74 | 11.09 | 11.46 | 12.28 |
| **HSLB 2010-120** | | 12 | | | | 45 | 4 | 4,330 | 12.48 | 12.87 | 13.29 | 13.74 | 14.73 |
| **HSLB 2010-120-6** | | 12 | | | | 50 | 6 | 6,500 | 12.48 | 12.87 | 13.29 | 13.74 | 14.73 |
| **HSLB 2010-140** | | 14 | | | | 50 | 4 | 5,020 | 14.54 | 15.00 | 15.49 | 16.01 | 17.18 |
| **HSLB 2010-140-6** | | 14 | | | | 60 | 6 | 7,070 | 14.54 | 15.00 | 15.49 | 16.01 | 17.18 |
| **HSLB 2010-160** | | 16 | | | | 50 | 4 | 5,930 | 16.61 | 17.13 | 17.69 | 18.29 | 19.62 |
| **HSLB 2010-160-6** | | 16 | | | | 60 | 6 | 8,550 | 16.61 | 17.13 | 17.69 | 18.29 | 19.62 |
| **HSLB 2010-180** | | 18 | | | | 55 | 4 | 5,930 | 18.67 | 19.26 | 19.89 | 20.57 | 22.07 |
| **HSLB 2010-200** | | 20 | | | | 55 | 4 | 7,180 | 20.73 | 21.39 | 22.09 | 22.85 | 24.52 |
| **HSLB 2010-200-6** | | 20 | | | | 70 | 6 | 10,150 | 20.73 | 21.39 | 22.09 | 22.85 | 24.52 |
| **HSLB 2010-220-6** | | 22 | | | | 70 | 6 | 10,600 | 22.80 | 23.52 | 24.29 | 25.12 | 26.97 |
| **HSLB 2012-025** | R0.6 | 2.5 | 0.96 | 1.19 | 16° | 45 | 4 | 5,360 | 2.54 | 2.60 | 2.67 | 2.74 | 2.91 |
| **HSLB 2012-040** | | 4 | | | | 45 | 4 | 5,360 | 4.08 | 4.20 | 4.32 | 4.45 | 4.75 |
| **HSLB 2012-060** | | 6 | | | | 45 | 4 | 5,810 | 6.15 | 6.33 | 6.52 | 6.73 | 7.19 |
| **HSLB 2012-060-6** | | 6 | | | | 50 | 6 | 8,270 | 6.15 | 6.33 | 6.52 | 6.73 | 7.19 |
| **HSLB 2012-080** | | 8 | | | | 45 | 4 | 5,810 | 8.21 | 8.46 | 8.72 | 9.01 | 9.64 |
| **HSLB 2012-080-6** | | 8 | | | | 50 | 6 | 8,270 | 8.21 | 8.46 | 8.72 | 9.01 | 9.64 |
| **HSLB 2012-100** | | 10 | | | | 45 | 4 | 5,810 | 10.27 | 10.59 | 10.92 | 11.28 | 12.09 |
| **HSLB 2012-100-6** | | 10 | | | | 50 | 6 | 8,270 | 10.27 | 10.59 | 10.92 | 11.28 | 12.09 |
| **HSLB 2012-120** | | 12 | | | | 45 | 4 | 5,810 | 12.33 | 12.72 | 13.12 | 13.56 | 14.54 |
| **HSLB 2012-120-6** | | 12 | | | | 50 | 6 | 8,270 | 12.33 | 12.72 | 13.12 | 13.56 | 14.54 |
| **HSLB 2012-140** | | 14 | | | | 50 | 4 | 6,270 | 14.40 | 14.85 | 15.33 | 15.84 | 16.98 |
| **HSLB 2012-160** | | 16 | | | | 50 | 4 | 6,840 | 16.46 | 16.98 | 17.53 | 18.12 | 19.43 |
| **HSLB 2012-160-6** | | 16 | | | | 60 | 6 | 9,410 | 16.46 | 16.98 | 17.53 | 18.12 | 19.43 |
| **HSLB 2012-180** | | 18 | | | | 55 | 4 | 7,410 | 18.52 | 19.11 | 19.73 | 20.39 | 21.88 |
| **HSLB 2012-200** | | 20 | | | | 60 | 4 | 7,410 | 20.58 | 21.23 | 21.93 | 22.67 | 24.33 |
| **HSLB 2014-060** | R0.7 | 6 | 1.12 | 1.37 | 16° | 45 | 4 | 5,020 | 6.18 | 6.36 | 6.55 | 6.76 | 7.22 |
| **HSLB 2014-080** | | 8 | | | | 45 | 4 | 5,020 | 8.24 | 8.49 | 8.75 | 9.03 | 9.66 |
| **HSLB 2014-120** | | 12 | | | | 45 | 4 | 5,020 | 12.37 | 12.75 | 13.15 | 13.59 | 14.56 |
| **HSLB 2014-160** | | 16 | | | | 50 | 4 | 5,020 | 16.49 | 17.01 | 17.56 | 18.14 | 19.45 |

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Long Neck Ball
Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2015-030 | | 3 | | | | 45 | 4 | 4,100 | 3.08 | 3.16 | 3.24 | 3.33 | 3.53 |
| HSLB 2015-040 | | 4 | | | | 45 | 4 | 4,100 | 4.11 | 4.23 | 4.34 | 4.47 | 4.76 |
| HSLB 2015-060 | | 6 | | | | 45 | 4 | 4,100 | 6.18 | 6.35 | 6.55 | 6.75 | 7.20 |
| HSLB 2015-060-6 | | 6 | | | | 50 | 6 | 6,610 | 6.18 | 6.35 | 6.55 | 6.75 | 7.20 |
| HSLB 2015-080 | | 8 | | | | 45 | 4 | 4,330 | 8.24 | 8.48 | 8.75 | 9.03 | 9.65 |
| HSLB 2015-080-6 | | 8 | | | | 50 | 6 | 6,610 | 8.24 | 8.48 | 8.75 | 9.03 | 9.65 |
| HSLB 2015-100 | | 10 | | | | 45 | 4 | 4,670 | 10.30 | 10.61 | 10.95 | 11.30 | 12.10 |
| HSLB 2015-100-6 | | 10 | | | | 50 | 6 | 6,610 | 10.30 | 10.61 | 10.95 | 11.30 | 12.10 |
| HSLB 2015-120 | | 12 | | | | 45 | 4 | 5,020 | 12.37 | 12.74 | 13.15 | 13.58 | 14.55 |
| HSLB 2015-120-6 | R0.75 | 12 | 1.2 | 1.47 | 16° | 50 | 6 | 7,520 | 12.37 | 12.74 | 13.15 | 13.58 | 14.55 |
| HSLB 2015-140 | | 14 | | | | 50 | 4 | 5,020 | 14.43 | 14.87 | 15.35 | 15.86 | 16.99 |
| HSLB 2015-160 | | 16 | | | | 50 | 4 | 5,020 | 16.49 | 17.00 | 17.55 | 18.14 | 19.44 |
| HSLB 2015-160-6 | | 16 | | | | 60 | 6 | 7,520 | 16.49 | 17.00 | 17.55 | 18.14 | 19.44 |
| HSLB 2015-180 | | 18 | | | | 55 | 4 | 5,020 | 18.55 | 19.13 | 19.75 | 20.41 | 21.89 |
| HSLB 2015-200 | | 20 | | | | 55 | 4 | 5,020 | 20.62 | 21.26 | 21.95 | 22.69 | 24.34 |
| HSLB 2015-200-6 | | 20 | | | | 60 | 6 | 7,520 | 20.62 | 21.26 | 21.95 | 22.69 | 24.34 |
| HSLB 2015-220 | | 22 | | | | 55 | 4 | 5,020 | 22.68 | 23.39 | 24.15 | 24.97 | No Interference |
| HSLB 2015-250 | | 25 | | | | 65 | 4 | 7,000 | 25.77 | 26.59 | 27.45 | 28.38 | No Interference |
| HSLB 2015-300 | | 30 | | | | 70 | 4 | 8,210 | 30.93 | 31.91 | 32.96 | 34.08 | No Interference |
| HSLB 2016-040 | | 4 | | | | 45 | 4 | 5,700 | 4.09 | 4.20 | 4.32 | 4.45 | 4.72 |
| HSLB 2016-080 | | 8 | | | | 45 | 4 | 5,810 | 8.22 | 8.46 | 8.72 | 9.00 | 9.62 |
| HSLB 2016-120 | R0.8 | 12 | 1.28 | 1.58 | 16° | 45 | 4 | 5,810 | 12.35 | 12.72 | 13.12 | 13.55 | 14.51 |
| HSLB 2016-160 | | 16 | | | | 50 | 4 | 5,810 | 16.47 | 16.98 | 17.53 | 18.11 | 19.41 |
| HSLB 2016-200 | | 20 | | | | 55 | 4 | 5,810 | 20.60 | 21.24 | 21.93 | 22.66 | No Interference |
| HSLB 2018-040 | | 4 | | | | 45 | 4 | 4,750 | 4.09 | 4.20 | 4.31 | 4.43 | 4.70 |
| HSLB 2018-060 | | 6 | | | | 45 | 4 | 4,750 | 6.15 | 6.33 | 6.51 | 6.71 | 7.15 |
| HSLB 2018-080 | | 8 | | | | 45 | 4 | 5,020 | 8.22 | 8.46 | 8.71 | 8.99 | 9.60 |
| HSLB 2018-100 | | 10 | | | | 45 | 4 | 5,020 | 10.28 | 10.59 | 10.91 | 11.26 | 12.04 |
| HSLB 2018-120 | | 12 | | | | 45 | 4 | 5,020 | 12.34 | 12.72 | 13.11 | 13.54 | 14.49 |
| HSLB 2018-160 | R0.9 | 16 | 1.44 | 1.78 | 16° | 50 | 4 | 5,020 | 16.47 | 16.97 | 17.52 | 18.10 | 19.39 |
| HSLB 2018-180 | | 18 | | | | 55 | 4 | 5,020 | 18.53 | 19.10 | 19.72 | 20.37 | 21.83 |
| HSLB 2018-200 | | 20 | | | | 55 | 4 | 5,020 | 20.59 | 21.23 | 21.92 | 22.65 | No Interference |
| HSLB 2018-220 | | 22 | | | | 60 | 4 | 6,870 | 22.66 | 23.36 | 24.12 | 24.93 | No Interference |
| HSLB 2018-250 | | 25 | | | | 65 | 4 | 7,000 | 25.75 | 26.56 | 27.42 | 28.34 | No Interference |
| HSLB 2018-300 | | 30 | | | | 70 | 4 | 7,930 | 30.91 | 31.88 | 32.92 | No Interference | No Interference |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2020-030 | R1 | 3 | 1.6 | 1.98 | 16° | 45 | 4 | 3,530 | 3.06 | 3.13 | 3.20 | 3.28 | 3.46 |
| HSLB 2020-040 | | 4 | | | | 45 | 4 | 3,530 | 4.09 | 4.19 | 4.30 | 4.42 | 4.68 |
| HSLB 2020-040-6 | | 4 | | | | 50 | 6 | 5,590 | 4.09 | 4.19 | 4.30 | 4.42 | 4.68 |
| HSLB 2020-060 | | 6 | | | | 45 | 4 | 3,990 | 6.15 | 6.32 | 6.50 | 6.70 | 7.13 |
| HSLB 2020-060-6 | | 6 | | | | 50 | 6 | 6,040 | 6.15 | 6.32 | 6.50 | 6.70 | 7.13 |
| HSLB 2020-080 | | 8 | | | | 45 | 4 | 4,330 | 8.21 | 8.45 | 8.70 | 8.97 | 9.58 |
| HSLB 2020-080-6 | | 8 | | | | 50 | 6 | 6,500 | 8.21 | 8.45 | 8.70 | 8.97 | 9.58 |
| HSLB 2020-100 | | 10 | | | | 45 | 4 | 4,330 | 10.28 | 10.58 | 10.90 | 11.25 | 12.02 |
| HSLB 2020-100-6 | | 10 | | | | 50 | 6 | 6,500 | 10.28 | 10.58 | 10.90 | 11.25 | 12.02 |
| HSLB 2020-120 | | 12 | | | | 45 | 4 | 4,330 | 12.34 | 12.71 | 13.10 | 13.53 | 14.47 |
| HSLB 2020-120-6 | | 12 | | | | 50 | 6 | 6,500 | 12.34 | 12.71 | 13.10 | 13.53 | 14.47 |
| HSLB 2020-130 | | 13 | | | | 45 | 4 | 4,330 | 13.37 | 13.77 | 14.20 | 14.67 | 15.69 |
| HSLB 2020-140 | | 14 | | | | 50 | 4 | 4,330 | 14.40 | 14.84 | 15.31 | 15.80 | 16.92 |
| HSLB 2020-160 | | 16 | | | | 50 | 4 | 4,330 | 16.46 | 16.97 | 17.51 | 18.08 | 19.36 |
| HSLB 2020-160-6 | | 16 | | | | 60 | 6 | 6,500 | 16.46 | 16.97 | 17.51 | 18.08 | 19.36 |
| HSLB 2020-180 | | 18 | | | | 55 | 4 | 4,330 | 18.53 | 19.10 | 19.71 | 20.36 | No Interference |
| HSLB 2020-200 | | 20 | | | | 55 | 4 | 4,330 | 20.59 | 21.23 | 21.91 | 22.64 | No Interference |
| HSLB 2020-200-6 | | 20 | | | | 70 | 6 | 6,500 | 20.59 | 21.23 | 21.91 | 22.64 | 24.26 |
| HSLB 2020-220 | | 22 | | | | 60 | 4 | 5,930 | 22.65 | 23.36 | 24.11 | 24.91 | No Interference |
| HSLB 2020-250 | | 25 | | | | 65 | 4 | 6,040 | 25.75 | 26.55 | 27.41 | 28.33 | No Interference |
| HSLB 2020-250-6 | | 25 | | | | 80 | 6 | 8,550 | 25.75 | 26.55 | 27.41 | 28.33 | 30.38 |
| HSLB 2020-270 | | 27 | | | | 65 | 4 | 6,040 | 27.81 | 28.68 | 29.61 | No Interference | No Interference |
| HSLB 2020-300 | | 30 | | | | 70 | 4 | 6,840 | 30.90 | 31.88 | 32.91 | No Interference | No Interference |
| HSLB 2020-300-6 | | 30 | | | | 80 | 6 | 9,690 | 30.90 | 31.88 | 32.91 | 34.02 | 36.50 |
| HSLB 2020-320 | | 32 | | | | 70 | 4 | 6,840 | 32.97 | 34.01 | 35.11 | No Interference | No Interference |
| HSLB 2020-350 | | 35 | | | | 80 | 4 | 9,350 | 36.06 | 37.20 | 38.42 | No Interference | No Interference |
| HSLB 2020-350-6 | | 35 | | | | 80 | 6 | 12,650 | 36.06 | 37.20 | 38.42 | 39.72 | No Interference |
| HSLB 2020-400 | | 40 | | | | 80 | 4 | 9,350 | 41.22 | 42.52 | No Interference | No Interference | No Interference |
| HSLB 2020-400-6 | | 40 | | | | 90 | 6 | 12,650 | 41.22 | 42.52 | 43.92 | 45.41 | No Interference |
| HSLB 2025-060 | R1.25 | 6 | 2 | 2.45 | 16° | 45 | 4 | 4,670 | 6.20 | 6.36 | 6.53 | 6.72 | 7.14 |
| HSLB 2025-080 | | 8 | | | | 45 | 4 | 4,700 | 8.26 | 8.49 | 8.74 | 9.00 | 9.59 |
| HSLB 2025-100 | | 10 | | | | 45 | 4 | 4,900 | 10.32 | 10.62 | 10.94 | 11.28 | 12.03 |
| HSLB 2025-150 | | 15 | | | | 50 | 4 | 5,810 | 15.48 | 15.94 | 16.44 | 16.97 | No Interference |
| HSLB 2025-200 | | 20 | | | | 55 | 4 | 6,840 | 20.64 | 21.27 | 21.94 | 22.66 | No Interference |
| HSLB 2025-250 | | 25 | | | | 65 | 4 | 7,300 | 25.79 | 26.59 | 27.44 | No Interference | No Interference |
| HSLB 2025-300 | | 30 | | | | 70 | 4 | 7,300 | 30.95 | 31.92 | No Interference | No Interference | No Interference |
| HSLB 2025-350 | | 35 | | | | 70 | 4 | 8,440 | 36.11 | 37.24 | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2030-060 | R1.5 | 6 | 2.4 | 2.95 | 16° | 60 | 6 | 4,330 | 6.19 | 6.34 | 6.51 | 6.68 | 7.08 |
| HSLB 2030-060-3 | | 6 | | | — | 60 | 3 | 3,990 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HSLB 2030-060-4 | | 6 | | | 16° | 60 | 4 | 3,990 | 6.19 | 6.34 | 6.51 | 6.68 | 7.08 |
| HSLB 2030-080 | | 8 | | | | 60 | 6 | 4,330 | 8.25 | 8.47 | 8.71 | 8.96 | 9.53 |
| HSLB 2030-100 | | 10 | | | | 60 | 6 | 5,020 | 10.31 | 10.60 | 10.91 | 11.24 | 11.98 |
| HSLB 2030-120 | | 12 | | | | 60 | 6 | 5,240 | 12.38 | 12.73 | 13.11 | 13.52 | 14.42 |
| HSLB 2030-140 | | 14 | | | | 60 | 6 | 5,810 | 14.44 | 14.86 | 15.31 | 15.79 | 16.87 |
| HSLB 2030-150 | | 15 | | | | 60 | 6 | 5,700 | 15.47 | 15.93 | 16.41 | 16.93 | 18.09 |
| HSLB 2030-160 | | 16 | | | | 60 | 6 | 5,810 | 16.50 | 16.99 | 17.51 | 18.07 | 19.32 |
| HSLB 2030-180 | | 18 | | | | 60 | 6 | 5,810 | 18.56 | 19.12 | 19.71 | 20.35 | 21.77 |
| HSLB 2030-200 | | 20 | | | | 70 | 6 | 5,590 | 20.63 | 21.25 | 21.91 | 22.63 | 24.21 |
| HSLB 2030-220 | | 22 | | | | 70 | 6 | 5,590 | 22.69 | 23.38 | 24.12 | 24.90 | 26.66 |
| HSLB 2030-250 | | 25 | | | | 70 | 6 | 5,590 | 25.78 | 26.57 | 27.42 | 28.32 | 30.33 |
| HSLB 2030-270 | | 27 | | | | 70 | 6 | 5,590 | 27.85 | 28.70 | 29.62 | 30.60 | No Interference |
| HSLB 2030-300 | | 30 | | | | 70 | 6 | 6,380 | 30.94 | 31.90 | 32.92 | 34.01 | No Interference |
| HSLB 2030-320 | | 32 | | | | 80 | 6 | 8,090 | 33.00 | 34.03 | 35.12 | 36.29 | No Interference |
| HSLB 2030-350 | | 35 | | | | 80 | 6 | 8,090 | 36.10 | 37.22 | 38.42 | 39.71 | No Interference |
| HSLB 2030-400 | | 40 | | | | 80 | 6 | 10,030 | 41.25 | 42.55 | 43.92 | No Interference | No Interference |
| HSLB 2035-100 | R1.75 | 10 | 2.8 | 3.45 | 16° | 60 | 6 | 6,380 | 10.31 | 10.59 | 10.88 | 11.21 | 11.92 |
| HSLB 2035-150 | | 15 | | | | 60 | 6 | 6,380 | 15.46 | 15.91 | 16.39 | 16.90 | 18.04 |
| HSLB 2035-200 | | 20 | | | | 65 | 6 | 6,840 | 20.62 | 21.23 | 21.89 | 22.59 | 24.16 |
| HSLB 2035-250 | | 25 | | | | 70 | 6 | 6,840 | 25.78 | 26.56 | 27.39 | 28.29 | No Interference |
| HSLB 2035-300 | | 30 | | | | 70 | 6 | 7,300 | 30.93 | 31.88 | 32.89 | 33.98 | No Interference |
| HSLB 2035-400 | | 40 | | | | 90 | 6 | 9,690 | 41.25 | 42.53 | 43.90 | No Interference | No Interference |
| HSLB 2035-450 | | 45 | | | | 90 | 6 | 10,600 | 46.40 | 47.85 | 49.40 | No Interference | No Interference |
| HSLB 2040-080 | R2 | 8 | 3.2 | 3.95 | 16° | 70 | 6 | 4,450 | 8.23 | 8.44 | 8.66 | 8.89 | 9.42 |
| HSLB 2040-080-4 | | 8 | | | — | 70 | 4 | 4,180 | No Interference | No Interference | No Interference | No Interference | No Interference |
| HSLB 2040-100 | | 10 | | | 16° | 70 | 6 | 4,450 | 10.30 | 10.57 | 10.86 | 11.17 | 11.87 |
| HSLB 2040-120 | | 12 | | | | 70 | 6 | 5,810 | 12.36 | 12.70 | 13.06 | 13.45 | 14.31 |
| HSLB 2040-140 | | 14 | | | | 70 | 6 | 5,810 | 14.42 | 14.83 | 15.26 | 15.73 | 16.76 |
| HSLB 2040-150 | | 15 | | | | 70 | 6 | 5,810 | 15.45 | 15.89 | 16.36 | 16.86 | 17.99 |
| HSLB 2040-160 | | 16 | | | | 70 | 6 | 5,810 | 16.49 | 16.96 | 17.46 | 18.00 | 19.21 |
| HSLB 2040-180 | | 18 | | | | 70 | 6 | 5,810 | 18.55 | 19.09 | 19.66 | 20.28 | No Interference |
| HSLB 2040-200 | | 20 | | | | 70 | 6 | 5,810 | 20.61 | 21.22 | 21.86 | 22.56 | No Interference |
| HSLB 2040-220 | | 22 | | | | 70 | 6 | 5,810 | 22.67 | 23.35 | 24.07 | 24.84 | No Interference |
| HSLB 2040-250 | | 25 | | | | 70 | 6 | 5,810 | 25.77 | 26.54 | 27.37 | 28.25 | No Interference |
| HSLB 2040-270 | | 27 | | | | 70 | 6 | 5,810 | 27.83 | 28.67 | 29.57 | 30.53 | No Interference |
| HSLB 2040-300 | | 30 | | | | 70 | 6 | 5,810 | 30.93 | 31.87 | 32.87 | No Interference | No Interference |
| HSLB 2040-320 | | 32 | | | | 80 | 6 | 6,730 | 32.99 | 34.00 | 35.07 | No Interference | No Interference |
| HSLB 2040-350 | | 35 | | | | 80 | 6 | 6,730 | 36.08 | 37.19 | 38.37 | No Interference | No Interference |
| HSLB 2040-400 | | 40 | | | | 90 | 6 | 7,520 | 41.24 | 42.51 | No Interference | No Interference | No Interference |
| HSLB 2040-450 | | 45 | | | | 90 | 6 | 9,690 | 46.40 | 47.84 | No Interference | No Interference | No Interference |
| HSLB 2040-500 | | 50 | | | | 100 | 6 | 10,370 | 51.55 | 53.16 | No Interference | No Interference | No Interference |
| HSLB 2040-600 | | 60 | | | | 120 | 6 | 10,580 | 61.87 | No Interference | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HSLB 2050-100** | R2.5 | 10 | 4 | 4.95 | 16° | 70 | 6 | 6,840 | 10.28 | 10.54 | 10.81 | 11.10 | 11.76 |
| **HSLB 2050-150** | | 15 | | | | 70 | 6 | 9,690 | 15.44 | 15.86 | 16.31 | 16.80 | No Interference |
| **HSLB 2050-200** | | 20 | | | | 70 | 6 | 9,690 | 20.60 | 21.19 | 21.82 | No Interference | No Interference |
| **HSLB 2050-250** | | 25 | | | | 70 | 6 | 9,690 | 25.75 | 26.51 | No Interference | No Interference | No Interference |
| **HSLB 2050-300** | | 30 | | | | 80 | 6 | 10,370 | 30.91 | 31.83 | No Interference | No Interference | No Interference |
| **HSLB 2050-350** | | 35 | | | | 80 | 6 | 10,370 | 36.07 | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2050-400** | | 40 | | | | 90 | 6 | 13,110 | 41.22 | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2050-450** | | 45 | | | | 100 | 6 | 13,680 | 46.38 | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2050-500** | | 50 | | | | 100 | 6 | 14,820 | 51.54 | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-100** | R3 | 10 | 4.8 | 5.95 | — | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-150** | | 15 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-180** | | 18 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-200** | | 20 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-220** | | 22 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-250** | | 25 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-270** | | 27 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-300** | | 30 | | | | 80 | 6 | 7,520 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-320** | | 32 | | | | 80 | 6 | 7,520 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-350** | | 35 | | | | 80 | 6 | 7,750 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-400** | | 40 | | | | 90 | 6 | 8,210 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-450** | | 45 | | | | 100 | 6 | 8,780 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-500** | | 50 | | | | 120 | 6 | 8,890 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-600** | | 60 | | | | 120 | 6 | 9,420 | No Interference | No Interference | No Interference | No Interference | No Interference |

# Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2001** | **R0.05** | 0.2 | 48,000 | 55 | 0.002 | 0.002 | 48,000 | 45 | 0.002 | 0.002 | 48,000 | 45 | 0.002 | 0.002 | 36,000 | 22 | 0.002 | 0.002 |
| | | 0.3 | 48,000 | 55 | 0.002 | 0.002 | 48,000 | 45 | 0.002 | 0.002 | 48,000 | 45 | 0.002 | 0.002 | 36,000 | 22 | 0.002 | 0.002 |
| | | 0.5 | 48,000 | 35 | 0.002 | 0.002 | 48,000 | 35 | 0.002 | 0.002 | 48,000 | 35 | 0.002 | 0.002 | 36,000 | 17 | 0.002 | 0.002 |
| **20015** | **R0.075** | 0.3 | 48,000 | 90 | 0.004 | 0.004 | 48,000 | 70 | 0.004 | 0.004 | 48,000 | 70 | 0.004 | 0.004 | 36,000 | 35 | 0.004 | 0.004 |
| | | 0.5 | 48,000 | 60 | 0.004 | 0.004 | 48,000 | 50 | 0.004 | 0.004 | 48,000 | 50 | 0.004 | 0.004 | 36,000 | 25 | 0.004 | 0.004 |
| | | 1 | 48,000 | 60 | 0.001 | 0.002 | 48,000 | 20 | 0.001 | 0.002 | 48,000 | 20 | 0.001 | 0.002 | 36,000 | 10 | 0.001 | 0.002 |
| **2002** | **R0.1** | 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 |
| | | 0.5 | 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 |
| | | 0.75 | 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 |
| | | 1 | 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 |
| | | 1.25 | 60,000 | 160 | 0.002 | 0.004 | 54,000 | 140 | 0.001 | 0.002 | 54,000 | 95 | 0.001 | 0.002 | 40,500 | 45 | 0.001 | 0.002 |
| | | 1.5 | 60,000 | 130 | 0.002 | 0.003 | 48,000 | 80 | 0.001 | 0.002 | 48,000 | 65 | 0.001 | 0.002 | 36,000 | 30 | 0.001 | 0.002 |
| | | 1.75 | 60,000 | 110 | 0.001 | 0.002 | 48,000 | 60 | 0.001 | 0.001 | 48,000 | 50 | 0.001 | 0.001 | 36,000 | 25 | 0.001 | 0.001 |
| | | 2 | 60,000 | 90 | 0.001 | 0.002 | 48,000 | 50 | 0.001 | 0.001 | 48,000 | 40 | 0.001 | 0.001 | 36,000 | 20 | 0.001 | 0.001 |
| | | 2.25 | 53,000 | 70 | 0.001 | 0.001 | 44,200 | 40 | 0.001 | 0.001 | 44,200 | 30 | 0.001 | 0.001 | 33,180 | 15 | 0.001 | 0.001 |
| | | 2.5 | 46,850 | 60 | 0.001 | 0.001 | 40,450 | 30 | 0.001 | 0.001 | 40,450 | 20 | 0.001 | 0.001 | 30,350 | 10 | 0.001 | 0.001 |
| | | 3 | 33,750 | 30 | 0.001 | 0.001 | 33,600 | 20 | 0.001 | 0.001 | 33,600 | 15 | 0.001 | 0.001 | 25,200 | 7 | 0.001 | 0.001 |
| **2003** | **R0.15** | 0.5 | 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 |
| | | 0.6 | 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 |
| | | 0.75 | 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 |
| | | 1 | 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 |
| | | 1.25 | 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 |
| | | 1.5 | 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 |
| | | 1.75 | 60,000 | 280 | 0.005 | 0.007 | 45,000 | 250 | 0.003 | 0.006 | 43,500 | 145 | 0.002 | 0.004 | 32,500 | 70 | 0.002 | 0.004 |
| | | 2 | 60,000 | 210 | 0.004 | 0.007 | 45,000 | 190 | 0.003 | 0.005 | 43,500 | 110 | 0.002 | 0.004 | 32,500 | 55 | 0.002 | 0.004 |
| | | 2.25 | 55,600 | 190 | 0.003 | 0.006 | 41,500 | 160 | 0.002 | 0.004 | 40,000 | 95 | 0.001 | 0.003 | 30,000 | 45 | 0.001 | 0.003 |
| | | 2.5 | 51,250 | 175 | 0.003 | 0.005 | 38,500 | 135 | 0.002 | 0.004 | 37,750 | 85 | 0.001 | 0.003 | 28,300 | 40 | 0.001 | 0.003 |
| | | 3 | 42,500 | 140 | 0.002 | 0.004 | 32,000 | 80 | 0.002 | 0.004 | 32,000 | 65 | 0.001 | 0.002 | 24,000 | 30 | 0.001 | 0.002 |
| | | 4 | 23,900 | 45 | 0.001 | 0.001 | 22,550 | 30 | 0.001 | 0.001 | 22,300 | 20 | 0.001 | 0.001 | 16,720 | 10 | 0.001 | 0.001 |
| | | 5 | 21,000 | 30 | 0.001 | 0.001 | 20,000 | 20 | 0.001 | 0.001 | 19,500 | 10 | 0.001 | 0.001 | 14,600 | 5 | 0.001 | 0.001 |
| **2004** | **R0.2** | 0.5 | 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 |
| | | 0.75 | 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 |
| | | 1 | 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 |
| | | 1.25 | 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 |
| | | 1.5 | 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 |
| | | 1.75 | 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 |
| | | 2 | 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 |
| | | 2.25 | 47,500 | 430 | 0.008 | 0.016 | 36,000 | 360 | 0.006 | 0.01 | 33,750 | 210 | 0.004 | 0.007 | 25,270 | 100 | 0.004 | 0.007 |
| | | 2.5 | 45,000 | 360 | 0.007 | 0.012 | 34,500 | 300 | 0.005 | 0.008 | 32,500 | 190 | 0.004 | 0.007 | 24,300 | 95 | 0.004 | 0.007 |
| | | 3 | 40,000 | 250 | 0.005 | 0.008 | 31,900 | 210 | 0.004 | 0.008 | 30,500 | 160 | 0.003 | 0.005 | 22,800 | 80 | 0.003 | 0.005 |
| | | 3.5 | 36,000 | 210 | 0.004 | 0.007 | 28,700 | 180 | 0.003 | 0.006 | 27,400 | 140 | 0.002 | 0.004 | 20,550 | 70 | 0.002 | 0.004 |
| | | 4 | 32,000 | 180 | 0.003 | 0.005 | 25,500 | 150 | 0.002 | 0.004 | 24,300 | 120 | 0.002 | 0.004 | 18,200 | 60 | 0.002 | 0.004 |
| | | 4.5 | 28,500 | 150 | 0.002 | 0.004 | 23,500 | 125 | 0.002 | 0.003 | 22,400 | 100 | 0.001 | 0.003 | 16,800 | 50 | 0.001 | 0.003 |
| | | 5 | 25,000 | 120 | 0.002 | 0.003 | 21,500 | 100 | 0.001 | 0.002 | 20,500 | 80 | 0.001 | 0.002 | 15,350 | 40 | 0.001 | 0.002 |
| | | 6 | 18,000 | 60 | 0.001 | 0.002 | 18,000 | 60 | 0.001 | 0.002 | 17,000 | 45 | 0.001 | 0.002 | 12,750 | 20 | 0.001 | 0.002 |

## Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| 2005 | R0.25 | 1 | 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 |
| | | 1.25 | 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 |
| | | 1.5 | 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 |
| | | 1.75 | 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 |
| | | 2 | 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 |
| | | 2.25 | 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 |
| | | 2.5 | 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 |
| | | 3 | 40,000 | 500 | 0.01 | 0.02 | 31,000 | 400 | 0.007 | 0.01 | 28,550 | 230 | 0.005 | 0.008 | 21,400 | 115 | 0.005 | 0.008 |
| | | 3.5 | 36,350 | 340 | 0.007 | 0.017 | 29,000 | 270 | 0.005 | 0.008 | 27,100 | 160 | 0.003 | 0.006 | 20,300 | 80 | 0.003 | 0.006 |
| | | 4 | 32,700 | 180 | 0.005 | 0.015 | 27,150 | 150 | 0.003 | 0.008 | 25,650 | 100 | 0.002 | 0.005 | 19,900 | 50 | 0.002 | 0.005 |
| | | 4.5 | 29,900 | 150 | 0.004 | 0.01 | 25,700 | 130 | 0.002 | 0.007 | 24,500 | 85 | 0.002 | 0.004 | 18,350 | 43 | 0.002 | 0.004 |
| | | 5 | 27,000 | 135 | 0.003 | 0.008 | 24,200 | 110 | 0.002 | 0.005 | 23,500 | 75 | 0.002 | 0.004 | 17,600 | 35 | 0.002 | 0.004 |
| | | 5.5 | 24,150 | 110 | 0.002 | 0.006 | 22,750 | 90 | 0.001 | 0.004 | 22,400 | 60 | 0.001 | 0.003 | 16,800 | 30 | 0.001 | 0.003 |
| | | 6 | 21,350 | 90 | 0.002 | 0.005 | 21,300 | 75 | 0.001 | 0.003 | 21,300 | 50 | 0.001 | 0.002 | 16,000 | 25 | 0.001 | 0.002 |
| | | 7 | 18,600 | 75 | 0.001 | 0.004 | 18,600 | 55 | 0.001 | 0.002 | 18,600 | 35 | 0.001 | 0.002 | 13,950 | 17 | 0.001 | 0.002 |
| | | 8 | 15,900 | 60 | 0.001 | 0.003 | 15,900 | 40 | 0.001 | 0.002 | 15,900 | 25 | 0.001 | 0.002 | 11,950 | 12 | 0.001 | 0.002 |
| | | 9 | 15,400 | 55 | 0.001 | 0.002 | 14,750 | 30 | 0.001 | 0.001 | 14,750 | 20 | 0.001 | 0.001 | 11,050 | 10 | 0.001 | 0.001 |
| | | 10 | 14,900 | 50 | 0.001 | 0.002 | 13,600 | 20 | 0.001 | 0.001 | 13,600 | 15 | 0.001 | 0.001 | 10,200 | 7 | 0.001 | 0.001 |
| 2006 | R0.3 | 1 | 40,000 | 1,400 | 0.045 | 0.15 | 30,000 | 1,500 | 0.03 | 0.13 | 26,500 | 1,000 | 0.015 | 0.09 | 20,000 | 500 | 0.015 | 0.09 |
| | | 1.25 | 40,000 | 1,250 | 0.035 | 0.14 | 30,000 | 1,350 | 0.025 | 0.11 | 26,500 | 900 | 0.01 | 0.08 | 20,000 | 450 | 0.01 | 0.08 |
| | | 1.5 | 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 |
| | | 1.75 | 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 |
| | | 2 | 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 |
| | | 2.25 | 40,000 | 950 | 0.025 | 0.1 | 30,000 | 1,000 | 0.015 | 0.09 | 26,500 | 660 | 0.008 | 0.065 | 20,000 | 330 | 0.008 | 0.07 |
| | | 2.5 | 40,000 | 800 | 0.02 | 0.1 | 30,000 | 800 | 0.015 | 0.09 | 26,500 | 520 | 0.008 | 0.065 | 20,000 | 260 | 0.008 | 0.065 |
| | | 3 | 40,000 | 800 | 0.02 | 0.1 | 30,000 | 800 | 0.015 | 0.09 | 26,500 | 520 | 0.008 | 0.065 | 20,000 | 260 | 0.008 | 0.065 |
| | | 3.5 | 40,000 | 500 | 0.015 | 0.09 | 30,000 | 500 | 0.01 | 0.075 | 26,500 | 340 | 0.006 | 0.05 | 20,000 | 170 | 0.006 | 0.05 |
| | | 4 | 40,000 | 500 | 0.015 | 0.09 | 30,000 | 500 | 0.01 | 0.075 | 26,500 | 340 | 0.006 | 0.05 | 20,000 | 170 | 0.006 | 0.05 |
| | | 4.5 | 32,000 | 400 | 0.01 | 0.075 | 25,000 | 390 | 0.007 | 0.05 | 23,000 | 260 | 0.005 | 0.04 | 18,000 | 130 | 0.005 | 0.04 |
| | | 5 | 32,000 | 400 | 0.01 | 0.075 | 25,000 | 390 | 0.007 | 0.05 | 23,000 | 260 | 0.005 | 0.04 | 18,000 | 130 | 0.005 | 0.04 |
| | | 5.5 | 28,000 | 350 | 0.008 | 0.065 | 23,000 | 350 | 0.006 | 0.05 | 21,000 | 230 | 0.004 | 0.04 | 15,750 | 115 | 0.004 | 0.04 |
| | | 6 | 24,000 | 300 | 0.007 | 0.06 | 21,000 | 320 | 0.005 | 0.04 | 19,500 | 210 | 0.004 | 0.03 | 15,000 | 105 | 0.004 | 0.03 |
| | | 6.5 | 22,000 | 270 | 0.006 | 0.06 | 19,500 | 300 | 0.004 | 0.04 | 18,500 | 190 | 0.003 | 0.03 | 13,900 | 95 | 0.003 | 0.03 |
| | | 7 | 20,000 | 250 | 0.006 | 0.05 | 18,500 | 280 | 0.004 | 0.03 | 17,500 | 180 | 0.003 | 0.02 | 13,100 | 90 | 0.003 | 0.02 |
| | | 8 | 16,000 | 200 | 0.005 | 0.05 | 16,000 | 240 | 0.003 | 0.02 | 16,000 | 160 | 0.003 | 0.02 | 12,000 | 80 | 0.003 | 0.02 |
| | | 9 | 15,450 | 185 | 0.004 | 0.035 | 15,450 | 200 | 0.002 | 0.017 | 15,450 | 135 | 0.002 | 0.017 | 11,580 | 65 | 0.002 | 0.017 |
| | | 10 | 14,900 | 175 | 0.003 | 0.02 | 14,900 | 175 | 0.002 | 0.015 | 14,900 | 115 | 0.002 | 0.015 | 11,100 | 55 | 0.002 | 0.015 |
| | | 12 | 13,800 | 150 | 0.002 | 0.015 | 13,800 | 110 | 0.001 | 0.01 | 13,800 | 70 | 0.001 | 0.01 | 10,350 | 35 | 0.001 | 0.01 |
| 2007 | R0.35 | 2 | 37,000 | 1,350 | 0.045 | 0.17 | 28,500 | 1,400 | 0.03 | 0.135 | 25,000 | 900 | 0.015 | 0.1 | 18,750 | 450 | 0.015 | 0.1 |
| | | 4 | 31,250 | 920 | 0.035 | 0.15 | 25,750 | 975 | 0.025 | 0.12 | 23,750 | 650 | 0.012 | 0.09 | 17,800 | 325 | 0.012 | 0.09 |
| | | 6 | 25,500 | 500 | 0.025 | 0.13 | 23,000 | 550 | 0.02 | 0.11 | 22,500 | 400 | 0.01 | 0.08 | 16,850 | 200 | 0.01 | 0.08 |
| | | 8 | 19,000 | 270 | 0.007 | 0.06 | 17,000 | 320 | 0.005 | 0.04 | 16,500 | 220 | 0.004 | 0.025 | 12,350 | 110 | 0.004 | 0.025 |

# Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| 2008 | R0.4 | 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 |
| | | 3 | 35,000 | 1,400 | 0.05 | 0.19 | 27,000 | 1,400 | 0.03 | 0.15 | 23,500 | 900 | 0.015 | 0.1 | 17,500 | 450 | 0.015 | 0.1 |
| | | 4 | 35,000 | 1,200 | 0.04 | 0.17 | 27,000 | 1,200 | 0.025 | 0.135 | 23,500 | 600 | 0.012 | 0.095 | 17,500 | 300 | 0.012 | 0.095 |
| | | 5 | 31,500 | 900 | 0.03 | 0.15 | 25,000 | 900 | 0.02 | 0.12 | 22,000 | 500 | 0.01 | 0.085 | 16,500 | 250 | 0.01 | 0.085 |
| | | 6 | 28,000 | 600 | 0.02 | 0.12 | 23,000 | 600 | 0.012 | 0.095 | 20,500 | 400 | 0.006 | 0.065 | 15,500 | 200 | 0.006 | 0.065 |
| | | 7 | 23,750 | 460 | 0.016 | 0.105 | 20,500 | 480 | 0.009 | 0.08 | 18,750 | 340 | 0.005 | 0.062 | 14,000 | 170 | 0.005 | 0.062 |
| | | 8 | 19,500 | 330 | 0.012 | 0.095 | 18,000 | 375 | 0.007 | 0.07 | 17,000 | 285 | 0.005 | 0.06 | 12,750 | 140 | 0.005 | 0.06 |
| | | 9 | 17,500 | 290 | 0.011 | 0.09 | 16,000 | 350 | 0.006 | 0.06 | 15,700 | 250 | 0.005 | 0.05 | 11,800 | 125 | 0.005 | 0.05 |
| | | 10 | 15,000 | 260 | 0.01 | 0.085 | 14,700 | 340 | 0.005 | 0.06 | 14,650 | 225 | 0.004 | 0.05 | 11,000 | 110 | 0.004 | 0.05 |
| | | 12 | 14,000 | 220 | 0.005 | 0.06 | 13,700 | 290 | 0.003 | 0.04 | 13,650 | 140 | 0.002 | 0.03 | 10,250 | 70 | 0.002 | 0.03 |
| | | 16 | 13,300 | 185 | 0.003 | 0.02 | 11,100 | 150 | 0.001 | 0.013 | 11,100 | 90 | 0.001 | 0.013 | 8,300 | 45 | 0.001 | 0.013 |
| 2009 | R0.45 | 2 | 32,500 | 1,650 | 0.1 | 0.28 | 25,500 | 1,800 | 0.55 | 0.21 | 22,000 | 1,300 | 0.025 | 0.14 | 16,500 | 650 | 0.025 | 0.14 |
| | | 4 | 32,500 | 1,650 | 0.08 | 0.25 | 25,500 | 1,800 | 0.04 | 0.18 | 22,000 | 1,300 | 0.02 | 0.13 | 16,500 | 650 | 0.02 | 0.13 |
| | | 6 | 29,000 | 800 | 0.035 | 0.17 | 22,000 | 800 | 0.02 | 0.13 | 20,000 | 620 | 0.015 | 0.11 | 15,000 | 310 | 0.015 | 0.11 |
| | | 8 | 25,500 | 700 | 0.015 | 0.11 | 18,500 | 500 | 0.01 | 0.09 | 18,500 | 420 | 0.01 | 0.09 | 13,850 | 210 | 0.01 | 0.09 |
| | | 10 | 20,000 | 400 | 0.012 | 0.1 | 15,700 | 400 | 0.008 | 0.08 | 15,700 | 300 | 0.008 | 0.08 | 11,800 | 150 | 0.008 | 0.08 |
| | | 12 | 15,000 | 280 | 0.01 | 0.09 | 13,300 | 300 | 0.006 | 0.07 | 13,300 | 220 | 0.006 | 0.07 | 10,000 | 110 | 0.006 | 0.07 |
| | | 14 | 14,000 | 240 | 0.007 | 0.07 | 12,000 | 250 | 0.004 | 0.035 | 12,000 | 160 | 0.004 | 0.035 | 9,000 | 80 | 0.004 | 0.035 |
| | | 16 | 13,700 | 220 | 0.005 | 0.05 | 10,800 | 200 | 0.003 | 0.03 | 10,800 | 130 | 0.003 | 0.03 | 8,100 | 65 | 0.003 | 0.03 |
| | | 18 | 13,000 | 200 | 0.004 | 0.025 | 9,750 | 150 | 0.002 | 0.015 | 9,750 | 100 | 0.002 | 0.015 | 7,300 | 50 | 0.002 | 0.015 |
| 2010 | R0.5 | 2 | 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 | 0.2 | 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 |
| | | 3 | 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 |
| | | 4 | 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 |
| | | 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 |
| | | 6 | 30,000 | 1,150 | 0.06 | 0.23 | 21,500 | 1,250 | 0.03 | 0.17 | 19,700 | 1,050 | 0.025 | 0.15 | 14,500 | 525 | 0.025 | 0.15 |
| | | 7 | 24,250 | 800 | 0.04 | 0.19 | 20,000 | 900 | 0.02 | 0.14 | 19,000 | 750 | 0.02 | 0.14 | 14,250 | 375 | 0.02 | 0.14 |
| | | 8 | 24,000 | 800 | 0.025 | 0.155 | 18,500 | 580 | 0.015 | 0.12 | 18,400 | 480 | 0.015 | 0.12 | 13,800 | 240 | 0.015 | 0.12 |
| | | 9 | 23,000 | 700 | 0.021 | 0.14 | 16,650 | 500 | 0.012 | 0.1 | 16,550 | 420 | 0.012 | 0.1 | 12,400 | 210 | 0.012 | 0.1 |
| | | 10 | 22,000 | 600 | 0.018 | 0.13 | 14,800 | 430 | 0.01 | 0.09 | 14,700 | 360 | 0.01 | 0.09 | 11,100 | 180 | 0.01 | 0.09 |
| | | 12 | 14,150 | 320 | 0.015 | 0.12 | 13,400 | 380 | 0.008 | 0.08 | 13,300 | 290 | 0.008 | 0.08 | 9,950 | 145 | 0.008 | 0.08 |
| | | 14 | 13,500 | 280 | 0.012 | 0.1 | 12,000 | 350 | 0.007 | 0.08 | 12,000 | 220 | 0.007 | 0.08 | 9,000 | 110 | 0.007 | 0.08 |
| | | 16 | 12,750 | 240 | 0.008 | 0.08 | 10,500 | 250 | 0.005 | 0.045 | 10,500 | 160 | 0.005 | 0.045 | 7,850 | 80 | 0.005 | 0.045 |
| | | 18 | 12,350 | 220 | 0.006 | 0.065 | 9,750 | 200 | 0.004 | 0.035 | 9,750 | 130 | 0.004 | 0.035 | 7,300 | 65 | 0.004 | 0.035 |
| | | 20 | 12,000 | 200 | 0.005 | 0.03 | 9,000 | 150 | 0.003 | 0.02 | 9,000 | 100 | 0.003 | 0.02 | 6,750 | 50 | 0.003 | 0.02 |
| | | 22 | 12,000 | 150 | 0.003 | 0.02 | 9,000 | 110 | 0.002 | 0.012 | 9,000 | 75 | 0.002 | 0.012 | 6,750 | 35 | 0.002 | 0.012 |
| 2012 | R0.6 | 2.5 | 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 |
| | | 4 | 30,000 | 2,000 | 0.12 | 0.36 | 20,000 | 2,000 | 0.06 | 0.24 | 17,500 | 1,750 | 0.036 | 0.2 | 13,100 | 875 | 0.036 | 0.2 |
| | | 6 | 30,000 | 2,000 | 0.12 | 0.36 | 20,000 | 2,000 | 0.06 | 0.24 | 17,500 | 1,750 | 0.036 | 0.2 | 13,100 | 875 | 0.036 | 0.2 |
| | | 8 | 20,200 | 800 | 0.05 | 0.23 | 16,600 | 900 | 0.025 | 0.17 | 15,850 | 750 | 0.025 | 0.17 | 11,900 | 375 | 0.025 | 0.17 |
| | | 10 | 15,500 | 480 | 0.03 | 0.18 | 15,500 | 580 | 0.015 | 0.13 | 15,350 | 480 | 0.015 | 0.13 | 11,500 | 240 | 0.015 | 0.13 |
| | | 12 | 12,400 | 360 | 0.02 | 0.15 | 12,400 | 430 | 0.01 | 0.095 | 12,250 | 360 | 0.01 | 0.095 | 9,200 | 180 | 0.01 | 0.095 |
| | | 14 | 11,850 | 320 | 0.018 | 0.14 | 11,200 | 380 | 0.008 | 0.085 | 11,100 | 290 | 0.008 | 0.085 | 8,300 | 145 | 0.008 | 0.085 |
| | | 16 | 11,300 | 280 | 0.014 | 0.12 | 10,000 | 360 | 0.007 | 0.08 | 10,000 | 230 | 0.007 | 0.08 | 7,500 | 115 | 0.007 | 0.08 |
| | | 18 | 10,900 | 260 | 0.011 | 0.1 | 9,400 | 300 | 0.006 | 0.07 | 9,400 | 190 | 0.006 | 0.07 | 7,050 | 95 | 0.006 | 0.07 |
| | | 20 | 10,500 | 240 | 0.009 | 0.09 | 8,800 | 250 | 0.006 | 0.05 | 8,800 | 160 | 0.006 | 0.05 | 6,600 | 80 | 0.006 | 0.05 |

## Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| 2014 | R0.7 | 6 | 25,200 | 2,000 | 0.13 | 0.42 | 17,150 | 2,000 | 0.065 | 0.27 | 15,000 | 1,750 | 0.036 | 0.23 | 11,250 | 875 | 0.036 | 0.23 |
| | | 8 | 25,200 | 1,300 | 0.08 | 0.32 | 15,350 | 1,250 | 0.04 | 0.23 | 14,050 | 1,050 | 0.03 | 0.2 | 10,550 | 525 | 0.03 | 0.2 |
| | | 12 | 13,500 | 450 | 0.035 | 0.21 | 12,500 | 460 | 0.025 | 0.18 | 12,000 | 300 | 0.02 | 0.16 | 9,000 | 150 | 0.02 | 0.16 |
| | | 16 | 10,000 | 320 | 0.016 | 0.145 | 9,050 | 390 | 0.01 | 0.12 | 8,850 | 230 | 0.012 | 0.12 | 6,650 | 115 | 0.012 | 0.12 |
| 2015 | R0.75 | 3 | 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 | 0.25 | 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 |
| | | 6 | 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 |
| | | 8 | 23,500 | 1,300 | 0.1 | 0.37 | 15,000 | 1,250 | 0.045 | 0.25 | 14,000 | 1,050 | 0.03 | 0.21 | 10,500 | 525 | 0.03 | 0.21 |
| | | 10 | 23,500 | 1,300 | 0.1 | 0.37 | 15,000 | 1,250 | 0.045 | 0.25 | 14,000 | 1,050 | 0.03 | 0.21 | 10,500 | 525 | 0.03 | 0.21 |
| | | 12 | 13,100 | 480 | 0.03 | 0.21 | 13,000 | 580 | 0.02 | 0.17 | 13,000 | 480 | 0.02 | 0.17 | 9,750 | 240 | 0.02 | 0.17 |
| | | 14 | 11,200 | 400 | 0.025 | 0.19 | 10,900 | 485 | 0.015 | 0.145 | 10,900 | 385 | 0.015 | 0.145 | 8,200 | 190 | 0.015 | 0.145 |
| | | 16 | 9,350 | 320 | 0.02 | 0.17 | 8,850 | 390 | 0.012 | 0.13 | 8,800 | 290 | 0.012 | 0.13 | 6,600 | 145 | 0.012 | 0.13 |
| | | 18 | 9,150 | 300 | 0.019 | 0.165 | 8,400 | 370 | 0.011 | 0.125 | 8,400 | 255 | 0.011 | 0.125 | 6,300 | 125 | 0.011 | 0.125 |
| | | 20 | 9,000 | 280 | 0.018 | 0.16 | 8,000 | 350 | 0.01 | 0.12 | 8,000 | 220 | 0.01 | 0.12 | 6,000 | 110 | 0.01 | 0.12 |
| | | 22 | 8,580 | 245 | 0.014 | 0.13 | 7,150 | 320 | 0.008 | 0.12 | 7,150 | 165 | 0.008 | 0.12 | 5,350 | 80 | 0.008 | 0.12 |
| | | 25 | 8,100 | 210 | 0.01 | 0.11 | 6,250 | 220 | 0.006 | 0.09 | 6,250 | 120 | 0.005 | 0.08 | 4,700 | 60 | 0.005 | 0.08 |
| | | 30 | 7,600 | 175 | 0.006 | 0.04 | 5,370 | 135 | 0.004 | 0.03 | 5,370 | 75 | 0.003 | 0.03 | 4,000 | 35 | 0.003 | 0.03 |
| 2016 | R0.8 | 4 | 30,000 | 2,500 | 0.25 | 0.58 | 17,500 | 2,100 | 0.12 | 0.4 | 15,300 | 1,800 | 0.06 | 0.3 | 11,500 | 900 | 0.06 | 0.3 |
| | | 8 | 30,000 | 2,500 | 0.16 | 0.48 | 17,500 | 2,100 | 0.08 | 0.32 | 15,300 | 1,800 | 0.05 | 0.275 | 11,500 | 900 | 0.05 | 0.275 |
| | | 12 | 13,500 | 500 | 0.04 | 0.245 | 13,500 | 600 | 0.024 | 0.19 | 13,400 | 490 | 0.024 | 0.19 | 10,050 | 245 | 0.024 | 0.19 |
| | | 16 | 10,800 | 375 | 0.03 | 0.21 | 10,800 | 450 | 0.016 | 0.15 | 10,700 | 370 | 0.016 | 0.15 | 8,000 | 185 | 0.016 | 0.15 |
| | | 20 | 10,300 | 330 | 0.025 | 0.19 | 9,750 | 400 | 0.013 | 0.13 | 9,650 | 230 | 0.013 | 0.13 | 8,000 | 115 | 0.013 | 0.13 |
| 2018 | R0.9 | 4 | 30,000 | 2,700 | 0.28 | 0.65 | 15,000 | 2,000 | 0.14 | 0.48 | 13,000 | 1,750 | 0.07 | 0.34 | 9,750 | 875 | 0.07 | 0.34 |
| | | 6 | 30,000 | 2,700 | 0.18 | 0.54 | 15,000 | 2,000 | 0.07 | 0.34 | 13,000 | 1,750 | 0.04 | 0.26 | 9,750 | 875 | 0.04 | 0.26 |
| | | 8 | 30,000 | 2,700 | 0.18 | 0.54 | 15,000 | 2,000 | 0.07 | 0.34 | 13,000 | 1,750 | 0.04 | 0.26 | 9,750 | 875 | 0.04 | 0.26 |
| | | 10 | 25,750 | 2,000 | 0.14 | 0.48 | 14,400 | 1,650 | 0.06 | 0.32 | 12,900 | 1,425 | 0.035 | 0.24 | 9,700 | 713 | 0.035 | 0.24 |
| | | 12 | 21,500 | 1,350 | 0.1 | 0.41 | 13,800 | 1,350 | 0.05 | 0.29 | 12,800 | 1,100 | 0.03 | 0.23 | 9,600 | 550 | 0.03 | 0.23 |
| | | 16 | 15,550 | 860 | 0.065 | 0.33 | 11,700 | 900 | 0.03 | 0.22 | 11,150 | 730 | 0.02 | 0.18 | 8,400 | 365 | 0.02 | 0.18 |
| | | 18 | 9,600 | 375 | 0.03 | 0.23 | 9,600 | 450 | 0.015 | 0.16 | 9,500 | 370 | 0.01 | 0.13 | 7,150 | 185 | 0.01 | 0.13 |
| | | 20 | 9,300 | 350 | 0.027 | 0.21 | 9,050 | 420 | 0.014 | 0.15 | 9,000 | 330 | 0.009 | 0.12 | 6,750 | 165 | 0.009 | 0.12 |
| | | 22 | 9,000 | 320 | 0.025 | 0.2 | 8,500 | 400 | 0.012 | 0.14 | 8,500 | 290 | 0.008 | 0.15 | 6,400 | 145 | 0.008 | 0.15 |
| | | 25 | 8,500 | 280 | 0.02 | 0.18 | 7,750 | 320 | 0.01 | 0.1 | 7,750 | 220 | 0.007 | 0.09 | 5,800 | 110 | 0.007 | 0.09 |
| | | 30 | 8,000 | 240 | 0.015 | 0.15 | 7,000 | 250 | 0.009 | 0.07 | 7,000 | 160 | 0.006 | 0.06 | 5,250 | 80 | 0.006 | 0.06 |

# Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| 2020 | R1 | 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 |
| | | 4 | 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 |
| | | 8 | 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 |
| | | 10 | 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 |
| | | 12 | 19,500 | 1,350 | 0.12 | 0.45 | 12,400 | 1,350 | 0.06 | 0.34 | 11,500 | 1,100 | 0.045 | 0.27 | 8,650 | 550 | 0.045 | 0.27 |
| | | 13 | 19,500 | 1,350 | 0.12 | 0.45 | 12,400 | 1,350 | 0.06 | 0.34 | 11,500 | 1,100 | 0.045 | 0.27 | 8,650 | 550 | 0.045 | 0.27 |
| | | 14 | 19,500 | 1,350 | 0.12 | 0.45 | 12,400 | 1,350 | 0.06 | 0.34 | 11,500 | 1,100 | 0.045 | 0.27 | 8,650 | 550 | 0.045 | 0.27 |
| | | 16 | 10,800 | 500 | 0.05 | 0.3 | 10,800 | 600 | 0.03 | 0.24 | 10,700 | 490 | 0.03 | 0.24 | 8,000 | 245 | 0.03 | 0.24 |
| | | 18 | 9,700 | 435 | 0.04 | 0.28 | 9,700 | 520 | 0.025 | 0.22 | 9,650 | 430 | 0.025 | 0.22 | 7,250 | 215 | 0.025 | 0.22 |
| | | 20 | 8,650 | 375 | 0.035 | 0.25 | 8,650 | 450 | 0.02 | 0.19 | 8,560 | 370 | 0.02 | 0.19 | 6,400 | 185 | 0.02 | 0.19 |
| | | 22 | 8,450 | 350 | 0.032 | 0.245 | 8,200 | 440 | 0.018 | 0.18 | 8,200 | 330 | 0.018 | 0.18 | 6,150 | 165 | 0.018 | 0.18 |
| | | 25 | 8,250 | 320 | 0.03 | 0.24 | 7,800 | 440 | 0.016 | 0.16 | 7,800 | 290 | 0.016 | 0.16 | 5,850 | 145 | 0.016 | 0.16 |
| | | 27 | 8,050 | 300 | 0.027 | 0.22 | 7,400 | 390 | 0.015 | 0.16 | 7,400 | 250 | 0.015 | 0.16 | 5,550 | 120 | 0.015 | 0.16 |
| | | 30 | 7,850 | 280 | 0.024 | 0.2 | 7,000 | 350 | 0.014 | 0.16 | 7,000 | 220 | 0.014 | 0.16 | 5,250 | 110 | 0.014 | 0.16 |
| | | 32 | 7,650 | 260 | 0.02 | 0.18 | 6,550 | 300 | 0.012 | 0.12 | 6,550 | 190 | 0.012 | 0.12 | 4,900 | 90 | 0.012 | 0.12 |
| | | 35 | 7,450 | 240 | 0.016 | 0.16 | 6,150 | 250 | 0.01 | 0.09 | 6,150 | 160 | 0.01 | 0.09 | 4,600 | 80 | 0.01 | 0.09 |
| | | 40 | 7,000 | 200 | 0.01 | 0.06 | 5,250 | 150 | 0.006 | 0.04 | 5,250 | 100 | 0.006 | 0.04 | 3,950 | 50 | 0.006 | 0.04 |
| 2025 | R1.25 | 6 | 25,000 | 3,000 | 0.35 | 0.85 | 12,400 | 2,200 | 0.17 | 0.6 | 11,000 | 1,850 | 0.1 | 0.45 | 8,250 | 920 | 0.1 | 0.45 |
| | | 8 | 25,000 | 3,000 | 0.24 | 0.76 | 12,400 | 2,200 | 0.13 | 0.51 | 11,000 | 1,850 | 0.08 | 0.38 | 8,250 | 920 | 0.08 | 0.38 |
| | | 10 | 25,000 | 3,000 | 0.24 | 0.76 | 12,400 | 2,200 | 0.13 | 0.51 | 11,000 | 1,850 | 0.08 | 0.38 | 8,250 | 920 | 0.08 | 0.38 |
| | | 15 | 17,300 | 1,400 | 0.145 | 0.57 | 11,000 | 1,400 | 0.08 | 0.44 | 10,300 | 1,140 | 0.06 | 0.35 | 7,700 | 570 | 0.06 | 0.35 |
| | | 20 | 9,600 | 520 | 0.06 | 0.38 | 9,600 | 630 | 0.04 | 0.31 | 9,600 | 510 | 0.04 | 0.31 | 7,200 | 255 | 0.04 | 0.31 |
| | | 25 | 6,900 | 375 | 0.042 | 0.32 | 6,900 | 450 | 0.024 | 0.235 | 6,840 | 370 | 0.024 | 0.235 | 5,150 | 185 | 0.024 | 0.235 |
| | | 30 | 6,500 | 320 | 0.025 | 0.24 | 6,200 | 400 | 0.02 | 0.22 | 6,200 | 280 | 0.02 | 0.22 | 4,650 | 140 | 0.02 | 0.22 |
| | | 35 | 6,200 | 280 | 0.017 | 0.2 | 5,500 | 350 | 0.014 | 0.18 | 5,500 | 220 | 0.014 | 0.18 | 4,150 | 110 | 0.014 | 0.18 |
| 2030 | R1.5 | 6 | 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 | 0.4 | 1 | 10,500 | 2,200 | 0.2 | 0.7 | 9,200 | 1,900 | 0.12 | 0.55 | 6,900 | 950 | 0.12 | 0.55 |
| | | 10 | 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 |
| | | 12 | 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 |
| | | 14 | 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 |
| | | 15 | 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 |
| | | 16 | 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 |
| | | 18 | 17,750 | 2,180 | 0.24 | 0.8 | 9,800 | 1,800 | 0.13 | 0.57 | 8,900 | 1,500 | 0.08 | 0.47 | 6,650 | 760 | 0.08 | 0.47 |
| | | 20 | 14,500 | 1,360 | 0.18 | 0.7 | 9,250 | 1,400 | 0.1 | 0.5 | 8,600 | 1,150 | 0.075 | 0.45 | 6,450 | 575 | 0.075 | 0.45 |
| | | 22 | 11,250 | 940 | 0.12 | 0.57 | 8,625 | 1,000 | 0.07 | 0.44 | 8,300 | 830 | 0.06 | 0.41 | 6,200 | 410 | 0.06 | 0.41 |
| | | 25 | 8,000 | 520 | 0.07 | 0.45 | 8,000 | 630 | 0.05 | 0.38 | 8,000 | 510 | 0.05 | 0.38 | 6,000 | 255 | 0.05 | 0.38 |
| | | 27 | 6,850 | 440 | 0.06 | 0.41 | 6,850 | 540 | 0.04 | 0.33 | 6,850 | 440 | 0.04 | 0.33 | 5,100 | 220 | 0.04 | 0.33 |
| | | 30 | 5,750 | 375 | 0.05 | 0.38 | 5,750 | 450 | 0.03 | 0.29 | 5,700 | 370 | 0.03 | 0.29 | 4,275 | 185 | 0.03 | 0.29 |
| | | 32 | 5,650 | 350 | 0.045 | 0.37 | 5,550 | 440 | 0.025 | 0.28 | 5,500 | 340 | 0.025 | 0.28 | 4,100 | 170 | 0.025 | 0.28 |
| | | 35 | 5,550 | 335 | 0.045 | 0.36 | 5,350 | 440 | 0.025 | 0.27 | 5,350 | 310 | 0.025 | 0.27 | 4,000 | 155 | 0.025 | 0.27 |
| | | 40 | 5,350 | 300 | 0.04 | 0.34 | 4,900 | 390 | 0.02 | 0.24 | 4,850 | 250 | 0.02 | 0.24 | 3,650 | 125 | 0.02 | 0.24 |

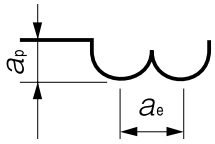
## Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| 2035 | R1.75 | 10 | 19,000 | 3,000 | 0.35 | 1.05 | 10,000 | 2,200 | 0.17 | 0.75 | 8,400 | 1,900 | 0.11 | 0.61 | 6,300 | 950 | 0.11 | 0.61 |
| | | 15 | 19,000 | 3,000 | 0.35 | 1.05 | 10,000 | 2,200 | 0.17 | 0.75 | 8,400 | 1,900 | 0.11 | 0.61 | 6,300 | 950 | 0.11 | 0.61 |
| | | 20 | 19,000 | 3,000 | 0.35 | 1.05 | 10,000 | 2,200 | 0.17 | 0.75 | 8,400 | 1,900 | 0.11 | 0.61 | 6,300 | 950 | 0.11 | 0.61 |
| | | 25 | 13,000 | 1,750 | 0.21 | 0.83 | 8,450 | 1,400 | 0.11 | 0.61 | 7,650 | 1,200 | 0.08 | 0.52 | 5,750 | 600 | 0.08 | 0.52 |
| | | 30 | 6,900 | 520 | 0.08 | 0.52 | 6,900 | 630 | 0.06 | 0.45 | 6,900 | 510 | 0.06 | 0.45 | 5,200 | 255 | 0.06 | 0.45 |
| | | 40 | 5,750 | 410 | 0.06 | 0.45 | 5,550 | 510 | 0.04 | 0.37 | 5,500 | 380 | 0.04 | 0.37 | 4,150 | 190 | 0.04 | 0.37 |
| | | 45 | 4,600 | 300 | 0.045 | 0.39 | 4,200 | 390 | 0.025 | 0.29 | 4,100 | 250 | 0.025 | 0.29 | 3,100 | 125 | 0.025 | 0.29 |
| 2040 | R2 | 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 |
| | | 10 | 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 |
| | | 12 | 18,000 | 3,200 | 0.4 | 1.2 | 9,000 | 2,300 | 0.2 | 0.85 | 7,900 | 2,000 | 0.13 | 0.7 | 5,900 | 1,000 | 0.13 | 0.7 |
| | | 14 | 18,000 | 3,200 | 0.4 | 1.2 | 9,000 | 2,300 | 0.2 | 0.85 | 7,900 | 2,000 | 0.13 | 0.7 | 5,900 | 1,000 | 0.13 | 0.7 |
| | | 15 | 18,000 | 3,200 | 0.4 | 1.2 | 9,000 | 2,300 | 0.2 | 0.85 | 7,900 | 2,000 | 0.13 | 0.7 | 5,900 | 1,000 | 0.13 | 0.7 |
| | | 16 | 18,000 | 3,200 | 0.4 | 1.2 | 9,000 | 2,300 | 0.2 | 0.85 | 7,900 | 2,000 | 0.13 | 0.7 | 5,900 | 1,000 | 0.13 | 0.7 |
| | | 18 | 18,000 | 3,200 | 0.4 | 1.2 | 9,000 | 2,300 | 0.2 | 0.85 | 7,900 | 2,000 | 0.13 | 0.7 | 5,900 | 1,000 | 0.13 | 0.7 |
| | | 20 | 18,000 | 3,200 | 0.4 | 1.2 | 9,000 | 2,300 | 0.2 | 0.85 | 7,900 | 2,000 | 0.13 | 0.7 | 5,900 | 1,000 | 0.13 | 0.7 |
| | | 22 | 15,000 | 2,350 | 0.32 | 1.05 | 8,500 | 1,850 | 0.16 | 0.75 | 7,650 | 1,600 | 0.11 | 0.6 | 5,750 | 810 | 0.11 | 0.6 |
| | | 25 | 12,500 | 1,500 | 0.25 | 0.95 | 8,000 | 1,450 | 0.13 | 0.7 | 7,450 | 1,250 | 0.09 | 0.55 | 5,600 | 625 | 0.09 | 0.55 |
| | | 27 | 9,750 | 1,000 | 0.17 | 0.76 | 7,500 | 1,050 | 0.09 | 0.55 | 7,200 | 890 | 0.07 | 0.5 | 5,400 | 440 | 0.07 | 0.5 |
| | | 30 | 7,000 | 550 | 0.1 | 0.6 | 7,000 | 660 | 0.06 | 0.45 | 7,000 | 540 | 0.06 | 0.45 | 5,250 | 270 | 0.06 | 0.45 |
| | | 32 | 6,500 | 535 | 0.09 | 0.59 | 6,500 | 640 | 0.055 | 0.44 | 6,500 | 520 | 0.055 | 0.44 | 4,850 | 260 | 0.055 | 0.44 |
| | | 35 | 6,000 | 520 | 0.09 | 0.59 | 6,000 | 630 | 0.055 | 0.43 | 6,000 | 510 | 0.055 | 0.43 | 4,500 | 255 | 0.055 | 0.43 |
| | | 40 | 4,300 | 375 | 0.065 | 0.5 | 4,300 | 450 | 0.04 | 0.39 | 4,300 | 370 | 0.04 | 0.39 | 3,200 | 185 | 0.04 | 0.39 |
| | | 45 | 4,150 | 330 | 0.058 | 0.47 | 4,000 | 440 | 0.033 | 0.36 | 4,000 | 300 | 0.033 | 0.36 | 3,000 | 150 | 0.033 | 0.36 |
| | | 50 | 4,000 | 300 | 0.053 | 0.44 | 3,750 | 400 | 0.03 | 0.33 | 3,750 | 260 | 0.03 | 0.33 | 2,800 | 130 | 0.03 | 0.33 |
| | | 60 | 3,900 | 280 | 0.048 | 0.4 | 3,500 | 350 | 0.028 | 0.3 | 3,500 | 220 | 0.028 | 0.3 | 2,600 | 110 | 0.028 | 0.3 |
| 2050 | R2.5 | 10 | 14,400 | 3,200 | 0.5 | 1.5 | 7,200 | 2,300 | 0.25 | 1.05 | 6,350 | 2,000 | 0.16 | 0.88 | 4,750 | 1,000 | 0.16 | 0.88 |
| | | 15 | 14,400 | 3,200 | 0.5 | 1.5 | 7,200 | 2,300 | 0.25 | 1.05 | 6,350 | 2,000 | 0.16 | 0.88 | 4,750 | 1,000 | 0.16 | 0.88 |
| | | 20 | 14,400 | 3,200 | 0.5 | 1.5 | 7,200 | 2,300 | 0.25 | 1.05 | 6,350 | 2,000 | 0.16 | 0.88 | 4,750 | 1,000 | 0.16 | 0.88 |
| | | 25 | 12,200 | 2,350 | 0.405 | 1.35 | 6,800 | 1,850 | 0.205 | 0.95 | 6,250 | 1,600 | 0.135 | 0.805 | 4,650 | 800 | 0.135 | 0.805 |
| | | 30 | 10,000 | 1,500 | 0.31 | 1.2 | 6,400 | 1,450 | 0.16 | 0.88 | 6,200 | 1,250 | 0.11 | 0.73 | 4,650 | 625 | 0.11 | 0.73 |
| | | 35 | 8,000 | 1,050 | 0.21 | 1 | 6,200 | 1,070 | 0.12 | 0.76 | 6,100 | 900 | 0.095 | 0.68 | 4,600 | 450 | 0.095 | 0.68 |
| | | 40 | 6,000 | 570 | 0.125 | 0.78 | 6,000 | 690 | 0.08 | 0.625 | 6,000 | 570 | 0.08 | 0.625 | 4,500 | 285 | 0.08 | 0.625 |
| | | 45 | 5,150 | 500 | 0.11 | 0.72 | 5,150 | 600 | 0.07 | 0.4 | 5,100 | 500 | 0.07 | 0.4 | 3,800 | 250 | 0.07 | 0.4 |
| | | 50 | 4,300 | 430 | 0.09 | 0.65 | 4,300 | 510 | 0.06 | 0.18 | 4,200 | 435 | 0.06 | 0.18 | 3,150 | 215 | 0.06 | 0.18 |

# Milling Conditions for HSLB / HSLB-S

| WORK MATERIAL | | | PREHARDENED STEELS HARDENED STEELS NAK / STAVAX(~55HRC) | | | | HARDENED STEELS SKD11 (55~62HRC) | | | | HARDENED STEELS HAP10 (62~66HRC) | | | | HARDENED STEELS HAP72 (66~70HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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 | 10 | 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 |
| | | 15 | 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 |
| | | 18 | 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 |
| | | 20 | 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 |
| | | 22 | 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 |
| | | 25 | 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 |
| | | 27 | 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 |
| | | 30 | 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 |
| | | 32 | 12,000 | 3,100 | 0.54 | 1.7 | 6,300 | 2,250 | 0.27 | 1.15 | 5,600 | 2,000 | 0.18 | 0.9 | 4,200 | 1,000 | 0.18 | 0.9 |
| | | 35 | 11,000 | 2,750 | 0.48 | 1.6 | 6,100 | 2,050 | 0.25 | 1.05 | 5,500 | 1,800 | 0.175 | 0.8 | 4,150 | 900 | 0.175 | 0.8 |
| | | 40 | 9,000 | 2,050 | 0.375 | 1.35 | 5,750 | 1,600 | 0.2 | 0.8 | 5,350 | 1,400 | 0.15 | 0.65 | 4,000 | 700 | 0.15 | 0.65 |
| | | 45 | 7,000 | 1,300 | 0.26 | 1.1 | 5,350 | 1,150 | 0.15 | 0.55 | 5,150 | 1,000 | 0.125 | 0.45 | 3,850 | 500 | 0.125 | 0.45 |
| | | 50 | 5,000 | 600 | 0.15 | 0.9 | 5,000 | 720 | 0.1 | 0.3 | 5,000 | 600 | 0.1 | 0.3 | 3,750 | 300 | 0.1 | 0.3 |
| | | 60 | 3,600 | 430 | 0.105 | 0.75 | 3,600 | 510 | 0.08 | 0.22 | 3,550 | 435 | 0.08 | 0.22 | 2,650 | 215 | 0.08 | 0.22 |

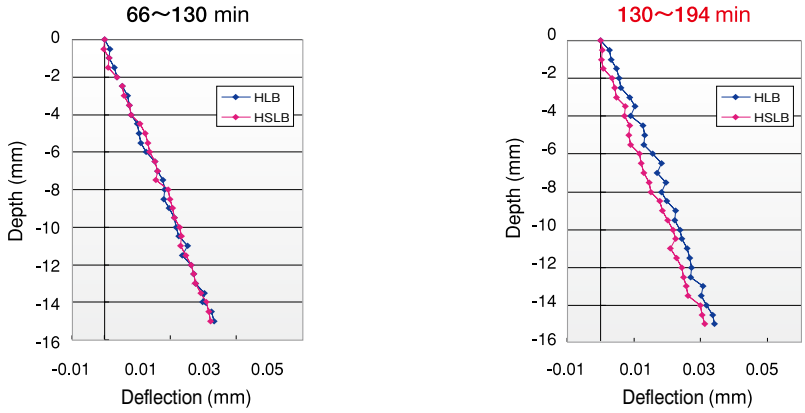
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

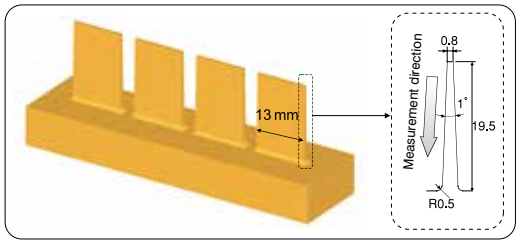



Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
・Every coolant offers stable milling.

**Copper Electrode Milling Comparison : HSLB generates less side force to reduce work piece deflection**

Variable rake cutting edge reduces tool deflection!
Better wear resistance than conventional +Rake.
After extended milling time, new HSLB makes less deflection than conventional HLB!



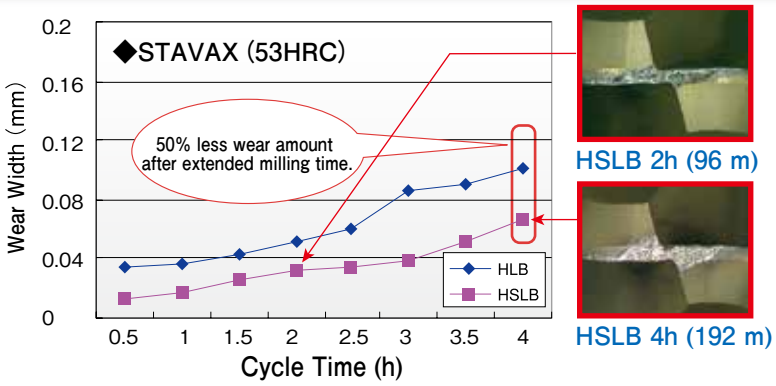




## Tool: HSLB R0.5 x Effective Length 20 mm

| | |
|---|---|
| Work Material | Copper (C1100) |
| Spindle Speed $n$ | 9,350 $min^{-1}$ |
| Feed Rate $Vf$ | 540 mm/min |
| Velocity $Vc$ | 29.4 m/min |
| Feed per tooth $f_z$ | 0.029 mm/tooth |
| Axial Depth $a_p$ | 0.017 mm |
| Radial Depth $a_e$ | 0.01 mm |
| Overhang Length | 30 mm |
| Cycle Time | 66 min/pocket |
| Coolant | Water Soluble |
| Milling Method | Contouring |

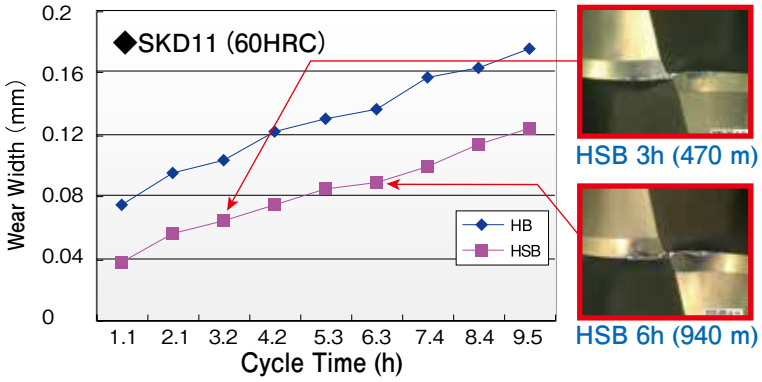
* Refer to page 580 for tool geometry.

**Wear Comparison:** **Better wear resistance compared to HB / HLB, for a wide range of materials.**




Tool: HSLB R0.5 x Effective Length 6 mm

| | |
|---|---|
| Work Material | STAVAX (53HRC) |
| Spindle Speed $n$ | 24,000 $min^{-1}$ |
| Feed Rate $Vf$ | 800 mm/min |
| Velocity $Vc$ | 75.4 m/min |
| Feed per tooth $f_z$ | 0.017 mm/tooth |
| Axial Depth $a_p$ | 0.024 mm |
| Radial Depth $a_e$ | 0.057 mm |
| Overhang Length | 20 mm |
| Coolant | Air Blow |
| Milling Method | Flat Pocket Milling |




Tool: HSB R3 x Length of Cut 9 mm

| | |
|---|---|
| Work Material | SKD11 (60HRC) |
| Spindle Speed $n$ | 10,000 $min^{-1}$ |
| Feed Rate $Vf$ | 3,000 mm/min |
| Velocity $Vc$ | 188 m/min |
| Feed per tooth $f_z$ | 0.15 mm/tooth |
| Axial Depth $a_p$ | 0.1 mm |
| Radial Depth $a_e$ | 0.15 mm |
| Overhang Length | 20 mm |
| Coolant | Air Blow |
| Milling Method | Flat Milling (both ways) |

## Size R0.1～R3

### Short Shank Series

# HSLB-S

Super MG | HARD MAX | 30° | R ±0.003 (R0.1～R2) | R ±0.005 (R3) | Shank Dia 0/-0.004 | Back Taper Geometry (～Except for R0.4 ℓ1 / D≦10)

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ◎ | ○ | | | ○ | | | ○ | ○ | | |

## Features

**Short Shank Long Neck Ball End Mills for high accuracy shrink-fit holder.**
**Offers high efficiency, long tool life and excellent surface finish on hard materials over 40HRC.**
**HARDMAX coat offers heat resistance, durability and lubricity at a high level.**
**Every coolant offers stable milling.**
**Ball tip point is designed with a negative rake angle that minimizes wear and improves the target dimensions.**
**The low negative rake angle at the peripheral side of the ball offers an excellent surface finish and prevents deflection.**

## Better Tolerance Design! Diameter Tolerance, Ball Radius Accuracy, and Shank Diameter Tolerance

### HSB / HSLB Tolerance

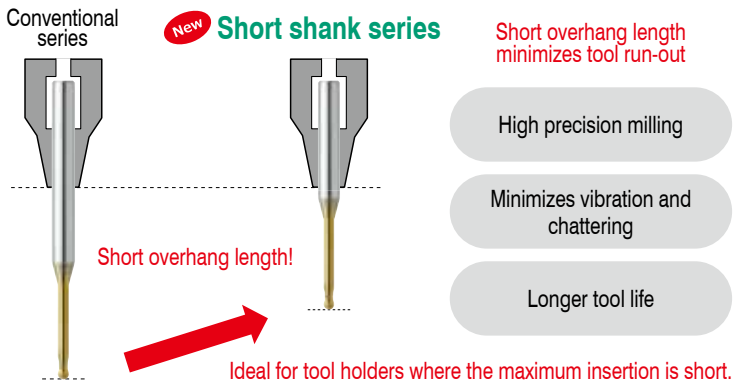
| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.1 ～ R3 | 0/-0.015 | ±0.005 | 0/-0.005 (h5) |

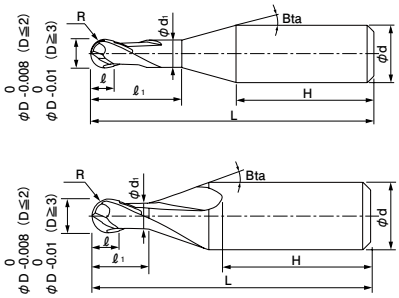
### HSB-S / HSLB-S Tolerance

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Shank Diameter Tolerance |
|---|---|---|---|
| R0.1 ～ R1 | 0/-0.008 | ±0.003 | 0/-0.004 (h4) |
| R1.5 ～ R2 | 0/-0.01 | | |
| R3 | | ±0.005 | |

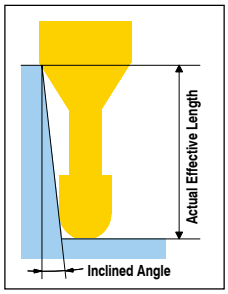
Shank diameter tolerance h4!

## Short overhang length with short shank length!






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




Total 61 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shank Length H | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HSLB 2002-005S | R0.1 | 0.5 | 0.16 | 0.19 | 16° | 35 | 4 | 26.0 | 8,090 | 0.63 | 0.66 | 0.68 | 0.71 | 0.76 |
| HSLB 2002-010S | | 1 | | | | 35 | 4 | 25.5 | 8,090 | 1.15 | 1.20 | 1.24 | 1.28 | 1.37 |
| HSLB 2003-005S | R0.15 | 0.5 | 0.24 | 0.29 | 16° | 35 | 4 | 26.0 | 7,980 | 0.63 | 0.65 | 0.68 | 0.70 | 0.75 |
| HSLB 2003-0075S | | 0.75 | | | | 35 | 4 | 26.0 | 7,980 | 0.89 | 0.92 | 0.96 | 0.99 | 1.05 |
| HSLB 2003-010S | | 1 | | | | 35 | 4 | 25.5 | 7,980 | 1.15 | 1.19 | 1.23 | 1.27 | 1.36 |
| HSLB 2003-015S | | 1.5 | | | | 35 | 4 | 25.0 | 8,550 | 1.66 | 1.72 | 1.77 | 1.83 | 1.96 |
| HSLB 2004-005S | R0.2 | 0.5 | 0.32 | 0.39 | 16° | 35 | 4 | 26.5 | 5,470 | 0.63 | 0.65 | 0.67 | 0.70 | 0.74 |
| HSLB 2004-010S | | 1 | | | | 35 | 4 | 26.0 | 5,470 | 1.15 | 1.19 | 1.23 | 1.26 | 1.35 |
| HSLB 2004-015S | | 1.5 | | | | 35 | 4 | 25.5 | 5,590 | 1.66 | 1.71 | 1.77 | 1.82 | 1.95 |
| HSLB 2004-020S | | 2 | | | | 35 | 4 | 25.0 | 5,700 | 2.18 | 2.25 | 2.32 | 2.39 | 2.56 |
| HSLB 2004-025S | | 2.5 | | | | 35 | 4 | 24.5 | 5,930 | 2.70 | 2.78 | 2.87 | 2.96 | 3.17 |
| HSLB 2004-030S | | 3 | | | | 35 | 4 | 24.0 | 6,270 | 3.21 | 3.31 | 3.42 | 3.53 | 3.79 |
| HSLB 2005-010S | R0.25 | 1 | 0.4 | 0.49 | 16° | 35 | 4 | 26.0 | 5,470 | 1.15 | 1.19 | 1.22 | 1.26 | 1.34 |
| HSLB 2005-015S | | 1.5 | | | | 35 | 4 | 25.5 | 5,470 | 1.65 | 1.71 | 1.76 | 1.82 | 1.94 |
| HSLB 2005-020S | | 2 | | | | 35 | 4 | 25.0 | 5,470 | 2.18 | 2.24 | 2.31 | 2.39 | 2.55 |
| HSLB 2005-025S | | 2.5 | | | | 35 | 4 | 24.5 | 5,470 | 2.69 | 2.78 | 2.86 | 2.96 | 3.16 |
| HSLB 2005-030S | | 3 | | | | 35 | 4 | 24.0 | 5,470 | 3.21 | 3.31 | 3.41 | 3.53 | 3.77 |
| HSLB 2006-010S | R0.3 | 1 | 0.48 | 0.59 | 16° | 35 | 4 | 26.0 | 4,670 | 1.14 | 1.18 | 1.22 | 1.25 | 1.33 |
| HSLB 2006-015S | | 1.5 | | | | 35 | 4 | 25.5 | 4,220 | 1.65 | 1.71 | 1.76 | 1.81 | 1.93 |
| HSLB 2006-020S | | 2 | | | | 35 | 4 | 25.0 | 4,220 | 2.17 | 2.24 | 2.31 | 2.38 | 2.54 |
| HSLB 2006-030S | | 3 | | | | 35 | 4 | 24.0 | 4,330 | 3.21 | 3.31 | 3.41 | 3.52 | 3.76 |
| HSLB 2006-040S | | 4 | | | | 40 | 4 | 28.0 | 4,450 | 4.24 | 4.37 | 4.51 | 4.66 | 4.99 |
| HSLB 2006-050S | | 5 | | | | 40 | 4 | 27.0 | 4,450 | 5.27 | 5.44 | 5.61 | 5.80 | 6.21 |
| HSLB 2006-060S | | 6 | | | | 40 | 4 | 26.0 | 4,450 | 6.30 | 6.50 | 6.71 | 6.93 | 7.43 |
| HSLB 2008-020S | R0.4 | 2 | 0.64 | 0.79 | 16° | 35 | 4 | 25.5 | 4,220 | 2.17 | 2.23 | 2.30 | 2.37 | 2.52 |
| HSLB 2008-030S | | 3 | | | | 35 | 4 | 24.5 | 4,450 | 3.21 | 3.30 | 3.40 | 3.50 | 3.74 |
| HSLB 2008-040S | | 4 | | | | 35 | 4 | 23.5 | 4,450 | 4.24 | 4.36 | 4.50 | 4.64 | 4.97 |
| HSLB 2008-060S | | 6 | | | | 40 | 4 | 26.5 | 4,450 | 6.30 | 6.49 | 6.70 | 6.92 | 7.41 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shank Length H | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HSLB 2010-020S** | R0.5 | 2 | 0.8 | 0.98 | 16° | 35 | 4 | 25.5 | 3,530 | 2.18 | 2.24 | 2.30 | 2.36 | 2.51 |
| **HSLB 2010-025S** | | 2.5 | | | | 35 | 4 | 25.0 | 3,530 | 2.70 | 2.77 | 2.85 | 2.93 | 3.12 |
| **HSLB 2010-030S** | | 3 | | | | 35 | 4 | 24.5 | 3,530 | 3.21 | 3.30 | 3.40 | 3.50 | 3.73 |
| **HSLB 2010-040S** | | 4 | | | | 35 | 4 | 23.5 | 3,990 | 4.24 | 4.37 | 4.50 | 4.64 | 4.96 |
| **HSLB 2010-060S** | | 6 | | | | 40 | 4 | 26.5 | 4,330 | 6.31 | 6.50 | 6.70 | 6.92 | 7.40 |
| **HSLB 2010-080S** | | 8 | | | | 40 | 4 | 24.5 | 4,330 | 8.37 | 8.63 | 8.90 | 9.20 | 9.85 |
| **HSLB 2015-030S** | R0.75 | 3 | 1.2 | 1.47 | 16° | 35 | 4 | 25.5 | 4,100 | 3.10 | 3.18 | 3.26 | 3.35 | 3.55 |
| **HSLB 2015-040S** | | 4 | | | | 35 | 4 | 24.5 | 4,100 | 4.13 | 4.24 | 4.36 | 4.49 | 4.77 |
| **HSLB 2015-060S** | | 6 | | | | 40 | 4 | 27.5 | 4,100 | 6.19 | 6.37 | 6.56 | 6.76 | 7.22 |
| **HSLB 2015-080S** | | 8 | | | | 40 | 4 | 25.5 | 4,330 | 8.25 | 8.50 | 8.76 | 9.04 | 9.67 |
| **HSLB 2015-100S** | | 10 | | | | 40 | 4 | 23.5 | 4,670 | 10.32 | 10.63 | 10.96 | 11.32 | 12.11 |
| **HSLB 2020-030S** | R1 | 3 | 1.6 | 1.98 | 16° | 35 | 4 | 26.5 | 3,530 | 3.07 | 3.14 | 3.21 | 3.29 | 3.47 |
| **HSLB 2020-040S** | | 4 | | | | 35 | 4 | 25.5 | 3,530 | 4.10 | 4.20 | 4.31 | 4.43 | 4.70 |
| **HSLB 2020-060S** | | 6 | | | | 35 | 4 | 23.5 | 3,990 | 6.16 | 6.33 | 6.51 | 6.71 | 7.14 |
| **HSLB 2020-080S** | | 8 | | | | 40 | 4 | 26.5 | 4,330 | 8.23 | 8.46 | 8.72 | 8.99 | 9.59 |
| **HSLB 2020-100S** | | 10 | | | | 40 | 4 | 24.5 | 4,330 | 10.29 | 10.59 | 10.92 | 11.26 | 12.04 |
| **HSLB 2020-120S** | | 12 | | | | 45 | 4 | 27.5 | 4,330 | 12.35 | 12.72 | 13.12 | 13.54 | 14.48 |
| **HSLB 2020-140S** | | 14 | | | | 45 | 4 | 25.5 | 4,330 | 14.41 | 14.85 | 15.32 | 15.82 | 16.93 |
| **HSLB 2020-160S** | | 16 | | | | 50 | 4 | 28.5 | 4,330 | 16.48 | 16.98 | 17.52 | 18.10 | 19.38 |
| **HSLB 2020-200S** | | 20 | | | | 50 | 4 | 24.5 | 4,330 | 20.60 | 21.24 | 21.92 | 22.65 | No Interference |
| **HSLB 2030-060-4S** | R1.5 | 6 | 2.4 | 2.95 | 16° | 35 | 4 | 25.0 | 4,330 | 6.20 | 6.35 | 6.52 | 6.69 | 7.09 |
| **HSLB 2030-080-4S** | | 8 | | | | 40 | 4 | 28.0 | 4,330 | 8.26 | 8.48 | 8.72 | 8.97 | 9.54 |
| **HSLB 2030-100-4S** | | 10 | | | | 40 | 4 | 26.0 | 5,020 | 10.32 | 10.61 | 10.92 | 11.25 | No Interference |
| **HSLB 2030-120-4S** | | 12 | | | | 40 | 4 | 24.0 | 5,240 | 12.38 | 12.74 | 13.12 | 13.53 | No Interference |
| **HSLB 2030-160-4S** | | 16 | | | | 45 | 4 | 25.0 | 5,810 | 16.51 | 17.00 | 17.52 | No Interference | No Interference |
| **HSLB 2030-200-4S** | | 20 | | | | 50 | 4 | 26.0 | 5,590 | 20.64 | 21.26 | No Interference | No Interference | No Interference |
| **HSLB 2040-080-4S** | R2 | 8 | 3.2 | 3.95 | — | 35 | 4 | 24.0 | 4,450 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2040-100-4S** | | 10 | | | | 40 | 4 | 28.0 | 4,450 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2040-120-4S** | | 12 | | | | 40 | 4 | 26.0 | 5,810 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2040-160-4S** | | 16 | | | | 45 | 4 | 27.0 | 5,810 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2040-200-4S** | | 20 | | | | 50 | 4 | 28.0 | 5,810 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-150S** | R3 | 15 | 4.8 | 5.95 | — | 45 | 6 | 28.0 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **HSLB 2060-200S** | | 20 | | | | 50 | 6 | 28.0 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |

Size **R0.05～R3**

# CSELB

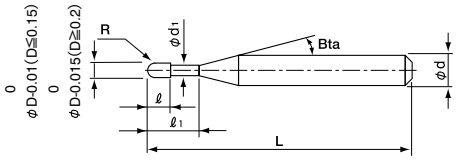
Super MG | UT COAT | Shank Dia 0/-0.005 | Back Taper Geometry

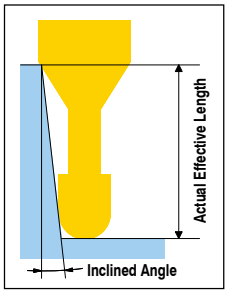
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | | | ○ | ○ | | |

## Features

**The robust geometry offers durability when roughing, yet gives excellent surface quality for finishing.**
**UTCOAT with improved hardness, durability, lubricity and adhesion offers better wear resistance and surface roughness.**
**Broad application range from Copper and raw materials to Hardened Steels (55HRC).**




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

| Radius of Ball Nose | Diameter Tolerance | Ball Radius Accuracy | Helix Angle |
|---|---|---|---|
| R0.05～R0.075 | 0/-0.01 | ±0.002 | 0° |
| R0.1～R3 | 0/-0.015 | ±0.005 | 30° |

Total 325 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φdi | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSELB 2001-002 | R0.05 | 0.2 | 0.08 | 0.095 | 11° | 45 | 4 | 11,630 | 0.22 | 0.24 | 0.26 | 0.28 | 0.31 |
| CSELB 2001-003 | | 0.3 | | | | 45 | 4 | 11,630 | 0.33 | 0.35 | 0.38 | 0.40 | 0.45 |
| CSELB 2001-005 | | 0.5 | | | | 45 | 4 | 12,540 | 0.54 | 0.58 | 0.61 | 0.64 | 0.72 |
| CSELB 20015-003 | R0.075 | 0.3 | 0.12 | 0.135 | 11° | 45 | 4 | 13,450 | 0.36 | 0.38 | 0.40 | 0.42 | 0.48 |
| CSELB 20015-005 | | 0.5 | | | | 45 | 4 | 14,250 | 0.58 | 0.60 | 0.63 | 0.67 | 0.75 |
| CSELB 20015-010 | | 1 | | | | 45 | 4 | 14,820 | 1.10 | 1.15 | 1.21 | 1.28 | 1.43 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2002-003 | R0.1 | 0.3 | 0.16 | 0.19 | 11° | 45 | 4 | 8,090 | 0.40 | 0.42 | 0.44 | 0.46 | 0.52 |
| CSELB 2002-005 | | 0.5 | | | | 45 | 4 | 8,090 | 0.61 | 0.64 | 0.67 | 0.71 | 0.79 |
| CSELB 2002-005-6 | | 0.5 | | | | 50 | 6 | 11,290 | 0.61 | 0.64 | 0.67 | 0.71 | 0.79 |
| CSELB 2002-0075 | | 0.75 | | | | 45 | 4 | 8,090 | 0.87 | 0.92 | 0.96 | 1.01 | 1.13 |
| CSELB 2002-010 | | 1 | | | | 45 | 4 | 8,090 | 1.14 | 1.19 | 1.25 | 1.32 | 1.48 |
| CSELB 2002-010-6 | | 1 | | | | 50 | 6 | 11,290 | 1.14 | 1.19 | 1.25 | 1.32 | 1.48 |
| CSELB 2002-0125 | | 1.25 | | | | 45 | 4 | 8,780 | 1.39 | 1.45 | 1.53 | 1.61 | 1.80 |
| CSELB 2002-015 | | 1.5 | | | | 45 | 4 | 8,780 | 1.65 | 1.73 | 1.81 | 1.91 | 2.14 |
| CSELB 2002-015-6 | | 1.5 | | | | 50 | 6 | 12,250 | 1.65 | 1.73 | 1.81 | 1.91 | 2.14 |
| CSELB 2002-0175 | | 1.75 | | | | 45 | 4 | 9,690 | 1.91 | 2.00 | 2.10 | 2.22 | 2.49 |
| CSELB 2002-020 | | 2 | | | | 45 | 4 | 9,690 | 2.17 | 2.28 | 2.39 | 2.52 | 2.83 |
| CSELB 2002-020-6 | | 2 | | | | 50 | 6 | 13,520 | 2.17 | 2.28 | 2.39 | 2.52 | 2.83 |
| CSELB 2002-0225 | | 2.25 | | | | 45 | 4 | 10,600 | 2.43 | 2.55 | 2.68 | 2.83 | 3.17 |
| CSELB 2002-025 | | 2.5 | | | | 45 | 4 | 10,600 | 2.69 | 2.83 | 2.97 | 3.13 | 3.51 |
| CSELB 2002-030 | | 3 | | | | 45 | 4 | 11,400 | 3.22 | 3.37 | 3.55 | 3.74 | 4.20 |
| CSELB 2003-005 | R0.15 | 0.5 | 0.24 | 0.29 | 11° | 45 | 4 | 7,980 | 0.61 | 0.64 | 0.67 | 0.70 | 0.77 |
| CSELB 2003-006 | | 0.6 | | | | 45 | 4 | 7,980 | 0.71 | 0.75 | 0.78 | 0.82 | 0.91 |
| CSELB 2003-0075 | | 0.75 | | | | 45 | 4 | 7,980 | 0.87 | 0.91 | 0.95 | 1.00 | 1.12 |
| CSELB 2003-010 | | 1 | | | | 45 | 4 | 7,980 | 1.13 | 1.19 | 1.24 | 1.31 | 1.46 |
| CSELB 2003-010-6 | | 1 | | | | 50 | 6 | 10,830 | 1.13 | 1.19 | 1.24 | 1.31 | 1.46 |
| CSELB 2003-0125 | | 1.25 | | | | 45 | 4 | 8,550 | 1.38 | 1.45 | 1.52 | 1.60 | 1.78 |
| CSELB 2003-015 | | 1.5 | | | | 45 | 4 | 8,550 | 1.64 | 1.72 | 1.81 | 1.90 | 2.12 |
| CSELB 2003-015-6 | | 1.5 | | | | 50 | 6 | 11,860 | 1.64 | 1.72 | 1.81 | 1.90 | 2.12 |
| CSELB 2003-0175 | | 1.75 | | | | 45 | 4 | 8,550 | 1.91 | 2.00 | 2.10 | 2.21 | 2.47 |
| CSELB 2003-020 | | 2 | | | | 45 | 4 | 8,550 | 2.17 | 2.27 | 2.38 | 2.51 | 2.81 |
| CSELB 2003-020-6 | | 2 | | | | 50 | 6 | 11,860 | 2.17 | 2.27 | 2.38 | 2.51 | 2.81 |
| CSELB 2003-0225 | | 2.25 | | | | 45 | 4 | 8,780 | 2.43 | 2.55 | 2.67 | 2.82 | 3.15 |
| CSELB 2003-025 | | 2.5 | | | | 45 | 4 | 8,780 | 2.69 | 2.82 | 2.96 | 3.12 | 3.49 |
| CSELB 2003-030 | | 3 | | | | 45 | 4 | 8,780 | 3.22 | 3.37 | 3.54 | 3.73 | 4.18 |
| CSELB 2003-040 | | 4 | | | | 45 | 4 | 9,120 | 4.26 | 4.47 | 4.70 | 4.95 | 5.55 |
| CSELB 2003-050 | | 5 | | | | 45 | 4 | 10,260 | 5.31 | 5.57 | 5.85 | 6.17 | 6.92 |
| CSELB 2004-005 | R0.2 | 0.5 | 0.32 | 0.39 | 11° | 45 | 4 | 5,470 | 0.61 | 0.63 | 0.66 | 0.69 | 0.76 |
| CSELB 2004-0075 | | 0.75 | | | | 45 | 4 | 5,470 | 0.87 | 0.91 | 0.95 | 0.99 | 1.10 |
| CSELB 2004-010 | | 1 | | | | 45 | 4 | 5,470 | 1.13 | 1.18 | 1.24 | 1.30 | 1.44 |
| CSELB 2004-010-6 | | 1 | | | | 50 | 6 | 7,980 | 1.13 | 1.18 | 1.24 | 1.30 | 1.44 |
| CSELB 2004-0125 | | 1.25 | | | | 45 | 4 | 5,590 | 1.38 | 1.44 | 1.51 | 1.59 | 1.76 |
| CSELB 2004-015 | | 1.5 | | | | 45 | 4 | 5,590 | 1.64 | 1.72 | 1.80 | 1.89 | 2.11 |
| CSELB 2004-015-6 | | 1.5 | | | | 50 | 6 | 8,090 | 1.64 | 1.72 | 1.80 | 1.89 | 2.11 |
| CSELB 2004-0175 | | 1.75 | | | | 45 | 4 | 5,700 | 1.90 | 1.99 | 2.09 | 2.19 | 2.45 |
| CSELB 2004-020 | | 2 | | | | 45 | 4 | 5,700 | 2.17 | 2.27 | 2.38 | 2.50 | 2.79 |
| CSELB 2004-020-6 | | 2 | | | | 50 | 6 | 8,320 | 2.17 | 2.27 | 2.38 | 2.50 | 2.79 |
| CSELB 2004-0225 | | 2.25 | | | | 45 | 4 | 5,930 | 2.43 | 2.54 | 2.67 | 2.80 | 3.13 |
| CSELB 2004-025 | | 2.5 | | | | 45 | 4 | 5,930 | 2.69 | 2.82 | 2.95 | 3.11 | 3.48 |
| CSELB 2004-025-6 | | 2.5 | | | | 50 | 6 | 8,550 | 2.69 | 2.82 | 2.95 | 3.11 | 3.48 |
| CSELB 2004-030 | | 3 | | | | 45 | 4 | 6,270 | 3.21 | 3.36 | 3.53 | 3.72 | 4.16 |
| CSELB 2004-030-6 | | 3 | | | | 50 | 6 | 9,120 | 3.21 | 3.36 | 3.53 | 3.72 | 4.16 |
| CSELB 2004-035 | | 3.5 | | | | 45 | 4 | 6,840 | 3.74 | 3.91 | 4.11 | 4.33 | 4.85 |
| CSELB 2004-040 | | 4 | | | | 45 | 4 | 6,840 | 4.26 | 4.46 | 4.69 | 4.94 | 5.53 |
| CSELB 2004-040-6 | | 4 | | | | 50 | 6 | 9,300 | 4.26 | 4.46 | 4.69 | 4.94 | 5.53 |
| CSELB 2004-045 | | 4.5 | | | | 45 | 4 | 7,180 | 4.78 | 5.01 | 5.27 | 5.55 | 6.21 |
| CSELB 2004-050 | | 5 | | | | 45 | 4 | 7,180 | 5.31 | 5.56 | 5.84 | 6.16 | 6.90 |
| CSELB 2004-060 | | 6 | | | | 45 | 4 | 8,320 | 6.35 | 6.66 | 7.00 | 7.38 | 8.27 |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2005-010 | | 1 | | | | 45 | 4 | 5,470 | 1.13 | 1.17 | 1.23 | 1.28 | 1.42 |
| CSELB 2005-0125 | | 1.25 | | | | 45 | 4 | 5,470 | 1.38 | 1.43 | 1.50 | 1.57 | 1.74 |
| CSELB 2005-015 | | 1.5 | | | | 45 | 4 | 5,470 | 1.64 | 1.71 | 1.79 | 1.88 | 2.09 |
| CSELB 2005-015-6 | | 1.5 | | | | 50 | 6 | 7,980 | 1.64 | 1.71 | 1.79 | 1.88 | 2.09 |
| CSELB 2005-0175 | | 1.75 | | | | 45 | 4 | 5,470 | 1.90 | 1.98 | 2.08 | 2.18 | 2.43 |
| CSELB 2005-020 | | 2 | | | | 45 | 4 | 5,470 | 2.16 | 2.26 | 2.37 | 2.49 | 2.77 |
| CSELB 2005-020-6 | | 2 | | | | 50 | 6 | 7,980 | 2.16 | 2.26 | 2.37 | 2.49 | 2.77 |
| CSELB 2005-0225 | | 2.25 | | | | 45 | 4 | 5,470 | 2.42 | 2.53 | 2.65 | 2.79 | 3.11 |
| CSELB 2005-025 | | 2.5 | | | | 45 | 4 | 5,470 | 2.68 | 2.81 | 2.94 | 3.10 | 3.45 |
| CSELB 2005-025-6 | | 2.5 | | | | 50 | 6 | 7,980 | 2.68 | 2.81 | 2.94 | 3.10 | 3.45 |
| CSELB 2005-030 | | 3 | | | | 45 | 4 | 5,470 | 3.21 | 3.36 | 3.52 | 3.70 | 4.14 |
| CSELB 2005-030-6 | R0.25 | 3 | 0.4 | 0.49 | 11° | 50 | 6 | 7,980 | 3.21 | 3.36 | 3.52 | 3.70 | 4.14 |
| CSELB 2005-035 | | 3.5 | | | | 45 | 4 | 5,470 | 3.73 | 3.91 | 4.10 | 4.31 | 4.82 |
| CSELB 2005-040 | | 4 | | | | 45 | 4 | 5,470 | 4.25 | 4.46 | 4.68 | 4.92 | 5.51 |
| CSELB 2005-040-6 | | 4 | | | | 50 | 6 | 7,980 | 4.25 | 4.46 | 4.68 | 4.92 | 5.51 |
| CSELB 2005-045 | | 4.5 | | | | 45 | 4 | 5,590 | 4.78 | 5.00 | 5.26 | 5.53 | 6.19 |
| CSELB 2005-050 | | 5 | | | | 45 | 4 | 5,590 | 5.30 | 5.55 | 5.83 | 6.14 | 6.88 |
| CSELB 2005-055 | | 5.5 | | | | 45 | 4 | 5,700 | 5.83 | 6.10 | 6.41 | 6.75 | 7.56 |
| CSELB 2005-060 | | 6 | | | | 45 | 4 | 5,700 | 6.35 | 6.65 | 6.99 | 7.36 | 8.25 |
| CSELB 2005-070 | | 7 | | | | 45 | 4 | 6,840 | 7.40 | 7.75 | 8.14 | 8.58 | 9.62 |
| CSELB 2005-080 | | 8 | | | | 45 | 4 | 6,840 | 8.44 | 8.85 | 9.30 | 9.80 | 10.99 |
| CSELB 2005-090 | | 9 | | | | 45 | 4 | 7,980 | 9.49 | 9.95 | 10.46 | 11.02 | 12.35 |
| CSELB 2005-100 | | 10 | | | | 50 | 4 | 8,500 | 10.54 | 11.05 | 11.61 | 12.24 | 13.72 |
| CSELB 2006-010 | | 1 | | | | 45 | 4 | 4,670 | 1.12 | 1.17 | 1.22 | 1.27 | 1.40 |
| CSELB 2006-0125 | | 1.25 | | | | 45 | 4 | 4,220 | 1.37 | 1.43 | 1.49 | 1.56 | 1.73 |
| CSELB 2006-015 | | 1.5 | | | | 45 | 4 | 4,220 | 1.63 | 1.70 | 1.78 | 1.87 | 2.07 |
| CSELB 2006-015-6 | | 1.5 | | | | 50 | 6 | 6,380 | 1.63 | 1.70 | 1.78 | 1.87 | 2.07 |
| CSELB 2006-0175 | | 1.75 | | | | 45 | 4 | 4,220 | 1.90 | 1.98 | 2.07 | 2.17 | 2.41 |
| CSELB 2006-020 | | 2 | | | | 45 | 4 | 4,220 | 2.16 | 2.25 | 2.36 | 2.48 | 2.75 |
| CSELB 2006-020-6 | | 2 | | | | 50 | 6 | 6,380 | 2.16 | 2.25 | 2.36 | 2.48 | 2.75 |
| CSELB 2006-0225 | | 2.25 | | | | 45 | 4 | 4,330 | 2.42 | 2.53 | 2.65 | 2.78 | 3.09 |
| CSELB 2006-025 | | 2.5 | | | | 45 | 4 | 4,330 | 2.68 | 2.80 | 2.94 | 3.08 | 3.44 |
| CSELB 2006-025-6 | | 2.5 | | | | 50 | 6 | 6,380 | 2.68 | 2.80 | 2.94 | 3.08 | 3.44 |
| CSELB 2006-030 | | 3 | | | | 45 | 4 | 4,330 | 3.21 | 3.35 | 3.51 | 3.69 | 4.12 |
| CSELB 2006-030-6 | | 3 | | | | 50 | 6 | 6,500 | 3.21 | 3.35 | 3.51 | 3.69 | 4.12 |
| CSELB 2006-035 | | 3.5 | | | | 45 | 4 | 4,450 | 3.73 | 3.90 | 4.09 | 4.30 | 4.81 |
| CSELB 2006-040 | | 4 | | | | 45 | 4 | 4,450 | 4.25 | 4.45 | 4.67 | 4.91 | 5.49 |
| CSELB 2006-040-6 | R0.3 | 4 | 0.48 | 0.59 | 11° | 50 | 6 | 6,730 | 4.25 | 4.45 | 4.67 | 4.91 | 5.49 |
| CSELB 2006-045 | | 4.5 | | | | 45 | 4 | 4,450 | 4.78 | 5.00 | 5.25 | 5.52 | 6.18 |
| CSELB 2006-050 | | 5 | | | | 45 | 4 | 4,450 | 5.30 | 5.55 | 5.83 | 6.13 | 6.86 |
| CSELB 2006-050-6 | | 5 | | | | 50 | 6 | 6,730 | 5.30 | 5.55 | 5.83 | 6.13 | 6.86 |
| CSELB 2006-055 | | 5.5 | | | | 45 | 4 | 4,450 | 5.82 | 6.10 | 6.40 | 6.74 | 7.54 |
| CSELB 2006-060 | | 6 | | | | 45 | 4 | 4,450 | 6.35 | 6.65 | 6.98 | 7.35 | 8.23 |
| CSELB 2006-060-6 | | 6 | | | | 50 | 6 | 6,730 | 6.35 | 6.65 | 6.98 | 7.35 | 8.23 |
| CSELB 2006-065 | | 6.5 | | | | 45 | 4 | 5,020 | 6.87 | 7.20 | 7.56 | 7.96 | 8.91 |
| CSELB 2006-070 | | 7 | | | | 45 | 4 | 5,020 | 7.39 | 7.75 | 8.14 | 8.57 | 9.60 |
| CSELB 2006-080 | | 8 | | | | 45 | 4 | 5,930 | 8.44 | 8.85 | 9.29 | 9.79 | 10.97 |
| CSELB 2006-080-6 | | 8 | | | | 50 | 6 | 8,550 | 8.44 | 8.85 | 9.29 | 9.79 | 10.97 |
| CSELB 2006-090 | | 9 | | | | 45 | 4 | 6,270 | 9.49 | 9.94 | 10.45 | 11.01 | 12.34 |
| CSELB 2006-100 | | 10 | | | | 50 | 4 | 6,040 | 10.53 | 11.04 | 11.60 | 12.23 | 13.71 |
| CSELB 2006-100-6 | | 10 | | | | 50 | 6 | 9,120 | 10.53 | 11.04 | 11.60 | 12.23 | 13.71 |
| CSELB 2006-120 | | 12 | | | | 50 | 4 | 6,840 | 12.63 | 13.24 | 13.92 | 14.66 | 16.44 |

UDC Series
CBN Series
Square
Square
Long Neck Square
Radius
Radius
Long Neck Radius
Taper Neck Radius
Ball / Long Shank Ball
Long Neck Ball
Ball
Taper Neck Ball
Taper
Taper
Spiral V Cutter
Drill
EURO Series
Technical Data



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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2007-020 | R0.35 | 2 | 0.56 | 0.69 | 11° | 45 | 4 | 4,220 | 2.16 | 2.25 | 2.35 | 2.46 | 2.73 |
| CSELB 2007-040 | | 4 | | | | 45 | 4 | 4,450 | 4.25 | 4.45 | 4.66 | 4.90 | 5.47 |
| CSELB 2007-060 | | 6 | | | | 45 | 4 | 4,450 | 6.34 | 6.64 | 6.97 | 7.34 | 8.21 |
| CSELB 2007-080 | | 8 | | | | 45 | 4 | 4,450 | 8.44 | 8.84 | 9.28 | 9.78 | 10.95 |
| CSELB 2008-020 | R0.4 | 2 | 0.64 | 0.79 | 11° | 45 | 4 | 4,220 | 2.15 | 2.24 | 2.34 | 2.45 | 2.72 |
| CSELB 2008-020-6 | | 2 | | | | 50 | 6 | 6,380 | 2.15 | 2.24 | 2.34 | 2.45 | 2.72 |
| CSELB 2008-030 | | 3 | | | | 45 | 4 | 4,450 | 3.20 | 3.34 | 3.50 | 3.67 | 4.09 |
| CSELB 2008-030-6 | | 3 | | | | 50 | 6 | 6,730 | 3.20 | 3.34 | 3.50 | 3.67 | 4.09 |
| CSELB 2008-040 | | 4 | | | | 45 | 4 | 4,450 | 4.25 | 4.44 | 4.65 | 4.89 | 5.45 |
| CSELB 2008-040-6 | | 4 | | | | 50 | 6 | 6,730 | 4.25 | 4.44 | 4.65 | 4.89 | 5.45 |
| CSELB 2008-050 | | 5 | | | | 45 | 4 | 4,450 | 5.29 | 5.54 | 5.81 | 6.11 | 6.82 |
| CSELB 2008-060 | | 6 | | | | 45 | 4 | 4,450 | 6.34 | 6.64 | 6.97 | 7.33 | 8.19 |
| CSELB 2008-060-6 | | 6 | | | | 50 | 6 | 6,730 | 6.34 | 6.64 | 6.97 | 7.33 | 8.19 |
| CSELB 2008-070 | | 7 | | | | 45 | 4 | 4,450 | 7.39 | 7.74 | 8.12 | 8.55 | 9.56 |
| CSELB 2008-080 | | 8 | | | | 45 | 4 | 4,450 | 8.44 | 8.84 | 9.28 | 9.77 | 10.93 |
| CSELB 2008-080-6 | | 8 | | | | 50 | 6 | 6,730 | 8.44 | 8.84 | 9.28 | 9.77 | 10.93 |
| CSELB 2008-090 | | 9 | | | | 45 | 4 | 5,930 | 9.48 | 9.93 | 10.43 | 10.99 | 12.30 |
| CSELB 2008-100 | | 10 | | | | 50 | 4 | 5,930 | 10.53 | 11.03 | 11.59 | 12.21 | 13.67 |
| CSELB 2008-100-6 | | 10 | | | | 50 | 6 | 8,550 | 10.53 | 11.03 | 11.59 | 12.21 | 13.67 |
| CSELB 2008-120 | | 12 | | | | 45 | 4 | 7,300 | 12.62 | 13.23 | 13.90 | 14.64 | 16.41 |
| CSELB 2008-160 | | 16 | | | | 50 | 4 | 9,990 | 16.81 | 17.62 | 18.52 | 19.52 | 21.88 |
| CSELB 2009-020 | R0.45 | 2 | 0.72 | 0.89 | 11° | 45 | 4 | 4,220 | 2.15 | 2.24 | 2.34 | 2.44 | 2.70 |
| CSELB 2009-040 | | 4 | | | | 45 | 4 | 4,450 | 4.25 | 4.44 | 4.65 | 4.88 | 5.44 |
| CSELB 2009-060 | | 6 | | | | 45 | 4 | 4,450 | 6.34 | 6.63 | 6.96 | 7.32 | 8.17 |
| CSELB 2009-080 | | 8 | | | | 45 | 4 | 4,450 | 8.43 | 8.83 | 9.27 | 9.76 | 10.91 |
| CSELB 2009-100 | | 10 | | | | 45 | 4 | 5,930 | 10.53 | 11.03 | 11.58 | 12.19 | 13.65 |
| CSELB 2009-120 | | 12 | | | | 45 | 4 | 7,300 | 12.62 | 13.23 | 13.89 | 14.63 | 16.39 |
| CSELB 2009-140 | | 14 | | | | 50 | 4 | 8,460 | 14.72 | 15.42 | 16.20 | 17.07 | 19.13 |
| CSELB 2009-160 | | 16 | | | | 50 | 4 | 9,990 | 16.81 | 17.62 | 18.51 | 19.51 | 21.87 |
| CSELB 2009-180 | | 18 | | | | 55 | 4 | 9,990 | 18.90 | 19.82 | 20.83 | 21.95 | 24.60 |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2010-020 | R0.5 | 2 | 0.8 | 0.98 | 11° | 45 | 4 | 3,530 | 2.17 | 2.25 | 2.35 | 2.45 | 2.70 |
| CSELB 2010-025 | | 2.5 | | | | 45 | 4 | 3,530 | 2.69 | 2.80 | 2.92 | 3.06 | 3.39 |
| CSELB 2010-030 | | 3 | | | | 45 | 4 | 3,530 | 3.21 | 3.35 | 3.50 | 3.67 | 4.07 |
| CSELB 2010-030-6 | | 3 | | | | 50 | 6 | 5,590 | 3.21 | 3.35 | 3.50 | 3.67 | 4.07 |
| CSELB 2010-040 | | 4 | | | | 45 | 4 | 3,990 | 4.26 | 4.45 | 4.66 | 4.89 | 5.44 |
| CSELB 2010-040-6 | | 4 | | | | 50 | 6 | 6,160 | 4.26 | 4.45 | 4.66 | 4.89 | 5.44 |
| CSELB 2010-050 | | 5 | | | | 45 | 4 | 3,990 | 5.31 | 5.55 | 5.81 | 6.11 | 6.81 |
| CSELB 2010-050-6 | | 5 | | | | 50 | 6 | 6,160 | 5.31 | 5.55 | 5.81 | 6.11 | 6.81 |
| CSELB 2010-060 | | 6 | | | | 45 | 4 | 4,330 | 6.35 | 6.65 | 6.97 | 7.33 | 8.18 |
| CSELB 2010-060-6 | | 6 | | | | 50 | 6 | 6,500 | 6.35 | 6.65 | 6.97 | 7.33 | 8.18 |
| CSELB 2010-070 | | 7 | | | | 45 | 4 | 4,330 | 7.40 | 7.74 | 8.12 | 8.55 | 9.55 |
| CSELB 2010-070-6 | | 7 | | | | 50 | 6 | 6,500 | 7.40 | 7.74 | 8.12 | 8.55 | 9.55 |
| CSELB 2010-080 | | 8 | | | | 45 | 4 | 4,330 | 8.45 | 8.84 | 9.28 | 9.76 | 10.92 |
| CSELB 2010-080-6 | | 8 | | | | 50 | 6 | 6,500 | 8.45 | 8.84 | 9.28 | 9.76 | 10.92 |
| CSELB 2010-090 | | 9 | | | | 45 | 4 | 4,330 | 9.49 | 9.94 | 10.44 | 10.98 | 12.29 |
| CSELB 2010-100 | | 10 | | | | 45 | 4 | 4,330 | 10.54 | 11.04 | 11.59 | 12.20 | 13.65 |
| CSELB 2010-100-6 | | 10 | | | | 50 | 6 | 6,500 | 10.54 | 11.04 | 11.59 | 12.20 | 13.65 |
| CSELB 2010-120 | | 12 | | | | 45 | 4 | 4,330 | 12.64 | 13.24 | 13.90 | 14.64 | 16.39 |
| CSELB 2010-120-6 | | 12 | | | | 50 | 6 | 6,500 | 12.64 | 13.24 | 13.90 | 14.64 | 16.39 |
| CSELB 2010-140 | | 14 | | | | 50 | 4 | 5,020 | 14.73 | 15.43 | 16.21 | 17.08 | 19.13 |
| CSELB 2010-140-6 | | 14 | | | | 60 | 6 | 7,070 | 14.73 | 15.43 | 16.21 | 17.08 | 19.13 |
| CSELB 2010-160 | | 16 | | | | 50 | 4 | 5,930 | 16.82 | 17.63 | 18.53 | 19.52 | 21.87 |
| CSELB 2010-160-6 | | 16 | | | | 60 | 6 | 8,550 | 16.82 | 17.63 | 18.53 | 19.52 | 21.87 |
| CSELB 2010-180 | | 18 | | | | 55 | 4 | 5,930 | 18.92 | 19.83 | 20.84 | 21.95 | 24.61 |
| CSELB 2010-200 | | 20 | | | | 55 | 4 | 7,180 | 21.01 | 22.03 | 23.15 | 24.39 | 27.35 |
| CSELB 2010-200-6 | | 20 | | | | 70 | 6 | 10,150 | 21.01 | 22.03 | 23.15 | 24.39 | 27.35 |
| CSELB 2010-220-6 | | 22 | | | | 70 | 6 | 10,600 | 23.11 | 24.22 | 25.46 | 26.83 | 30.08 |
| CSELB 2012-025 | R0.6 | 2.5 | 0.96 | 1.19 | 11° | 45 | 4 | 5,360 | 2.58 | 2.68 | 2.80 | 2.92 | 3.22 |
| CSELB 2012-040 | | 4 | | | | 45 | 4 | 5,360 | 4.15 | 4.33 | 4.53 | 4.75 | 5.27 |
| CSELB 2012-060 | | 6 | | | | 45 | 4 | 5,810 | 6.25 | 6.53 | 6.84 | 7.19 | 8.01 |
| CSELB 2012-060-6 | | 6 | | | | 50 | 6 | 8,270 | 6.25 | 6.53 | 6.84 | 7.19 | 8.01 |
| CSELB 2012-080 | | 8 | | | | 45 | 4 | 5,810 | 8.34 | 8.73 | 9.15 | 9.63 | 10.75 |
| CSELB 2012-080-6 | | 8 | | | | 50 | 6 | 8,270 | 8.34 | 8.73 | 9.15 | 9.63 | 10.75 |
| CSELB 2012-100 | | 10 | | | | 45 | 4 | 5,810 | 10.44 | 10.92 | 11.46 | 12.06 | 13.49 |
| CSELB 2012-100-6 | | 10 | | | | 50 | 6 | 8,270 | 10.44 | 10.92 | 11.46 | 12.06 | 13.49 |
| CSELB 2012-120 | | 12 | | | | 45 | 4 | 5,810 | 12.53 | 13.12 | 13.78 | 14.50 | 16.23 |
| CSELB 2012-120-6 | | 12 | | | | 50 | 6 | 8,270 | 12.53 | 13.12 | 13.78 | 14.50 | 16.23 |
| CSELB 2012-140 | | 14 | | | | 50 | 4 | 6,270 | 14.62 | 15.32 | 16.09 | 16.94 | 18.96 |
| CSELB 2012-160 | | 16 | | | | 50 | 4 | 6,840 | 16.72 | 17.52 | 18.40 | 19.38 | 21.70 |
| CSELB 2012-160-6 | | 16 | | | | 60 | 6 | 9,410 | 16.72 | 17.52 | 18.40 | 19.38 | 21.70 |
| CSELB 2012-180 | | 18 | | | | 55 | 4 | 7,410 | 18.81 | 19.71 | 20.71 | 21.82 | 24.44 |
| CSELB 2012-200 | | 20 | | | | 60 | 4 | 7,410 | 20.91 | 21.91 | 23.02 | 24.25 | 27.18 |





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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2014-060 | R0.7 | 6 | 1.12 | 1.37 | 11° | 45 | 4 | 5,020 | 6.30 | 6.58 | 6.89 | 7.23 | 8.04 |
| CSELB 2014-080 | | 8 | | | | 45 | 4 | 5,020 | 8.39 | 8.77 | 9.20 | 9.67 | 10.78 |
| CSELB 2014-120 | | 12 | | | | 45 | 4 | 5,020 | 12.58 | 13.17 | 13.82 | 14.54 | 16.26 |
| CSELB 2014-160 | | 16 | | | | 50 | 4 | 5,020 | 16.77 | 17.56 | 18.44 | 19.42 | 21.74 |
| CSELB 2015-030 | R0.75 | 3 | 1.2 | 1.47 | 11° | 45 | 4 | 4,100 | 3.15 | 3.28 | 3.41 | 3.56 | 3.92 |
| CSELB 2015-040 | | 4 | | | | 45 | 4 | 4,100 | 4.20 | 4.37 | 4.57 | 4.78 | 5.29 |
| CSELB 2015-060 | | 6 | | | | 45 | 4 | 4,100 | 6.29 | 6.57 | 6.88 | 7.22 | 8.03 |
| CSELB 2015-060-6 | | 6 | | | | 50 | 6 | 6,610 | 6.29 | 6.57 | 6.88 | 7.22 | 8.03 |
| CSELB 2015-080 | | 8 | | | | 45 | 4 | 4,330 | 8.39 | 8.77 | 9.19 | 9.66 | 10.77 |
| CSELB 2015-080-6 | | 8 | | | | 50 | 6 | 6,610 | 8.39 | 8.77 | 9.19 | 9.66 | 10.77 |
| CSELB 2015-100 | | 10 | | | | 45 | 4 | 4,670 | 10.48 | 10.97 | 11.50 | 12.09 | 13.50 |
| CSELB 2015-100-6 | | 10 | | | | 50 | 6 | 6,610 | 10.48 | 10.97 | 11.50 | 12.09 | 13.50 |
| CSELB 2015-120 | | 12 | | | | 45 | 4 | 5,020 | 12.58 | 13.16 | 13.81 | 14.53 | 16.24 |
| CSELB 2015-120-6 | | 12 | | | | 50 | 6 | 7,520 | 12.58 | 13.16 | 13.81 | 14.53 | 16.24 |
| CSELB 2015-140 | | 14 | | | | 50 | 4 | 5,020 | 14.67 | 15.36 | 16.12 | 16.97 | 18.98 |
| CSELB 2015-160 | | 16 | | | | 50 | 4 | 5,020 | 16.76 | 17.56 | 18.43 | 19.41 | 21.72 |
| CSELB 2015-160-6 | | 16 | | | | 60 | 6 | 7,520 | 16.76 | 17.56 | 18.43 | 19.41 | 21.72 |
| CSELB 2015-180 | | 18 | | | | 55 | 4 | 5,020 | 18.86 | 19.76 | 20.75 | 21.85 | 24.46 |
| CSELB 2015-200 | | 20 | | | | 55 | 4 | 5,020 | 20.95 | 21.95 | 23.06 | 24.28 | No Interference |
| CSELB 2015-200-6 | | 20 | | | | 60 | 6 | 7,520 | 20.95 | 21.95 | 23.06 | 24.28 | 27.19 |
| CSELB 2015-220 | | 22 | | | | 55 | 4 | 5,020 | 23.05 | 24.15 | 25.37 | 26.72 | No Interference |
| CSELB 2015-250 | | 25 | | | | 65 | 4 | 7,000 | 26.19 | 27.45 | 28.84 | 30.38 | No Interference |
| CSELB 2015-300 | | 30 | | | | 70 | 4 | 8,210 | 31.42 | 32.94 | 34.61 | 36.47 | No Interference |
| CSELB 2016-040 | R0.8 | 4 | 1.28 | 1.58 | 11° | 45 | 4 | 5,700 | 4.17 | 4.34 | 4.53 | 4.74 | 5.24 |
| CSELB 2016-080 | | 8 | | | | 45 | 4 | 5,810 | 8.36 | 8.74 | 9.15 | 9.61 | 10.71 |
| CSELB 2016-120 | | 12 | | | | 45 | 4 | 5,810 | 12.55 | 13.13 | 13.77 | 14.49 | 16.19 |
| CSELB 2016-160 | | 16 | | | | 50 | 4 | 5,810 | 16.74 | 17.53 | 18.40 | 19.37 | 21.66 |
| CSELB 2016-200 | | 20 | | | | 55 | 4 | 5,810 | 20.92 | 21.92 | 23.02 | 24.24 | No Interference |
| CSELB 2018-040 | R0.9 | 4 | 1.44 | 1.78 | 11° | 45 | 4 | 4,750 | 4.17 | 4.33 | 4.51 | 4.72 | 5.20 |
| CSELB 2018-060 | | 6 | | | | 45 | 4 | 4,750 | 6.26 | 6.53 | 6.83 | 7.15 | 7.94 |
| CSELB 2018-080 | | 8 | | | | 45 | 4 | 5,020 | 8.35 | 8.73 | 9.14 | 9.59 | 10.68 |
| CSELB 2018-100 | | 10 | | | | 45 | 4 | 5,020 | 10.45 | 10.92 | 11.45 | 12.03 | 13.41 |
| CSELB 2018-120 | | 12 | | | | 45 | 4 | 5,020 | 12.54 | 13.12 | 13.76 | 14.47 | 16.15 |
| CSELB 2018-160 | | 16 | | | | 50 | 4 | 5,020 | 16.73 | 17.52 | 18.38 | 19.34 | 21.63 |
| CSELB 2018-180 | | 18 | | | | 55 | 4 | 5,020 | 18.82 | 19.71 | 20.69 | 21.78 | No Interference |
| CSELB 2018-200 | | 20 | | | | 55 | 4 | 5,020 | 20.92 | 21.91 | 23.00 | 24.22 | No Interference |
| CSELB 2018-220 | | 22 | | | | 60 | 4 | 6,870 | 23.01 | 24.11 | 25.32 | 26.66 | No Interference |
| CSELB 2018-250 | | 25 | | | | 65 | 4 | 7,000 | 26.15 | 27.40 | 28.78 | 30.32 | No Interference |
| CSELB 2018-300 | | 30 | | | | 70 | 4 | 7,930 | 31.39 | 32.90 | 34.56 | No Interference | No Interference |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2020-030 | R1 | 3 | 1.6 | 1.98 | 11° | 45 | 4 | 3,530 | 3.11 | 3.22 | 3.34 | 3.48 | 3.79 |
| CSELB 2020-040 | | 4 | | | | 45 | 4 | 3,530 | 4.16 | 4.32 | 4.50 | 4.70 | 5.16 |
| CSELB 2020-040-6 | | 4 | | | | 50 | 6 | 5,590 | 4.16 | 4.32 | 4.50 | 4.70 | 5.16 |
| CSELB 2020-060 | | 6 | | | | 45 | 4 | 3,990 | 6.26 | 6.52 | 6.81 | 7.13 | 7.90 |
| CSELB 2020-060-6 | | 6 | | | | 50 | 6 | 6,040 | 6.26 | 6.52 | 6.81 | 7.13 | 7.90 |
| CSELB 2020-080 | | 8 | | | | 45 | 4 | 4,330 | 8.35 | 8.72 | 9.12 | 9.57 | 10.64 |
| CSELB 2020-080-6 | | 8 | | | | 50 | 6 | 6,500 | 8.35 | 8.72 | 9.12 | 9.57 | 10.64 |
| CSELB 2020-100 | | 10 | | | | 45 | 4 | 4,330 | 10.44 | 10.91 | 11.43 | 12.01 | 13.38 |
| CSELB 2020-100-6 | | 10 | | | | 50 | 6 | 6,500 | 10.44 | 10.91 | 11.43 | 12.01 | 13.38 |
| CSELB 2020-120 | | 12 | | | | 45 | 4 | 4,330 | 12.54 | 13.11 | 13.74 | 14.45 | 16.12 |
| CSELB 2020-120-6 | | 12 | | | | 50 | 6 | 6,500 | 12.54 | 13.11 | 13.74 | 14.45 | 16.12 |
| CSELB 2020-130 | | 13 | | | | 45 | 4 | 4,330 | 13.59 | 14.21 | 14.90 | 15.67 | 17.49 |
| CSELB 2020-140 | | 14 | | | | 50 | 4 | 4,330 | 14.63 | 15.31 | 16.06 | 16.89 | 18.85 |
| CSELB 2020-160 | | 16 | | | | 50 | 4 | 4,330 | 16.73 | 17.51 | 18.37 | 19.32 | No Interference |
| CSELB 2020-160-6 | | 16 | | | | 60 | 6 | 6,500 | 16.73 | 17.51 | 18.37 | 19.32 | 21.59 |
| CSELB 2020-180 | | 18 | | | | 55 | 4 | 4,330 | 18.82 | 19.70 | 20.68 | 21.76 | No Interference |
| CSELB 2020-200 | | 20 | | | | 55 | 4 | 4,330 | 20.91 | 21.90 | 22.99 | 24.20 | No Interference |
| CSELB 2020-200-6 | | 20 | | | | 70 | 6 | 6,500 | 20.91 | 21.90 | 22.99 | 24.20 | 27.07 |
| CSELB 2020-220 | | 22 | | | | 60 | 4 | 5,930 | 23.01 | 24.10 | 25.30 | 26.64 | No Interference |
| CSELB 2020-250 | | 25 | | | | 65 | 4 | 6,040 | 26.15 | 27.39 | 28.77 | No Interference | No Interference |
| CSELB 2020-250-6 | | 25 | | | | 80 | 6 | 8,550 | 26.15 | 27.39 | 28.77 | 30.29 | 33.92 |
| CSELB 2020-270 | | 27 | | | | 65 | 4 | 6,040 | 28.24 | 29.59 | 31.08 | No Interference | No Interference |
| CSELB 2020-300 | | 30 | | | | 70 | 4 | 6,840 | 31.38 | 32.89 | 34.55 | No Interference | No Interference |
| CSELB 2020-300-6 | | 30 | | | | 80 | 6 | 9,690 | 31.38 | 32.89 | 34.55 | 36.39 | No Interference |
| CSELB 2020-320 | | 32 | | | | 70 | 4 | 6,840 | 33.48 | 35.08 | 36.86 | No Interference | No Interference |
| CSELB 2020-350 | | 35 | | | | 80 | 4 | 9,350 | 36.62 | 38.38 | No Interference | No Interference | No Interference |
| CSELB 2020-350-6 | | 35 | | | | 80 | 6 | 12,650 | 36.62 | 38.38 | 40.32 | 42.48 | No Interference |
| CSELB 2020-400 | | 40 | | | | 80 | 4 | 9,350 | 41.85 | 43.87 | No Interference | No Interference | No Interference |
| CSELB 2020-400-6 | | 40 | | | | 90 | 6 | 12,650 | 41.85 | 43.87 | 46.10 | 48.58 | No Interference |
| CSELB 2025-060 | R1.25 | 6 | 2 | 2.45 | 11° | 45 | 4 | 4,670 | 6.33 | 6.58 | 6.86 | 7.17 | 7.92 |
| CSELB 2025-080 | | 8 | | | | 45 | 4 | 4,700 | 8.42 | 8.78 | 9.17 | 9.61 | 10.66 |
| CSELB 2025-100 | | 10 | | | | 45 | 4 | 4,900 | 10.51 | 10.97 | 11.48 | 12.05 | 13.39 |
| CSELB 2025-150 | | 15 | | | | 50 | 4 | 5,810 | 15.75 | 16.47 | 17.26 | 18.14 | No Interference |
| CSELB 2025-200 | | 20 | | | | 55 | 4 | 6,840 | 20.98 | 21.96 | 23.04 | No Interference | No Interference |
| CSELB 2025-250 | | 25 | | | | 65 | 4 | 7,300 | 26.22 | 27.45 | 28.82 | No Interference | No Interference |
| CSELB 2025-300 | | 30 | | | | 70 | 4 | 7,300 | 31.45 | 32.95 | No Interference | No Interference | No Interference |
| CSELB 2025-350 | | 35 | | | | 70 | 4 | 8,440 | 36.69 | 38.44 | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| CSELB 2030-060 | R1.5 | 6 | 2.4 | 2.95 | 11° | 60 | 6 | 4,330 | 6.31 | 6.55 | 6.82 | 7.12 | 7.83 |
| CSELB 2030-060-3 | | 6 | | | — | 60 | 3 | 3,990 | No Interference | No Interference | No Interference | No Interference | No Interference |
| CSELB 2030-060-4 | | 6 | | | 11° | 60 | 4 | 3,990 | 6.31 | 6.55 | 6.82 | 7.12 | 7.83 |
| CSELB 2030-080 | | 8 | | | | 60 | 6 | 4,330 | 8.41 | 8.75 | 9.13 | 9.56 | 10.57 |
| CSELB 2030-100 | | 10 | | | | 60 | 6 | 5,020 | 10.50 | 10.95 | 11.44 | 12.00 | 13.30 |
| CSELB 2030-120 | | 12 | | | | 60 | 6 | 5,240 | 12.60 | 13.15 | 13.76 | 14.43 | 16.04 |
| CSELB 2030-140 | | 14 | | | | 60 | 6 | 5,810 | 14.69 | 15.34 | 16.07 | 16.87 | 18.78 |
| CSELB 2030-150 | | 15 | | | | 60 | 6 | 5,700 | 15.74 | 16.44 | 17.22 | 18.09 | 20.15 |
| CSELB 2030-160 | | 16 | | | | 60 | 6 | 5,810 | 16.78 | 17.54 | 18.38 | 19.31 | 21.52 |
| CSELB 2030-180 | | 18 | | | | 60 | 6 | 5,810 | 18.88 | 19.74 | 20.69 | 21.75 | 24.26 |
| CSELB 2030-200 | | 20 | | | | 70 | 6 | 5,590 | 20.97 | 21.94 | 23.00 | 24.19 | 27.00 |
| CSELB 2030-220 | | 22 | | | | 70 | 6 | 5,590 | 23.07 | 24.13 | 25.31 | 26.62 | 29.73 |
| CSELB 2030-250 | | 25 | | | | 70 | 6 | 5,590 | 26.21 | 27.43 | 28.78 | 30.28 | No Interference |
| CSELB 2030-270 | | 27 | | | | 70 | 6 | 5,590 | 28.30 | 29.63 | 31.09 | 32.72 | No Interference |
| CSELB 2030-300 | | 30 | | | | 70 | 6 | 6,380 | 31.44 | 32.92 | 34.56 | 36.38 | No Interference |
| CSELB 2030-320 | | 32 | | | | 80 | 6 | 8,090 | 33.54 | 35.12 | 36.87 | 38.81 | No Interference |
| CSELB 2030-350 | | 35 | | | | 80 | 6 | 8,090 | 36.68 | 38.42 | 40.34 | 42.47 | No Interference |
| CSELB 2030-400 | | 40 | | | | 80 | 6 | 10,030 | 41.91 | 43.91 | 46.12 | No Interference | No Interference |
| CSELB 2035-100 | R1.75 | 10 | 2.8 | 3.45 | 11° | 60 | 6 | 6,380 | 10.49 | 10.93 | 11.41 | 11.94 | 13.21 |
| CSELB 2035-150 | | 15 | | | | 60 | 6 | 6,380 | 15.72 | 16.42 | 17.19 | 18.04 | 20.06 |
| CSELB 2035-200 | | 20 | | | | 65 | 6 | 6,840 | 20.96 | 21.91 | 22.96 | 24.13 | No Interference |
| CSELB 2035-250 | | 25 | | | | 70 | 6 | 6,840 | 26.19 | 27.40 | 28.74 | 30.23 | No Interference |
| CSELB 2035-300 | | 30 | | | | 70 | 6 | 7,300 | 31.43 | 32.90 | 34.52 | 36.32 | No Interference |
| CSELB 2035-400 | | 40 | | | | 90 | 6 | 9,690 | 41.90 | 43.88 | 46.08 | No Interference | No Interference |
| CSELB 2035-450 | | 45 | | | | 90 | 6 | 10,600 | 47.13 | 49.38 | No Interference | No Interference | No Interference |
| CSELB 2040-080 | R2 | 8 | 3.2 | 3.95 | 11° | 70 | 6 | 4,450 | 8.38 | 8.70 | 9.06 | 9.45 | 10.39 |
| CSELB 2040-080-4 | | 8 | | | — | 70 | 4 | 4,180 | No Interference | No Interference | No Interference | No Interference | No Interference |
| CSELB 2040-100 | | 10 | | | 11° | 70 | 6 | 4,450 | 10.48 | 10.90 | 11.37 | 11.89 | 13.12 |
| CSELB 2040-120 | | 12 | | | | 70 | 6 | 5,810 | 12.57 | 13.10 | 13.68 | 14.33 | 15.86 |
| CSELB 2040-140 | | 14 | | | | 70 | 6 | 5,810 | 14.67 | 15.30 | 15.99 | 16.76 | 18.60 |
| CSELB 2040-150 | | 15 | | | | 70 | 6 | 5,810 | 15.71 | 16.39 | 17.15 | 17.98 | 19.97 |
| CSELB 2040-160 | | 16 | | | | 70 | 6 | 5,810 | 16.76 | 17.49 | 18.30 | 19.20 | No Interference |
| CSELB 2040-180 | | 18 | | | | 70 | 6 | 5,810 | 18.85 | 19.69 | 20.61 | 21.64 | No Interference |
| CSELB 2040-200 | | 20 | | | | 70 | 6 | 5,810 | 20.95 | 21.89 | 22.93 | 24.08 | No Interference |
| CSELB 2040-220 | | 22 | | | | 70 | 6 | 5,810 | 23.04 | 24.08 | 25.24 | 26.52 | No Interference |
| CSELB 2040-250 | | 25 | | | | 70 | 6 | 5,810 | 26.18 | 27.38 | 28.70 | 30.17 | No Interference |
| CSELB 2040-270 | | 27 | | | | 70 | 6 | 5,810 | 28.28 | 29.58 | 31.01 | No Interference | No Interference |
| CSELB 2040-300 | | 30 | | | | 70 | 6 | 5,810 | 31.42 | 32.87 | 34.48 | No Interference | No Interference |
| CSELB 2040-320 | | 32 | | | | 80 | 6 | 6,730 | 33.51 | 35.07 | 36.79 | No Interference | No Interference |
| CSELB 2040-350 | | 35 | | | | 80 | 6 | 6,730 | 36.65 | 38.37 | 40.26 | No Interference | No Interference |
| CSELB 2040-400 | | 40 | | | | 90 | 6 | 7,520 | 41.89 | 43.86 | No Interference | No Interference | No Interference |
| CSELB 2040-450 | | 45 | | | | 90 | 6 | 9,690 | 47.12 | 49.35 | No Interference | No Interference | No Interference |
| CSELB 2040-500 | | 50 | | | | 100 | 6 | 10,370 | 52.36 | 54.85 | No Interference | No Interference | No Interference |
| CSELB 2040-600 | | 60 | | | | 120 | 6 | 10,580 | 62.83 | No Interference | No Interference | No Interference | No Interference |

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Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **CSELB 2050-100** | R2.5 | 10 | 4 | 4.95 | 11° | 70 | 6 | 6,840 | 10.45 | 10.85 | 11.29 | 11.78 | No Interference |
| **CSELB 2050-150** | | 15 | | | | 70 | 6 | 9,690 | 15.69 | 16.35 | 17.07 | No Interference | No Interference |
| **CSELB 2050-200** | | 20 | | | | 70 | 6 | 9,690 | 20.92 | 21.84 | No Interference | No Interference | No Interference |
| **CSELB 2050-250** | | 25 | | | | 70 | 6 | 9,690 | 26.16 | 27.33 | No Interference | No Interference | No Interference |
| **CSELB 2050-300** | | 30 | | | | 80 | 6 | 10,370 | 31.39 | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2050-350** | | 35 | | | | 80 | 6 | 10,370 | 36.63 | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2050-400** | | 40 | | | | 90 | 6 | 13,110 | 41.86 | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2050-450** | | 45 | | | | 100 | 6 | 13,680 | 47.10 | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2050-500** | | 50 | | | | 100 | 6 | 14,820 | 52.33 | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-100** | R3 | 10 | 4.8 | 5.95 | — | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-150** | | 15 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-180** | | 18 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-200** | | 20 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-220** | | 22 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-250** | | 25 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-270** | | 27 | | | | 80 | 6 | 7,300 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-300** | | 30 | | | | 80 | 6 | 7,520 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-320** | | 32 | | | | 80 | 6 | 7,520 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-350** | | 35 | | | | 80 | 6 | 7,750 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-400** | | 40 | | | | 90 | 6 | 8,210 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-450** | | 45 | | | | 100 | 6 | 8,780 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-500** | | 50 | | | | 120 | 6 | 8,890 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CSELB 2060-600** | | 60 | | | | 120 | 6 | 9,420 | No Interference | No Interference | No Interference | No Interference | No Interference |

# Milling Conditions for CSELB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2001-002** | | 0.2 | 54,000 | 85 | 0.004 | 0.004 | 54,000 | 85 | 0.004 | 0.004 | 48,000 | 55 | 0.002 | 0.002 | 48,000 | 55 | 0.002 | 0.002 |
| **2001-003** | **R0.05** | 0.3 | 54,000 | 85 | 0.004 | 0.004 | 54,000 | 85 | 0.004 | 0.004 | 48,000 | 55 | 0.002 | 0.002 | 48,000 | 55 | 0.002 | 0.002 |
| **2001-005** | | 0.5 | 54,000 | 75 | 0.004 | 0.004 | 54,000 | 75 | 0.004 | 0.004 | 48,000 | 35 | 0.002 | 0.002 | 48,000 | 35 | 0.002 | 0.002 |
| **20015-003** | | 0.3 | 54,000 | 160 | 0.007 | 0.009 | 54,000 | 160 | 0.007 | 0.009 | 48,000 | 90 | 0.004 | 0.004 | 48,000 | 90 | 0.004 | 0.004 |
| **20015-005** | **R0.075** | 0.5 | 54,000 | 140 | 0.007 | 0.009 | 54,000 | 140 | 0.007 | 0.009 | 48,000 | 60 | 0.004 | 0.004 | 48,000 | 60 | 0.004 | 0.004 |
| **20015-010** | | 1 | 54,000 | 100 | 0.003 | 0.005 | 54,000 | 100 | 0.003 | 0.005 | 48,000 | 60 | 0.001 | 0.002 | 48,000 | 60 | 0.001 | 0.002 |
| **2002-003** | | 0.3 | 60,000 | 350 | 0.008 | 0.024 | 60,000 | 350 | 0.008 | 0.016 | 60,000 | 300 | 0.008 | 0.024 | 60,000 | 300 | 0.006 | 0.018 |
| **2002-005** | | 0.5 | 60,000 | 350 | 0.008 | 0.024 | 60,000 | 350 | 0.008 | 0.016 | 60,000 | 300 | 0.008 | 0.024 | 60,000 | 300 | 0.006 | 0.018 |
| **2002-0075** | | 0.75 | 60,000 | 300 | 0.007 | 0.021 | 60,000 | 320 | 0.007 | 0.015 | 60,000 | 300 | 0.007 | 0.021 | 60,000 | 270 | 0.005 | 0.015 |
| **2002-010** | | 1 | 60,000 | 250 | 0.006 | 0.018 | 60,000 | 250 | 0.005 | 0.015 | 60,000 | 250 | 0.006 | 0.018 | 60,000 | 220 | 0.005 | 0.015 |
| **2002-0125** | | 1.25 | 54,000 | 225 | 0.005 | 0.016 | 54,000 | 215 | 0.004 | 0.013 | 60,000 | 225 | 0.005 | 0.016 | 54,000 | 195 | 0.004 | 0.013 |
| **2002-015** | **R0.1** | 1.5 | 48,000 | 200 | 0.005 | 0.015 | 48,000 | 180 | 0.004 | 0.012 | 60,000 | 200 | 0.005 | 0.015 | 48,000 | 170 | 0.004 | 0.012 |
| **2002-0175** | | 1.75 | 48,000 | 175 | 0.004 | 0.012 | 48,000 | 165 | 0.003 | 0.01 | 60,000 | 175 | 0.004 | 0.012 | 48,000 | 145 | 0.003 | 0.009 |
| **2002-020** | | 2 | 48,000 | 150 | 0.003 | 0.009 | 48,000 | 150 | 0.003 | 0.009 | 60,000 | 150 | 0.003 | 0.009 | 48,000 | 120 | 0.003 | 0.007 |
| **2002-0225** | | 2.25 | 44,000 | 125 | 0.003 | 0.007 | 44,000 | 125 | 0.003 | 0.007 | 53,000 | 125 | 0.002 | 0.007 | 44,000 | 110 | 0.002 | 0.005 |
| **2002-025** | | 2.5 | 40,000 | 100 | 0.003 | 0.006 | 40,000 | 100 | 0.003 | 0.006 | 46,000 | 100 | 0.002 | 0.006 | 40,000 | 100 | 0.002 | 0.004 |
| **2002-030** | | 3 | 33,000 | 50 | 0.002 | 0.003 | 33,000 | 50 | 0.002 | 0.003 | 33,000 | 50 | 0.002 | 0.003 | 33,000 | 50 | 0.002 | 0.002 |
| **2003-005** | | 0.5 | 43,000 | 500 | 0.012 | 0.036 | 43,000 | 500 | 0.012 | 0.024 | 54,000 | 450 | 0.012 | 0.036 | 43,000 | 450 | 0.008 | 0.024 |
| **2003-006** | | 0.6 | 43,000 | 500 | 0.012 | 0.036 | 43,000 | 500 | 0.012 | 0.024 | 54,000 | 450 | 0.012 | 0.036 | 43,000 | 450 | 0.008 | 0.024 |
| **2003-0075** | | 0.75 | 43,000 | 500 | 0.012 | 0.036 | 43,000 | 500 | 0.012 | 0.024 | 54,000 | 450 | 0.012 | 0.036 | 43,000 | 450 | 0.008 | 0.024 |
| **2003-010** | | 1 | 43,000 | 450 | 0.01 | 0.03 | 43,000 | 450 | 0.008 | 0.024 | 54,000 | 400 | 0.01 | 0.03 | 43,000 | 400 | 0.007 | 0.021 |
| **2003-0125** | | 1.25 | 43,000 | 425 | 0.009 | 0.027 | 43,000 | 425 | 0.007 | 0.022 | 54,000 | 400 | 0.009 | 0.027 | 43,000 | 400 | 0.006 | 0.019 |
| **2003-015** | | 1.5 | 43,000 | 400 | 0.008 | 0.024 | 43,000 | 400 | 0.007 | 0.021 | 54,000 | 400 | 0.008 | 0.024 | 43,000 | 400 | 0.006 | 0.018 |
| **2003-0175** | **R0.15** | 1.75 | 41,500 | 350 | 0.007 | 0.021 | 41,500 | 350 | 0.006 | 0.019 | 52,000 | 350 | 0.007 | 0.022 | 41,500 | 350 | 0.005 | 0.016 |
| **2003-020** | | 2 | 40,000 | 300 | 0.006 | 0.018 | 40,000 | 300 | 0.006 | 0.018 | 50,000 | 300 | 0.007 | 0.021 | 40,000 | 300 | 0.005 | 0.015 |
| **2003-0225** | | 2.25 | 40,000 | 275 | 0.005 | 0.016 | 40,000 | 275 | 0.005 | 0.016 | 48,000 | 275 | 0.006 | 0.018 | 40,000 | 275 | 0.004 | 0.013 |
| **2003-025** | | 2.5 | 40,000 | 250 | 0.005 | 0.015 | 40,000 | 250 | 0.005 | 0.015 | 46,000 | 250 | 0.005 | 0.015 | 40,000 | 250 | 0.004 | 0.012 |
| **2003-030** | | 3 | 38,000 | 200 | 0.004 | 0.012 | 38,000 | 200 | 0.004 | 0.012 | 42,000 | 200 | 0.004 | 0.012 | 38,000 | 200 | 0.004 | 0.008 |
| **2003-040** | | 4 | 35,000 | 100 | 0.003 | 0.009 | 35,000 | 100 | 0.003 | 0.009 | 35,000 | 100 | 0.003 | 0.009 | 32,000 | 100 | 0.003 | 0.005 |
| **2003-050** | | 5 | 26,000 | 60 | 0.003 | 0.004 | 26,000 | 60 | 0.003 | 0.004 | 26,000 | 60 | 0.003 | 0.004 | 26,000 | 60 | 0.003 | 0.003 |
| **2004-005** | | 0.5 | 35,000 | 1,200 | 0.03 | 0.09 | 35,000 | 1,200 | 0.02 | 0.04 | 50,000 | 650 | 0.025 | 0.075 | 35,000 | 650 | 0.015 | 0.045 |
| **2004-0075** | | 0.75 | 35,000 | 1,200 | 0.03 | 0.09 | 35,000 | 1,200 | 0.02 | 0.04 | 50,000 | 650 | 0.025 | 0.075 | 35,000 | 650 | 0.015 | 0.045 |
| **2004-010** | | 1 | 35,000 | 1,200 | 0.03 | 0.09 | 35,000 | 1,200 | 0.02 | 0.04 | 50,000 | 650 | 0.025 | 0.075 | 35,000 | 650 | 0.015 | 0.045 |
| **2004-0125** | | 1.25 | 35,000 | 1,050 | 0.025 | 0.075 | 35,000 | 1,050 | 0.018 | 0.036 | 50,000 | 600 | 0.022 | 0.067 | 35,000 | 575 | 0.013 | 0.04 |
| **2004-015** | | 1.5 | 35,000 | 900 | 0.02 | 0.06 | 35,000 | 900 | 0.016 | 0.033 | 50,000 | 550 | 0.02 | 0.06 | 35,000 | 500 | 0.012 | 0.036 |
| **2004-0175** | | 1.75 | 35,000 | 750 | 0.017 | 0.052 | 35,000 | 750 | 0.013 | 0.033 | 50,000 | 525 | 0.017 | 0.052 | 35,000 | 450 | 0.011 | 0.033 |
| **2004-020** | | 2 | 35,000 | 600 | 0.015 | 0.045 | 35,000 | 600 | 0.011 | 0.033 | 50,000 | 500 | 0.015 | 0.045 | 35,000 | 400 | 0.01 | 0.03 |
| **2004-0225** | **R0.2** | 2.25 | 35,000 | 525 | 0.013 | 0.04 | 35,000 | 525 | 0.01 | 0.031 | 48,000 | 475 | 0.013 | 0.04 | 35,000 | 380 | 0.01 | 0.027 |
| **2004-025** | | 2.5 | 35,000 | 450 | 0.012 | 0.036 | 35,000 | 450 | 0.01 | 0.03 | 46,000 | 450 | 0.012 | 0.036 | 35,000 | 360 | 0.01 | 0.025 |
| **2004-030** | | 3 | 35,000 | 400 | 0.01 | 0.03 | 35,000 | 400 | 0.008 | 0.024 | 42,000 | 400 | 0.01 | 0.03 | 35,000 | 330 | 0.007 | 0.021 |
| **2004-035** | | 3.5 | 35,000 | 350 | 0.007 | 0.02 | 35,000 | 350 | 0.006 | 0.018 | 38,000 | 350 | 0.007 | 0.021 | 35,000 | 300 | 0.007 | 0.018 |
| **2004-040** | | 4 | 35,000 | 300 | 0.005 | 0.015 | 35,000 | 300 | 0.005 | 0.015 | 35,000 | 300 | 0.005 | 0.015 | 35,000 | 250 | 0.005 | 0.015 |
| **2004-045** | | 4.5 | 32,000 | 230 | 0.004 | 0.012 | 32,000 | 230 | 0.004 | 0.012 | 32,000 | 230 | 0.004 | 0.012 | 32,000 | 200 | 0.004 | 0.01 |
| **2004-050** | | 5 | 30,000 | 160 | 0.003 | 0.01 | 30,000 | 160 | 0.003 | 0.01 | 30,000 | 160 | 0.003 | 0.01 | 30,000 | 150 | 0.003 | 0.008 |
| **2004-060** | | 6 | 23,000 | 90 | 0.003 | 0.005 | 23,000 | 90 | 0.003 | 0.005 | 23,000 | 90 | 0.003 | 0.005 | 23,000 | 80 | 0.003 | 0.004 |

## Milling Conditions for CSELB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2005-010** | R0.25 | 1 | 34,000 | 1,300 | 0.035 | 0.105 | 34,000 | 1,300 | 0.03 | 0.06 | 45,000 | 900 | 0.03 | 0.09 | 32,000 | 900 | 0.02 | 0.06 |
| **2005-0125** | | 1.25 | 34,000 | 1,150 | 0.032 | 0.097 | 34,000 | 1,150 | 0.027 | 0.055 | 45,000 | 850 | 0.027 | 0.082 | 32,000 | 850 | 0.019 | 0.057 |
| **2005-015** | | 1.5 | 34,000 | 1,000 | 0.03 | 0.09 | 34,000 | 1,000 | 0.025 | 0.05 | 45,000 | 800 | 0.025 | 0.075 | 32,000 | 800 | 0.018 | 0.054 |
| **2005-0175** | | 1.75 | 34,000 | 900 | 0.027 | 0.082 | 34,000 | 900 | 0.024 | 0.048 | 45,000 | 750 | 0.023 | 0.07 | 32,000 | 750 | 0.017 | 0.051 |
| **2005-020** | | 2 | 34,000 | 800 | 0.025 | 0.075 | 34,000 | 800 | 0.023 | 0.046 | 45,000 | 700 | 0.022 | 0.066 | 32,000 | 700 | 0.016 | 0.048 |
| **2005-0225** | | 2.25 | 34,000 | 750 | 0.022 | 0.067 | 34,000 | 750 | 0.019 | 0.045 | 45,000 | 650 | 0.02 | 0.06 | 32,000 | 650 | 0.015 | 0.046 |
| **2005-025** | | 2.5 | 34,000 | 700 | 0.02 | 0.06 | 34,000 | 700 | 0.015 | 0.045 | 45,000 | 600 | 0.018 | 0.054 | 32,000 | 600 | 0.015 | 0.045 |
| **2005-030** | | 3 | 32,000 | 550 | 0.016 | 0.048 | 32,000 | 550 | 0.012 | 0.036 | 41,000 | 550 | 0.014 | 0.042 | 31,000 | 500 | 0.012 | 0.036 |
| **2005-035** | | 3.5 | 32,000 | 500 | 0.014 | 0.042 | 32,000 | 500 | 0.011 | 0.033 | 38,000 | 500 | 0.012 | 0.036 | 30,500 | 450 | 0.01 | 0.03 |
| **2005-040** | | 4 | 31,000 | 450 | 0.012 | 0.036 | 31,000 | 450 | 0.01 | 0.03 | 35,000 | 450 | 0.01 | 0.03 | 30,000 | 390 | 0.01 | 0.03 |
| **2005-045** | | 4.5 | 30,000 | 390 | 0.01 | 0.03 | 30,000 | 390 | 0.008 | 0.024 | 32,000 | 390 | 0.008 | 0.024 | 29,500 | 350 | 0.008 | 0.024 |
| **2005-050** | | 5 | 29,000 | 340 | 0.007 | 0.021 | 29,000 | 340 | 0.007 | 0.021 | 29,000 | 340 | 0.006 | 0.018 | 29,000 | 300 | 0.006 | 0.018 |
| **2005-055** | | 5.5 | 26,000 | 280 | 0.007 | 0.021 | 26,000 | 280 | 0.007 | 0.021 | 26,000 | 280 | 0.006 | 0.018 | 26,000 | 250 | 0.006 | 0.018 |
| **2005-060** | | 6 | 24,000 | 220 | 0.006 | 0.018 | 24,000 | 220 | 0.006 | 0.018 | 24,000 | 220 | 0.005 | 0.015 | 24,000 | 200 | 0.005 | 0.015 |
| **2005-070** | | 7 | 21,000 | 180 | 0.005 | 0.015 | 21,000 | 180 | 0.005 | 0.015 | 21,000 | 180 | 0.004 | 0.012 | 21,000 | 160 | 0.004 | 0.012 |
| **2005-080** | | 8 | 19,000 | 130 | 0.004 | 0.012 | 19,000 | 130 | 0.004 | 0.012 | 19,000 | 130 | 0.003 | 0.009 | 19,000 | 110 | 0.003 | 0.009 |
| **2005-090** | | 9 | 18,000 | 120 | 0.003 | 0.009 | 18,000 | 120 | 0.003 | 0.009 | 18,000 | 120 | 0.002 | 0.008 | 18,000 | 100 | 0.002 | 0.008 |
| **2005-100** | | 10 | 17,000 | 100 | 0.003 | 0.009 | 17,000 | 100 | 0.003 | 0.009 | 17,000 | 100 | 0.002 | 0.006 | 17,000 | 80 | 0.002 | 0.006 |
| **2006-010** | R0.3 | 1 | 33,000 | 1,500 | 0.05 | 0.15 | 33,000 | 1,500 | 0.04 | 0.08 | 40,000 | 1,300 | 0.045 | 0.09 | 30,000 | 1,300 | 0.04 | 0.06 |
| **2006-0125** | | 1.25 | 33,000 | 1,500 | 0.05 | 0.15 | 33,000 | 1,500 | 0.04 | 0.08 | 40,000 | 1,300 | 0.045 | 0.09 | 30,000 | 1,300 | 0.04 | 0.06 |
| **2006-015** | | 1.5 | 33,000 | 1,500 | 0.05 | 0.15 | 33,000 | 1,500 | 0.04 | 0.08 | 40,000 | 1,300 | 0.045 | 0.09 | 30,000 | 1,300 | 0.04 | 0.06 |
| **2006-0175** | | 1.75 | 33,000 | 1,450 | 0.047 | 0.142 | 33,000 | 1,450 | 0.038 | 0.076 | 40,000 | 1,250 | 0.045 | 0.09 | 30,000 | 1,250 | 0.038 | 0.057 |
| **2006-020** | | 2 | 33,000 | 1,400 | 0.045 | 0.135 | 33,000 | 1,400 | 0.036 | 0.072 | 40,000 | 1,200 | 0.045 | 0.09 | 30,000 | 1,200 | 0.036 | 0.054 |
| **2006-0225** | | 2.25 | 33,000 | 1,250 | 0.042 | 0.127 | 33,000 | 1,300 | 0.034 | 0.069 | 40,000 | 1,100 | 0.042 | 0.085 | 30,000 | 1,150 | 0.034 | 0.053 |
| **2006-025** | | 2.5 | 33,000 | 1,100 | 0.04 | 0.12 | 33,000 | 1,200 | 0.033 | 0.066 | 40,000 | 1,000 | 0.04 | 0.08 | 30,000 | 1,100 | 0.033 | 0.053 |
| **2006-030** | | 3 | 33,000 | 900 | 0.035 | 0.105 | 33,000 | 900 | 0.025 | 0.066 | 40,000 | 800 | 0.03 | 0.075 | 30,000 | 900 | 0.026 | 0.052 |
| **2006-035** | | 3.5 | 32,000 | 900 | 0.03 | 0.09 | 32,000 | 800 | 0.022 | 0.066 | 38,000 | 650 | 0.025 | 0.075 | 28,000 | 720 | 0.02 | 0.06 |
| **2006-040** | | 4 | 31,000 | 700 | 0.027 | 0.081 | 31,000 | 700 | 0.02 | 0.06 | 35,000 | 560 | 0.022 | 0.066 | 28,000 | 600 | 0.018 | 0.054 |
| **2006-045** | | 4.5 | 29,000 | 500 | 0.024 | 0.072 | 29,000 | 550 | 0.017 | 0.051 | 32,000 | 500 | 0.018 | 0.054 | 26,000 | 500 | 0.015 | 0.045 |
| **2006-050** | | 5 | 29,000 | 440 | 0.018 | 0.054 | 29,000 | 440 | 0.015 | 0.045 | 29,000 | 440 | 0.015 | 0.045 | 26,000 | 440 | 0.012 | 0.036 |
| **2006-055** | | 5.5 | 26,000 | 410 | 0.016 | 0.048 | 26,000 | 410 | 0.014 | 0.042 | 26,000 | 410 | 0.014 | 0.042 | 25,000 | 410 | 0.01 | 0.03 |
| **2006-060** | | 6 | 24,000 | 380 | 0.012 | 0.036 | 24,000 | 380 | 0.012 | 0.036 | 24,000 | 380 | 0.01 | 0.03 | 24,000 | 380 | 0.008 | 0.024 |
| **2006-065** | | 6.5 | 22,000 | 340 | 0.011 | 0.033 | 22,000 | 340 | 0.011 | 0.033 | 22,000 | 340 | 0.009 | 0.027 | 22,000 | 340 | 0.007 | 0.021 |
| **2006-070** | | 7 | 21,000 | 310 | 0.01 | 0.03 | 21,000 | 310 | 0.01 | 0.03 | 21,000 | 310 | 0.008 | 0.024 | 21,000 | 310 | 0.006 | 0.018 |
| **2006-080** | | 8 | 18,000 | 240 | 0.008 | 0.024 | 18,000 | 240 | 0.008 | 0.024 | 18,000 | 240 | 0.006 | 0.018 | 18,000 | 240 | 0.005 | 0.015 |
| **2006-090** | | 9 | 16,000 | 180 | 0.007 | 0.021 | 16,000 | 180 | 0.007 | 0.021 | 16,000 | 180 | 0.005 | 0.015 | 16,000 | 180 | 0.004 | 0.012 |
| **2006-100** | | 10 | 15,000 | 160 | 0.006 | 0.018 | 15,000 | 160 | 0.006 | 0.018 | 15,000 | 160 | 0.004 | 0.012 | 15,000 | 160 | 0.003 | 0.01 |
| **2006-120** | | 12 | 14,000 | 150 | 0.005 | 0.015 | 14,000 | 150 | 0.005 | 0.015 | 14,000 | 150 | 0.003 | 0.009 | 14,000 | 150 | 0.002 | 0.008 |
| **2007-020** | R0.35 | 2 | 32,000 | 1,800 | 0.07 | 0.21 | 32,000 | 1,600 | 0.05 | 0.1 | 38,000 | 1,600 | 0.06 | 0.12 | 28,000 | 1,600 | 0.05 | 0.075 |
| **2007-040** | | 4 | 32,000 | 1,000 | 0.05 | 0.15 | 32,000 | 900 | 0.03 | 0.09 | 34,000 | 800 | 0.04 | 0.12 | 28,000 | 800 | 0.03 | 0.06 |
| **2007-060** | | 6 | 26,000 | 550 | 0.022 | 0.066 | 26,000 | 550 | 0.018 | 0.054 | 26,000 | 500 | 0.018 | 0.054 | 23,000 | 500 | 0.014 | 0.042 |
| **2007-080** | | 8 | 19,000 | 340 | 0.012 | 0.036 | 19,000 | 340 | 0.012 | 0.036 | 19,000 | 320 | 0.01 | 0.03 | 19,000 | 320 | 0.008 | 0.024 |

# Milling Conditions for CSELB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2008-020** | | 2 | 30,000 | 2,200 | 0.1 | 0.3 | 30,000 | 1,800 | 0.06 | 0.12 | 35,000 | 1,800 | 0.07 | 0.14 | 25,000 | 1,700 | 0.07 | 0.1 |
| **2008-030** | | 3 | 30,000 | 1,700 | 0.08 | 0.24 | 30,000 | 1,600 | 0.05 | 0.1 | 35,000 | 1,600 | 0.06 | 0.12 | 25,000 | 1,500 | 0.06 | 0.09 |
| **2008-040** | | 4 | 30,000 | 1,400 | 0.07 | 0.21 | 30,000 | 1,300 | 0.04 | 0.1 | 35,000 | 1,300 | 0.05 | 0.12 | 25,000 | 1,200 | 0.045 | 0.09 |
| **2008-050** | | 5 | 30,000 | 1,100 | 0.06 | 0.18 | 30,000 | 1,100 | 0.035 | 0.1 | 30,000 | 1,100 | 0.04 | 0.12 | 25,000 | 1,000 | 0.04 | 0.08 |
| **2008-060** | | 6 | 27,000 | 900 | 0.04 | 0.12 | 27,000 | 900 | 0.025 | 0.075 | 27,000 | 800 | 0.03 | 0.09 | 23,000 | 800 | 0.023 | 0.069 |
| **2008-070** | **R0.4** | 7 | 24,000 | 700 | 0.025 | 0.075 | 24,000 | 700 | 0.022 | 0.066 | 24,000 | 600 | 0.02 | 0.06 | 21,000 | 600 | 0.015 | 0.045 |
| **2008-080** | | 8 | 19,000 | 450 | 0.02 | 0.06 | 19,000 | 450 | 0.02 | 0.06 | 19,000 | 450 | 0.015 | 0.045 | 19,000 | 450 | 0.01 | 0.03 |
| **2008-090** | | 9 | 18,000 | 400 | 0.016 | 0.048 | 18,000 | 400 | 0.016 | 0.048 | 18,000 | 360 | 0.013 | 0.039 | 18,000 | 360 | 0.009 | 0.027 |
| **2008-100** | | 10 | 15,000 | 350 | 0.012 | 0.036 | 15,000 | 350 | 0.012 | 0.036 | 15,000 | 300 | 0.01 | 0.03 | 15,000 | 300 | 0.007 | 0.021 |
| **2008-120** | | 12 | 14,000 | 300 | 0.01 | 0.03 | 14,000 | 300 | 0.01 | 0.03 | 14,000 | 240 | 0.006 | 0.018 | 14,000 | 240 | 0.006 | 0.018 |
| **2008-160** | | 16 | 13,500 | 240 | 0.006 | 0.018 | 13,500 | 240 | 0.006 | 0.018 | 13,500 | 190 | 0.003 | 0.01 | 13,500 | 190 | 0.003 | 0.01 |
| **2009-020** | | 2 | 30,000 | 2,100 | 0.11 | 0.33 | 30,000 | 1,600 | 0.07 | 0.14 | 33,000 | 1,700 | 0.08 | 0.16 | 24,000 | 1,600 | 0.08 | 0.12 |
| **2009-040** | | 4 | 30,000 | 1,600 | 0.08 | 0.24 | 30,000 | 1,500 | 0.055 | 0.12 | 33,000 | 1,400 | 0.06 | 0.14 | 24,000 | 1,300 | 0.05 | 0.1 |
| **2009-060** | | 6 | 27,000 | 1,100 | 0.06 | 0.18 | 27,000 | 1,100 | 0.035 | 0.1 | 27,000 | 850 | 0.04 | 0.12 | 22,000 | 800 | 0.034 | 0.1 |
| **2009-080** | | 8 | 22,000 | 710 | 0.03 | 0.09 | 22,000 | 700 | 0.023 | 0.069 | 22,000 | 560 | 0.021 | 0.063 | 18,500 | 550 | 0.017 | 0.051 |
| **2009-100** | **R0.45** | 10 | 18,000 | 500 | 0.02 | 0.06 | 18,000 | 500 | 0.018 | 0.054 | 18,000 | 430 | 0.015 | 0.045 | 18,000 | 430 | 0.01 | 0.03 |
| **2009-120** | | 12 | 16,000 | 420 | 0.015 | 0.045 | 16,000 | 420 | 0.015 | 0.045 | 16,000 | 350 | 0.009 | 0.027 | 16,000 | 350 | 0.007 | 0.021 |
| **2009-140** | | 14 | 14,000 | 380 | 0.012 | 0.042 | 14,000 | 380 | 0.012 | 0.042 | 14,000 | 280 | 0.006 | 0.018 | 14,000 | 280 | 0.006 | 0.018 |
| **2009-160** | | 16 | 13,500 | 360 | 0.01 | 0.04 | 13,500 | 360 | 0.01 | 0.04 | 13,500 | 200 | 0.004 | 0.016 | 13,500 | 200 | 0.004 | 0.016 |
| **2009-180** | | 18 | 13,000 | 340 | 0.006 | 0.024 | 13,000 | 340 | 0.006 | 0.024 | 13,000 | 120 | 0.003 | 0.012 | 13,000 | 120 | 0.003 | 0.012 |
| **2010-020** | | 2 | 30,000 | 2,000 | 0.12 | 0.36 | 30,000 | 1,600 | 0.08 | 0.16 | 30,000 | 1,600 | 0.09 | 0.18 | 22,000 | 1,600 | 0.09 | 0.13 |
| **2010-025** | | 2.5 | 30,000 | 2,000 | 0.12 | 0.36 | 30,000 | 1,600 | 0.08 | 0.16 | 30,000 | 1,600 | 0.09 | 0.18 | 22,000 | 1,600 | 0.09 | 0.13 |
| **2010-030** | | 3 | 30,000 | 1,800 | 0.11 | 0.33 | 24,000 | 1,600 | 0.07 | 0.14 | 30,000 | 1,500 | 0.08 | 0.16 | 21,500 | 1,400 | 0.08 | 0.12 |
| **2010-040** | | 4 | 30,000 | 1,700 | 0.09 | 0.27 | 24,000 | 1,500 | 0.065 | 0.13 | 30,000 | 1,300 | 0.075 | 0.15 | 21,500 | 1,300 | 0.075 | 0.1 |
| **2010-050** | | 5 | 30,000 | 1,600 | 0.08 | 0.24 | 24,000 | 1,400 | 0.06 | 0.12 | 30,000 | 1,200 | 0.07 | 0.14 | 21,500 | 1,200 | 0.06 | 0.09 |
| **2010-060** | | 6 | 30,000 | 1,400 | 0.06 | 0.18 | 18,000 | 1,200 | 0.04 | 0.12 | 30,000 | 1,100 | 0.06 | 0.12 | 21,500 | 1,100 | 0.05 | 0.1 |
| **2010-070** | | 7 | 27,000 | 1,200 | 0.05 | 0.15 | 17,000 | 1,000 | 0.03 | 0.09 | 24,000 | 800 | 0.04 | 0.12 | 20,000 | 900 | 0.03 | 0.09 |
| **2010-080** | **R0.5** | 8 | 24,000 | 1,000 | 0.04 | 0.12 | 16,500 | 900 | 0.027 | 0.081 | 18,500 | 620 | 0.035 | 0.1 | 18,500 | 580 | 0.025 | 0.1 |
| **2010-090** | | 9 | 22,000 | 720 | 0.035 | 0.11 | 15,500 | 700 | 0.02 | 0.08 | 16,500 | 550 | 0.025 | 0.1 | 16,500 | 500 | 0.02 | 0.08 |
| **2010-100** | | 10 | 20,000 | 650 | 0.03 | 0.09 | 15,000 | 500 | 0.018 | 0.072 | 14,800 | 490 | 0.02 | 0.08 | 14,800 | 430 | 0.015 | 0.06 |
| **2010-120** | | 12 | 18,000 | 600 | 0.02 | 0.08 | 15,000 | 500 | 0.016 | 0.064 | 13,400 | 380 | 0.01 | 0.05 | 13,400 | 380 | 0.008 | 0.04 |
| **2010-140** | | 14 | 16,000 | 530 | 0.015 | 0.06 | 14,000 | 460 | 0.015 | 0.06 | 12,000 | 350 | 0.008 | 0.04 | 12,000 | 350 | 0.006 | 0.03 |
| **2010-160** | | 16 | 14,000 | 460 | 0.014 | 0.056 | 14,000 | 460 | 0.014 | 0.056 | 10,500 | 250 | 0.005 | 0.025 | 10,500 | 250 | 0.005 | 0.025 |
| **2010-180** | | 18 | 13,500 | 440 | 0.012 | 0.06 | 13,500 | 440 | 0.012 | 0.06 | 9,500 | 200 | 0.004 | 0.02 | 9,500 | 200 | 0.004 | 0.02 |
| **2010-200** | | 20 | 13,000 | 430 | 0.008 | 0.04 | 13,000 | 430 | 0.008 | 0.04 | 9,000 | 150 | 0.003 | 0.015 | 9,000 | 150 | 0.003 | 0.015 |
| **2010-220** | | 22 | 12,000 | 380 | 0.007 | 0.035 | 12,000 | 380 | 0.007 | 0.035 | 8,500 | 120 | 0.002 | 0.01 | 8,500 | 120 | 0.002 | 0.01 |
| **2012-025** | | 2.5 | 30,000 | 2,000 | 0.13 | 0.39 | 30,000 | 1,600 | 0.09 | 0.18 | 30,000 | 1,600 | 0.1 | 0.2 | 18,000 | 1,600 | 0.1 | 0.15 |
| **2012-040** | | 4 | 30,000 | 1,800 | 0.12 | 0.36 | 20,000 | 1,500 | 0.08 | 0.16 | 30,000 | 1,400 | 0.09 | 0.18 | 18,000 | 1,400 | 0.09 | 0.13 |
| **2012-060** | | 6 | 30,000 | 1,600 | 0.09 | 0.27 | 20,000 | 1,200 | 0.07 | 0.14 | 30,000 | 1,100 | 0.08 | 0.16 | 18,000 | 1,100 | 0.08 | 0.12 |
| **2012-080** | | 8 | 25,000 | 1,200 | 0.06 | 0.18 | 15,000 | 900 | 0.05 | 0.12 | 20,000 | 800 | 0.06 | 0.15 | 16,500 | 750 | 0.05 | 0.11 |
| **2012-100** | **R0.6** | 10 | 20,000 | 900 | 0.05 | 0.15 | 13,500 | 650 | 0.035 | 0.11 | 16,000 | 640 | 0.045 | 0.12 | 15,500 | 550 | 0.03 | 0.09 |
| **2012-120** | | 12 | 16,500 | 600 | 0.035 | 0.12 | 12,500 | 480 | 0.025 | 0.1 | 12,000 | 440 | 0.03 | 0.12 | 12,500 | 430 | 0.018 | 0.072 |
| **2012-140** | | 14 | 14,500 | 520 | 0.025 | 0.1 | 12,500 | 480 | 0.022 | 0.088 | 11,000 | 400 | 0.015 | 0.06 | 11,500 | 370 | 0.014 | 0.056 |
| **2012-160** | | 16 | 13,000 | 470 | 0.018 | 0.072 | 11,500 | 440 | 0.018 | 0.072 | 10,000 | 350 | 0.01 | 0.05 | 10,000 | 350 | 0.01 | 0.05 |
| **2012-180** | | 18 | 12,000 | 460 | 0.014 | 0.07 | 11,250 | 440 | 0.014 | 0.07 | 9,500 | 260 | 0.008 | 0.04 | 9,500 | 260 | 0.007 | 0.035 |
| **2012-200** | | 20 | 11,000 | 440 | 0.013 | 0.065 | 11,000 | 440 | 0.013 | 0.065 | 9,000 | 220 | 0.006 | 0.03 | 9,000 | 220 | 0.005 | 0.025 |

## Milling Conditions for CSELB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2014-060** | **R0.7** | 6 | 30,000 | 1,700 | 0.11 | 0.33 | 23,000 | 1,500 | 0.08 | 0.16 | 30,000 | 1,300 | 0.09 | 0.18 | 16,000 | 1,200 | 0.09 | 0.13 |
| **2014-080** | | 8 | 30,000 | 1,400 | 0.09 | 0.27 | 17,000 | 1,000 | 0.06 | 0.15 | 30,000 | 1,000 | 0.07 | 0.17 | 15,000 | 900 | 0.06 | 0.12 |
| **2014-120** | | 12 | 17,000 | 900 | 0.06 | 0.18 | 13,000 | 600 | 0.04 | 0.12 | 13,000 | 580 | 0.045 | 0.14 | 12,500 | 550 | 0.03 | 0.1 |
| **2014-160** | | 16 | 12,500 | 540 | 0.028 | 0.12 | 11,000 | 500 | 0.024 | 0.1 | 9,500 | 380 | 0.016 | 0.08 | 9,500 | 380 | 0.015 | 0.06 |
| **2015-030** | **R0.75** | 3 | 30,000 | 2,000 | 0.15 | 0.45 | 30,000 | 1,600 | 0.12 | 0.24 | 30,000 | 1,700 | 0.12 | 0.24 | 18,000 | 1,500 | 0.12 | 0.18 |
| **2015-040** | | 4 | 30,000 | 1,800 | 0.14 | 0.42 | 30,000 | 1,500 | 0.11 | 0.22 | 30,000 | 1,600 | 0.11 | 0.22 | 18,000 | 1,400 | 0.11 | 0.17 |
| **2015-060** | | 6 | 30,000 | 1,800 | 0.12 | 0.36 | 23,000 | 1,300 | 0.1 | 0.2 | 30,000 | 1,400 | 0.1 | 0.2 | 15,000 | 1,200 | 0.1 | 0.16 |
| **2015-080** | | 8 | 30,000 | 1,600 | 0.11 | 0.33 | 18,000 | 1,100 | 0.08 | 0.16 | 30,000 | 1,200 | 0.08 | 0.2 | 14,000 | 1,000 | 0.08 | 0.16 |
| **2015-100** | | 10 | 23,000 | 1,200 | 0.09 | 0.27 | 15,000 | 850 | 0.06 | 0.15 | 23,500 | 900 | 0.06 | 0.18 | 14,000 | 700 | 0.05 | 0.15 |
| **2015-120** | | 12 | 16,000 | 900 | 0.07 | 0.21 | 13,000 | 600 | 0.05 | 0.15 | 13,000 | 650 | 0.05 | 0.15 | 13,000 | 550 | 0.03 | 0.12 |
| **2015-140** | | 14 | 14,500 | 700 | 0.05 | 0.19 | 10,500 | 550 | 0.04 | 0.12 | 10,500 | 500 | 0.04 | 0.12 | 10,500 | 470 | 0.025 | 0.1 |
| **2015-160** | | 16 | 13,000 | 650 | 0.04 | 0.16 | 10,000 | 550 | 0.03 | 0.12 | 8,850 | 400 | 0.03 | 0.12 | 8,850 | 390 | 0.02 | 0.08 |
| **2015-180** | | 18 | 12,000 | 580 | 0.03 | 0.15 | 10,000 | 510 | 0.025 | 0.1 | 8,500 | 350 | 0.018 | 0.09 | 8,500 | 360 | 0.014 | 0.07 |
| **2015-200** | | 20 | 10,500 | 530 | 0.02 | 0.1 | 9,200 | 470 | 0.02 | 0.1 | 8,000 | 320 | 0.012 | 0.06 | 8,000 | 320 | 0.012 | 0.06 |
| **2015-220** | | 22 | 10,000 | 500 | 0.015 | 0.075 | 9,000 | 460 | 0.015 | 0.075 | 7,500 | 270 | 0.01 | 0.05 | 7,500 | 270 | 0.008 | 0.04 |
| **2015-250** | | 25 | 9,000 | 440 | 0.014 | 0.07 | 8,750 | 440 | 0.014 | 0.07 | 7,250 | 250 | 0.008 | 0.04 | 7,250 | 250 | 0.006 | 0.03 |
| **2015-300** | | 30 | 8,500 | 420 | 0.012 | 0.06 | 8,500 | 420 | 0.012 | 0.06 | 7,000 | 130 | 0.006 | 0.03 | 7,000 | 130 | 0.004 | 0.02 |
| **2016-040** | **R0.8** | 4 | 30,000 | 2,000 | 0.16 | 0.48 | 30,000 | 1,600 | 0.12 | 0.24 | 30,000 | 1,800 | 0.12 | 0.36 | 18,000 | 1,400 | 0.1 | 0.2 |
| **2016-080** | | 8 | 30,000 | 1,700 | 0.15 | 0.45 | 15,000 | 1,100 | 0.1 | 0.2 | 30,000 | 1,500 | 0.12 | 0.24 | 13,500 | 1,000 | 0.08 | 0.24 |
| **2016-120** | | 12 | 23,000 | 1,200 | 0.1 | 0.3 | 11,000 | 700 | 0.06 | 0.18 | 18,000 | 1,000 | 0.06 | 0.18 | 12,500 | 650 | 0.04 | 0.16 |
| **2016-160** | | 16 | 15,000 | 800 | 0.05 | 0.2 | 10,000 | 530 | 0.034 | 0.13 | 10,000 | 530 | 0.035 | 0.14 | 9,000 | 420 | 0.02 | 0.1 |
| **2016-200** | | 20 | 11,000 | 580 | 0.034 | 0.17 | 9,400 | 490 | 0.025 | 0.12 | 8,500 | 400 | 0.018 | 0.09 | 7,800 | 380 | 0.014 | 0.07 |
| **2018-040** | **R0.9** | 4 | 30,000 | 2,000 | 0.18 | 0.54 | 30,000 | 1,800 | 0.16 | 0.32 | 30,000 | 1,900 | 0.16 | 0.48 | 16,000 | 1,300 | 0.14 | 0.28 |
| **2018-060** | | 6 | 30,000 | 1,800 | 0.18 | 0.52 | 24,000 | 1,500 | 0.15 | 0.29 | 30,000 | 1,700 | 0.16 | 0.4 | 14,000 | 1,200 | 0.13 | 0.27 |
| **2018-080** | | 8 | 30,000 | 1,800 | 0.17 | 0.5 | 18,000 | 1,200 | 0.13 | 0.26 | 30,000 | 1,700 | 0.16 | 0.32 | 12,000 | 1,000 | 0.11 | 0.26 |
| **2018-100** | | 10 | 30,000 | 1,800 | 0.16 | 0.48 | 15,000 | 1,100 | 0.11 | 0.23 | 24,000 | 1,400 | 0.12 | 0.28 | 12,000 | 900 | 0.09 | 0.23 |
| **2018-120** | | 12 | 24,000 | 1,450 | 0.12 | 0.36 | 13,000 | 1,000 | 0.08 | 0.2 | 18,000 | 1,100 | 0.09 | 0.23 | 12,000 | 750 | 0.07 | 0.21 |
| **2018-160** | | 16 | 15,000 | 900 | 0.07 | 0.3 | 12,000 | 750 | 0.05 | 0.18 | 15,000 | 750 | 0.04 | 0.14 | 9,500 | 480 | 0.025 | 0.11 |
| **2018-180** | | 18 | 13,000 | 800 | 0.06 | 0.24 | 11,000 | 650 | 0.04 | 0.16 | 11,000 | 600 | 0.035 | 0.14 | 8,800 | 440 | 0.02 | 0.1 |
| **2018-200** | | 20 | 11,500 | 650 | 0.05 | 0.2 | 9,500 | 600 | 0.03 | 0.15 | 8,500 | 450 | 0.025 | 0.11 | 8,300 | 420 | 0.018 | 0.08 |
| **2018-220** | | 22 | 10,000 | 590 | 0.035 | 0.18 | 8,500 | 550 | 0.03 | 0.14 | 8,000 | 400 | 0.02 | 0.1 | 7,800 | 400 | 0.015 | 0.075 |
| **2018-250** | | 25 | 8,000 | 500 | 0.035 | 0.17 | 8,000 | 480 | 0.025 | 0.12 | 7,000 | 350 | 0.018 | 0.09 | 7,000 | 350 | 0.012 | 0.06 |
| **2018-300** | | 30 | 7,500 | 450 | 0.025 | 0.13 | 7,500 | 420 | 0.02 | 0.08 | 6,500 | 280 | 0.014 | 0.07 | 6,500 | 280 | 0.008 | 0.04 |

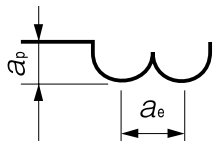
# Milling Conditions for CSELB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2020-030** | R1 | 3 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.21 | 0.42 | 30,000 | 2,000 | 0.2 | 0.6 | 16,000 | 1,300 | 0.17 | 0.5 |
| **2020-040** | | 4 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.21 | 0.42 | 30,000 | 2,000 | 0.2 | 0.6 | 16,000 | 1,300 | 0.17 | 0.5 |
| **2020-060** | | 6 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.21 | 0.42 | 30,000 | 2,000 | 0.2 | 0.6 | 14,000 | 1,100 | 0.15 | 0.4 |
| **2020-080** | | 8 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.18 | 0.36 | 30,000 | 2,000 | 0.16 | 0.56 | 12,000 | 950 | 0.12 | 0.4 |
| **2020-100** | | 10 | 30,000 | 2,000 | 0.2 | 0.6 | 30,000 | 2,000 | 0.14 | 0.42 | 30,000 | 2,000 | 0.13 | 0.45 | 10,800 | 850 | 0.1 | 0.4 |
| **2020-120** | | 12 | 30,000 | 2,000 | 0.18 | 0.54 | 30,000 | 2,000 | 0.12 | 0.36 | 30,000 | 2,000 | 0.1 | 0.35 | 10,800 | 850 | 0.08 | 0.32 |
| **2020-130** | | 13 | 26,000 | 1,700 | 0.17 | 0.52 | 26,000 | 1,700 | 0.11 | 0.34 | 25,000 | 1,600 | 0.09 | 0.3 | 10,800 | 850 | 0.07 | 0.28 |
| **2020-140** | | 14 | 22,000 | 1,450 | 0.15 | 0.5 | 22,000 | 1,450 | 0.11 | 0.33 | 20,000 | 1,300 | 0.08 | 0.24 | 10,800 | 850 | 0.06 | 0.24 |
| **2020-160** | | 16 | 15,000 | 1,000 | 0.1 | 0.4 | 15,000 | 1,000 | 0.07 | 0.28 | 10,800 | 700 | 0.06 | 0.18 | 10,800 | 600 | 0.03 | 0.15 |
| **2020-180** | | 18 | 13,500 | 900 | 0.08 | 0.32 | 13,500 | 900 | 0.06 | 0.24 | 9,700 | 600 | 0.05 | 0.15 | 9,700 | 520 | 0.025 | 0.12 |
| **2020-200** | | 20 | 12,000 | 800 | 0.07 | 0.28 | 12,000 | 800 | 0.05 | 0.2 | 8,650 | 500 | 0.04 | 0.16 | 8,650 | 450 | 0.02 | 0.1 |
| **2020-220** | | 22 | 10,500 | 700 | 0.05 | 0.25 | 10,500 | 700 | 0.04 | 0.2 | 8,200 | 470 | 0.03 | 0.12 | 8,200 | 440 | 0.018 | 0.09 |
| **2020-250** | | 25 | 9,000 | 600 | 0.04 | 0.2 | 9,000 | 600 | 0.035 | 0.17 | 7,800 | 440 | 0.025 | 0.1 | 7,800 | 440 | 0.016 | 0.08 |
| **2020-270** | | 27 | 8,000 | 530 | 0.037 | 0.18 | 8,000 | 530 | 0.032 | 0.16 | 7,400 | 390 | 0.022 | 0.09 | 7,400 | 390 | 0.013 | 0.06 |
| **2020-300** | | 30 | 7,000 | 470 | 0.035 | 0.17 | 7,000 | 470 | 0.03 | 0.15 | 7,000 | 350 | 0.02 | 0.08 | 7,000 | 350 | 0.01 | 0.05 |
| **2020-320** | | 32 | 6,750 | 450 | 0.032 | 0.16 | 6,750 | 450 | 0.027 | 0.13 | 6,550 | 300 | 0.017 | 0.07 | 6,550 | 300 | 0.009 | 0.04 |
| **2020-350** | | 35 | 6,500 | 430 | 0.03 | 0.15 | 6,500 | 430 | 0.025 | 0.12 | 6,150 | 250 | 0.015 | 0.06 | 6,150 | 250 | 0.008 | 0.04 |
| **2020-400** | | 40 | 6,500 | 430 | 0.02 | 0.1 | 6,500 | 430 | 0.02 | 0.1 | 5,250 | 150 | 0.01 | 0.05 | 5,250 | 150 | 0.006 | 0.03 |
| **2025-060** | R1.25 | 6 | 27,000 | 2,300 | 0.28 | 0.75 | 27,000 | 2,300 | 0.25 | 0.5 | 27,000 | 2,300 | 0.25 | 0.75 | 13,000 | 1,100 | 0.21 | 0.63 |
| **2025-080** | | 8 | 27,000 | 2,300 | 0.28 | 0.75 | 27,000 | 2,300 | 0.25 | 0.5 | 27,000 | 2,300 | 0.25 | 0.75 | 13,000 | 1,100 | 0.21 | 0.63 |
| **2025-100** | | 10 | 25,000 | 2,100 | 0.26 | 0.67 | 25,000 | 2,100 | 0.23 | 0.46 | 24,000 | 2,200 | 0.2 | 0.65 | 11,000 | 930 | 0.14 | 0.44 |
| **2025-150** | | 15 | 22,000 | 1,950 | 0.23 | 0.59 | 22,000 | 1,950 | 0.15 | 0.45 | 20,000 | 1,600 | 0.13 | 0.42 | 9,000 | 720 | 0.08 | 0.32 |
| **2025-200** | | 20 | 11,000 | 1,150 | 0.14 | 0.38 | 11,000 | 1,150 | 0.1 | 0.3 | 8,000 | 600 | 0.06 | 0.24 | 7,600 | 470 | 0.04 | 0.12 |
| **2025-250** | | 25 | 8,300 | 1,000 | 0.09 | 0.27 | 8,300 | 1,000 | 0.06 | 0.24 | 6,200 | 450 | 0.045 | 0.18 | 5,800 | 400 | 0.03 | 0.1 |
| **2025-300** | | 30 | 7,000 | 700 | 0.06 | 0.24 | 7,000 | 700 | 0.05 | 0.2 | 5,000 | 380 | 0.03 | 0.12 | 4,800 | 360 | 0.022 | 0.088 |
| **2025-350** | | 35 | 5,500 | 530 | 0.04 | 0.2 | 5,500 | 530 | 0.035 | 0.17 | 4,200 | 300 | 0.025 | 0.1 | 4,200 | 270 | 0.015 | 0.06 |
| **2030-060** | R1.5 | 6 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.3 | 0.9 | 14,000 | 1,400 | 0.25 | 0.76 |
| **2030-080** | | 8 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.32 | 0.9 | 24,000 | 2,500 | 0.3 | 0.9 | 14,000 | 1,400 | 0.25 | 0.76 |
| **2030-100** | | 10 | 22,000 | 2,300 | 0.28 | 0.8 | 22,000 | 2,300 | 0.28 | 0.8 | 24,000 | 2,500 | 0.25 | 0.75 | 13,000 | 1,200 | 0.25 | 0.76 |
| **2030-120** | | 12 | 22,000 | 2,300 | 0.28 | 0.7 | 22,000 | 2,300 | 0.28 | 0.7 | 20,000 | 2,100 | 0.2 | 0.65 | 10,700 | 1,000 | 0.18 | 0.54 |
| **2030-140** | | 14 | 20,000 | 2,100 | 0.24 | 0.6 | 20,000 | 2,100 | 0.24 | 0.6 | 18,000 | 1,850 | 0.18 | 0.5 | 9,400 | 800 | 0.16 | 0.48 |
| **2030-150** | | 15 | 20,000 | 2,100 | 0.24 | 0.6 | 20,000 | 2,100 | 0.24 | 0.6 | 17,000 | 1,750 | 0.17 | 0.5 | 9,200 | 750 | 0.14 | 0.42 |
| **2030-160** | | 16 | 20,000 | 2,100 | 0.24 | 0.6 | 20,000 | 2,100 | 0.24 | 0.6 | 16,000 | 1,650 | 0.16 | 0.5 | 9,000 | 700 | 0.14 | 0.42 |
| **2030-180** | | 18 | 17,000 | 1,950 | 0.22 | 0.5 | 17,000 | 1,950 | 0.22 | 0.5 | 13,500 | 1,300 | 0.14 | 0.43 | 8,000 | 650 | 0.12 | 0.36 |
| **2030-200** | | 20 | 14,000 | 1,800 | 0.2 | 0.45 | 14,000 | 1,800 | 0.2 | 0.45 | 11,000 | 1,000 | 0.12 | 0.36 | 7,000 | 600 | 0.1 | 0.3 |
| **2030-220** | | 22 | 11,000 | 1,500 | 0.18 | 0.38 | 11,000 | 1,500 | 0.18 | 0.38 | 8,700 | 750 | 0.1 | 0.3 | 6,300 | 490 | 0.08 | 0.24 |
| **2030-250** | | 25 | 8,000 | 1,250 | 0.16 | 0.32 | 8,000 | 1,250 | 0.16 | 0.32 | 6,400 | 510 | 0.08 | 0.24 | 5,600 | 390 | 0.06 | 0.18 |
| **2030-270** | | 27 | 7,000 | 1,100 | 0.13 | 0.31 | 7,000 | 1,100 | 0.13 | 0.31 | 5,500 | 480 | 0.06 | 0.22 | 4,700 | 380 | 0.05 | 0.15 |
| **2030-300** | | 30 | 6,000 | 1,000 | 0.1 | 0.3 | 6,000 | 1,000 | 0.1 | 0.3 | 4,600 | 450 | 0.05 | 0.2 | 3,900 | 370 | 0.04 | 0.12 |
| **2030-320** | | 32 | 5,700 | 900 | 0.085 | 0.29 | 5,700 | 900 | 0.085 | 0.29 | 3,900 | 380 | 0.045 | 0.18 | 3,400 | 320 | 0.035 | 0.11 |
| **2030-350** | | 35 | 5,500 | 800 | 0.07 | 0.28 | 5,500 | 800 | 0.07 | 0.28 | 3,300 | 320 | 0.04 | 0.16 | 2,900 | 270 | 0.03 | 0.1 |
| **2030-400** | | 40 | 4,500 | 700 | 0.05 | 0.25 | 4,500 | 700 | 0.05 | 0.25 | 2,700 | 240 | 0.03 | 0.12 | 2,300 | 210 | 0.02 | 0.08 |

## Milling Conditions for CSELB

| WORK MATERIAL | | | COPPER / ALUMINUM ALLOYS | | | | CARBON STEELS / ALLOY STEELS S45C / S50C / SK / SCM (~325HB) | | | | PREHARDENED STEELS NAK80 / STAVAX / HPM38 (30~45HRC) | | | | HARDENED STEELS STAVAX / HPM38 / SKD61 (45~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2035-100** | **R1.75** | 10 | 24,000 | 2,700 | 0.35 | 1 | 24,000 | 2,700 | 0.35 | 1 | 21,000 | 2,400 | 0.35 | 1 | 12,000 | 1,700 | 0.3 | 0.9 |
| **2035-150** | | 15 | 20,000 | 2,200 | 0.29 | 0.8 | 20,000 | 2,200 | 0.29 | 0.8 | 17,000 | 2,000 | 0.25 | 0.7 | 9,100 | 1,000 | 0.19 | 0.57 |
| **2035-200** | | 20 | 15,000 | 1,800 | 0.24 | 0.6 | 15,000 | 1,800 | 0.24 | 0.6 | 12,000 | 1,450 | 0.14 | 0.45 | 6,800 | 600 | 0.13 | 0.39 |
| **2035-250** | | 25 | 10,000 | 1,600 | 0.2 | 0.47 | 10,000 | 1,600 | 0.2 | 0.47 | 8,500 | 950 | 0.12 | 0.34 | 6,000 | 540 | 0.09 | 0.27 |
| **2035-300** | | 30 | 6,900 | 1,200 | 0.18 | 0.36 | 6,900 | 1,200 | 0.18 | 0.36 | 5,500 | 480 | 0.09 | 0.24 | 4,800 | 380 | 0.06 | 0.18 |
| **2035-400** | | 40 | 4,500 | 780 | 0.07 | 0.3 | 4,500 | 780 | 0.07 | 0.3 | 3,000 | 310 | 0.04 | 0.18 | 2,800 | 260 | 0.035 | 0.11 |
| **2035-450** | | 45 | 3,900 | 680 | 0.06 | 0.26 | 3,900 | 680 | 0.06 | 0.26 | 2,300 | 240 | 0.03 | 0.14 | 2,000 | 200 | 0.025 | 0.1 |
| **2040-080** | **R2** | 8 | 24,000 | 2,900 | 0.4 | 1.2 | 24,000 | 2,900 | 0.4 | 1.2 | 18,000 | 2,400 | 0.4 | 1.2 | 11,000 | 2,000 | 0.34 | 1 |
| **2040-100** | | 10 | 24,000 | 2,900 | 0.4 | 1.2 | 24,000 | 2,900 | 0.4 | 1.2 | 18,000 | 2,400 | 0.4 | 1.2 | 11,000 | 2,000 | 0.34 | 1 |
| **2040-120** | | 12 | 24,000 | 2,900 | 0.4 | 1.2 | 24,000 | 2,900 | 0.4 | 1.2 | 18,000 | 2,400 | 0.4 | 1.2 | 9,700 | 1,500 | 0.28 | 0.85 |
| **2040-140** | | 14 | 21,000 | 2,630 | 0.35 | 1.1 | 21,000 | 2,630 | 0.35 | 1.1 | 15,000 | 2,150 | 0.3 | 1.1 | 9,700 | 1,200 | 0.28 | 0.8 |
| **2040-150** | | 15 | 19,000 | 2,350 | 0.32 | 1 | 19,000 | 2,350 | 0.32 | 1 | 15,000 | 2,150 | 0.3 | 1 | 8,800 | 1,100 | 0.24 | 0.7 |
| **2040-160** | | 16 | 18,000 | 2,250 | 0.3 | 1 | 18,000 | 2,250 | 0.3 | 1 | 15,000 | 2,150 | 0.3 | 0.9 | 8,000 | 1,000 | 0.2 | 0.6 |
| **2040-180** | | 18 | 16,500 | 2,050 | 0.3 | 0.95 | 16,500 | 2,050 | 0.3 | 0.95 | 13,500 | 1,950 | 0.25 | 0.8 | 7,500 | 850 | 0.17 | 0.5 |
| **2040-200** | | 20 | 15,000 | 1,900 | 0.3 | 0.9 | 15,000 | 1,900 | 0.3 | 0.9 | 12,000 | 1,750 | 0.2 | 0.7 | 7,000 | 750 | 0.15 | 0.45 |
| **2040-220** | | 22 | 13,500 | 1,700 | 0.27 | 0.8 | 13,500 | 1,700 | 0.27 | 0.8 | 10,500 | 1,500 | 0.17 | 0.6 | 6,500 | 650 | 0.13 | 0.4 |
| **2040-250** | | 25 | 12,000 | 1,550 | 0.25 | 0.7 | 12,000 | 1,550 | 0.25 | 0.7 | 9,000 | 1,300 | 0.15 | 0.5 | 6,000 | 560 | 0.12 | 0.36 |
| **2040-270** | | 27 | 9,500 | 1,450 | 0.22 | 0.6 | 9,500 | 1,450 | 0.22 | 0.6 | 8,000 | 1,050 | 0.12 | 0.4 | 5,500 | 510 | 0.1 | 0.28 |
| **2040-300** | | 30 | 7,000 | 1,400 | 0.2 | 0.5 | 7,000 | 1,400 | 0.2 | 0.5 | 7,000 | 850 | 0.1 | 0.3 | 5,000 | 460 | 0.08 | 0.2 |
| **2040-320** | | 32 | 6,500 | 1,300 | 0.2 | 0.45 | 6,500 | 1,300 | 0.2 | 0.45 | 5,900 | 650 | 0.1 | 0.27 | 4,500 | 410 | 0.075 | 0.18 |
| **2040-350** | | 35 | 6,000 | 1,200 | 0.2 | 0.4 | 6,000 | 1,200 | 0.2 | 0.4 | 4,800 | 450 | 0.1 | 0.25 | 4,000 | 370 | 0.07 | 0.17 |
| **2040-400** | | 40 | 4,000 | 1,000 | 0.11 | 0.33 | 4,000 | 1,000 | 0.11 | 0.33 | 3,450 | 400 | 0.06 | 0.24 | 2,900 | 270 | 0.06 | 0.15 |
| **2040-450** | | 45 | 3,800 | 760 | 0.08 | 0.32 | 3,800 | 760 | 0.08 | 0.32 | 2,700 | 300 | 0.05 | 0.2 | 2,300 | 240 | 0.04 | 0.12 |
| **2040-500** | | 50 | 3,400 | 680 | 0.07 | 0.28 | 3,400 | 680 | 0.07 | 0.28 | 2,000 | 240 | 0.04 | 0.16 | 1,700 | 190 | 0.03 | 0.12 |
| **2040-600** | | 60 | 3,000 | 600 | 0.05 | 0.2 | 3,000 | 600 | 0.05 | 0.2 | 1,800 | 220 | 0.03 | 0.12 | 1,600 | 170 | 0.02 | 0.08 |
| **2050-100** | **R2.5** | 10 | 18,000 | 3,000 | 0.5 | 1.5 | 18,000 | 3,000 | 0.5 | 1.5 | 13,750 | 2,400 | 0.45 | 1.4 | 8,800 | 1,800 | 0.42 | 1.2 |
| **2050-150** | | 15 | 18,000 | 3,000 | 0.5 | 1.5 | 18,000 | 3,000 | 0.5 | 1.5 | 13,750 | 2,400 | 0.45 | 1.4 | 7,800 | 1,300 | 0.34 | 1 |
| **2050-200** | | 20 | 14,000 | 2,600 | 0.37 | 1.2 | 15,600 | 2,600 | 0.37 | 1.2 | 12,000 | 1,800 | 0.36 | 1.1 | 6,300 | 830 | 0.27 | 0.75 |
| **2050-250** | | 25 | 12,000 | 2,000 | 0.33 | 1.1 | 12,000 | 2,000 | 0.33 | 1.1 | 9,600 | 1,350 | 0.25 | 1 | 5,700 | 750 | 0.25 | 0.67 |
| **2050-300** | | 30 | 9,600 | 1,800 | 0.31 | 0.9 | 9,600 | 1,800 | 0.31 | 0.9 | 8,400 | 1,100 | 0.23 | 0.8 | 5,000 | 650 | 0.2 | 0.5 |
| **2050-350** | | 35 | 8,400 | 1,700 | 0.3 | 0.75 | 8,400 | 1,700 | 0.3 | 0.75 | 7,200 | 850 | 0.2 | 0.6 | 4,400 | 530 | 0.16 | 0.33 |
| **2050-400** | | 40 | 5,500 | 1,500 | 0.25 | 0.5 | 4,800 | 1,500 | 0.25 | 0.5 | 3,800 | 440 | 0.13 | 0.35 | 3,300 | 390 | 0.09 | 0.22 |
| **2050-450** | | 45 | 4,000 | 1,200 | 0.2 | 0.42 | 4,000 | 1,200 | 0.2 | 0.42 | 3,300 | 400 | 0.11 | 0.3 | 2,800 | 330 | 0.08 | 0.18 |
| **2050-500** | | 50 | 3,200 | 1,000 | 0.16 | 0.37 | 3,200 | 1,000 | 0.16 | 0.37 | 2,750 | 350 | 0.08 | 0.27 | 2,350 | 270 | 0.07 | 0.15 |
| **2060-100** | **R3** | 10 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 7,500 | 1,800 | 0.5 | 1.5 |
| **2060-150** | | 15 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 7,500 | 1,800 | 0.5 | 1.5 |
| **2060-180** | | 18 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 7,000 | 1,500 | 0.45 | 1.45 |
| **2060-200** | | 20 | 16,000 | 3,100 | 0.6 | 1.8 | 16,000 | 3,100 | 0.6 | 1.8 | 11,000 | 2,310 | 0.55 | 1.7 | 6,500 | 1,300 | 0.4 | 1.4 |
| **2060-220** | | 22 | 14,500 | 2,850 | 0.52 | 1.6 | 14,500 | 2,850 | 0.52 | 1.6 | 10,500 | 2,050 | 0.47 | 1.5 | 5,900 | 1,050 | 0.36 | 1.1 |
| **2060-250** | | 25 | 13,000 | 2,600 | 0.45 | 1.5 | 13,000 | 2,600 | 0.45 | 1.5 | 10,000 | 1,800 | 0.4 | 1.3 | 5,300 | 840 | 0.32 | 0.9 |
| **2060-270** | | 27 | 11,500 | 2,350 | 0.42 | 1.4 | 11,500 | 2,350 | 0.42 | 1.4 | 9,000 | 1,550 | 0.35 | 1.2 | 5,000 | 790 | 0.31 | 0.85 |
| **2060-300** | | 30 | 10,000 | 2,100 | 0.4 | 1.3 | 10,000 | 2,100 | 0.4 | 1.3 | 8,000 | 1,350 | 0.3 | 1.1 | 4,700 | 750 | 0.3 | 0.8 |
| **2060-320** | | 32 | 9,000 | 1,950 | 0.39 | 1.2 | 9,000 | 1,950 | 0.39 | 1.2 | 7,500 | 1,200 | 0.28 | 1 | 4,400 | 710 | 0.27 | 0.7 |
| **2060-350** | | 35 | 8,000 | 1,800 | 0.38 | 1.1 | 8,000 | 1,800 | 0.38 | 1.1 | 7,000 | 1,100 | 0.26 | 0.9 | 4,200 | 670 | 0.25 | 0.6 |
| **2060-400** | | 40 | 7,000 | 1,800 | 0.36 | 0.9 | 7,000 | 1,800 | 0.36 | 0.9 | 6,000 | 900 | 0.23 | 0.75 | 3,700 | 550 | 0.2 | 0.4 |
| **2060-450** | | 45 | 5,800 | 1,700 | 0.33 | 0.75 | 5,800 | 1,700 | 0.33 | 0.75 | 4,600 | 670 | 0.19 | 0.6 | 3,200 | 470 | 0.15 | 0.3 |
| **2060-500** | | 50 | 4,000 | 1,500 | 0.3 | 0.6 | 4,000 | 1,500 | 0.3 | 0.6 | 3,200 | 450 | 0.15 | 0.4 | 2,800 | 400 | 0.1 | 0.2 |
| **2060-600** | | 60 | 2,700 | 1,000 | 0.21 | 0.42 | 2,700 | 1,000 | 0.21 | 0.42 | 2,300 | 320 | 0.1 | 0.3 | 1,950 | 270 | 0.08 | 0.16 |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
・Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
・Recommend wet coolant for Copper.

*** Refer to page 579 for tool shape.**

## Size R0.2～R3

# DCLB

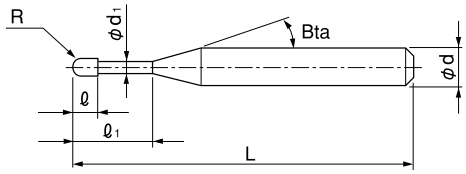
MG | DIA | 35° | R ±0.01 | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |

## Features

**Diamond coated 2 flute long neck ball end mills for Graphite Electrodes.**
**A highly adhesive coating base, offers long tool life and excellent wear resistance.**




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

Neck diameter / effective length by inclined angles have been changed.
Change date: From production in December, 2012.

Total 68 models

Unit（mm）

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1° 30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DCLB 2004-0020 | R0.2 | 2 | 0.32 | 0.37 | 16° | 45 | 4 | 13,000 | 2.24 | 2.41 | 2.54 | 2.65 | 2.85 |
| DCLB 2004-0030 | | 3 | | | | 45 | 4 | 13,000 | 3.33 | 3.52 | 3.67 | 3.80 | 4.08 |
| DCLB 2004-0040 | | 4 | | | | 45 | 4 | 13,000 | 4.39 | 4.61 | 4.78 | 4.94 | 5.30 |
| DCLB 2004-0050 | | 5 | | | | 45 | 4 | 13,000 | 5.45 | 5.69 | 5.88 | 6.08 | 6.52 |
| DCLB 2005-0020 | R0.25 | 2 | 0.4 | 0.47 | 16° | 45 | 4 | 13,000 | 2.29 | 2.49 | 2.64 | 2.78 | 3.01 |
| DCLB 2005-0030 | | 3 | | | | 45 | 4 | 13,000 | 3.39 | 3.61 | 3.79 | 3.95 | 4.24 |
| DCLB 2005-0060 | | 6 | | | | 45 | 4 | 13,000 | 6.59 | 6.89 | 7.13 | 7.37 | 7.91 |
| DCLB 2005-0100 | | 10 | | | | 45 | 4 | 13,000 | 10.78 | 11.16 | 11.53 | 11.93 | 12.80 |
| DCLB 2006-0020 | R0.3 | 2 | 0.48 | 0.57 | 16° | 45 | 4 | 13,000 | 2.33 | 2.55 | 2.73 | 2.89 | 3.16 |
| DCLB 2006-0030 | | 3 | | | | 45 | 4 | 13,000 | 3.44 | 3.70 | 3.90 | 4.08 | 4.40 |
| DCLB 2006-0040 | | 4 | | | | 45 | 4 | 13,000 | 4.53 | 4.82 | 5.05 | 5.24 | 5.62 |
| DCLB 2006-0060 | | 6 | | | | 45 | 4 | 13,000 | 6.67 | 7.01 | 7.28 | 7.52 | 8.07 |
| DCLB 2006-0100 | | 10 | | | | 45 | 4 | 13,000 | 10.89 | 11.31 | 11.68 | 12.08 | 12.96 |
| DCLB 2006-0120 | | 12 | | | | 45 | 4 | 13,000 | 12.98 | 13.44 | 13.88 | 14.36 | 15.41 |
| DCLB 2008-0100 | R0.4 | 10 | 0.64 | 0.77 | 16° | 45 | 4 | 13,000 | 10.88 | 11.30 | 11.67 | 12.07 | 12.94 |
| DCLB 2008-0120 | | 12 | | | | 50 | 4 | 13,000 | 12.97 | 13.43 | 13.87 | 14.34 | 15.39 |
| DCLB 2008-0160 | | 16 | | | | 50 | 4 | 13,000 | 17.13 | 17.69 | 18.27 | 18.90 | 20.28 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1° 30′ | 2° | 3° |
| DCLB 2010-0030 | R0.5 | 3 | 0.8 | 0.96 | 16° | 45 | 4 | 13,000 | 3.45 | 3.69 | 3.89 | 4.06 | 4.37 |
| DCLB 2010-0050 | | 5 | | | | 45 | 4 | 13,000 | 5.61 | 5.91 | 6.16 | 6.37 | 6.81 |
| DCLB 2010-0060 | | 6 | | | | 45 | 4 | 13,000 | 6.67 | 7.01 | 7.27 | 7.51 | 8.04 |
| DCLB 2010-0080 | | 8 | | | | 45 | 4 | 13,000 | 8.79 | 9.17 | 9.47 | 9.78 | 10.48 |
| DCLB 2010-0100 | | 10 | 1.5 | | | 60 | 4 | 13,000 | 10.89 | 11.31 | 11.67 | 12.06 | 12.93 |
| DCLB 2010-0100-08 | | 10 | 0.8 | | | 45 | 4 | 13,000 | 10.89 | 11.31 | 11.67 | 12.06 | 12.93 |
| DCLB 2010-0120 | | 12 | | | | 50 | 4 | 13,000 | 12.98 | 13.44 | 13.87 | 14.34 | 15.38 |
| DCLB 2010-0160 | | 16 | | | | 50 | 4 | 13,000 | 17.14 | 17.70 | 18.27 | 18.89 | 20.27 |
| DCLB 2010-0200 | | 20 | 1.5 | | | 60 | 4 | 13,000 | 21.28 | 21.95 | 22.68 | 23.45 | 25.17 |
| DCLB 2015-0060 | R0.75 | 6 | 1.2 | 1.44 | 16° | 45 | 4 | 15,000 | 6.14 | 6.32 | 6.51 | 6.71 | 7.16 |
| DCLB 2015-0100 | | 10 | | | | 45 | 4 | 15,000 | 10.27 | 10.58 | 10.91 | 11.27 | 12.06 |
| DCLB 2015-0160 | | 16 | | | | 50 | 4 | 15,000 | 16.46 | 16.97 | 17.51 | 18.10 | 19.40 |
| DCLB 2020-0040 | R1 | 4 | 1.6 | 1.9 | 16° | 45 | 4 | 13,000 | 4.13 | 4.23 | 4.34 | 4.46 | 4.73 |
| DCLB 2020-0060 | | 6 | | | | 45 | 4 | 13,000 | 6.19 | 6.36 | 6.54 | 6.74 | 7.17 |
| DCLB 2020-0080 | | 8 | | | | 45 | 4 | 13,000 | 8.25 | 8.49 | 8.74 | 9.02 | 9.62 |
| DCLB 2020-0100 | | 10 | | | | 45 | 4 | 13,000 | 10.31 | 10.62 | 10.94 | 11.29 | 12.07 |
| DCLB 2020-0120 | | 12 | | | | 45 | 4 | 13,000 | 12.38 | 12.75 | 13.15 | 13.57 | 14.52 |
| DCLB 2020-0160 | | 16 | | | | 50 | 4 | 13,000 | 16.50 | 17.01 | 17.55 | 18.12 | 19.41 |
| DCLB 2020-0200-16 | | 20 | | | | 60 | 4 | 13,000 | 20.63 | 21.27 | 21.95 | 22.68 | No Interference |
| DCLB 2020-0200 | | 20 | 3 | | | 70 | 4 | 13,000 | 20.63 | 21.27 | 21.95 | 22.68 | No Interference |
| DCLB 2020-0250 | | 25 | 1.6 | | | 65 | 4 | 13,000 | 25.79 | 26.59 | 27.45 | 28.37 | No Interference |
| DCLB 2020-0250-30 | | 25 | 3 | | | 65 | 4 | 13,000 | 25.79 | 26.59 | 27.45 | 28.37 | No Interference |
| DCLB 2020-0300-16 | | 30 | 1.6 | | | 70 | 4 | 13,000 | 30.94 | 31.92 | 32.95 | No Interference | No Interference |
| DCLB 2020-0300 | | 30 | 3 | | | 70 | 4 | 13,000 | 30.94 | 31.92 | 32.95 | No Interference | No Interference |
| DCLB 2020-0350 | | 35 | | 1.91 | 16° | 70 | 4 | 13,000 | 36.09 | 37.23 | 38.45 | No Interference | No Interference |
| DCLB 2020-0400 | | 40 | 1.6 | | | 80 | 4 | 13,500 | 41.25 | 42.55 | No Interference | No Interference | No Interference |
| DCLB 2030-0160 | R1.5 | 16 | 2.4 | 2.9 | 16° | 60 | 6 | 15,000 | 16.49 | 16.98 | 17.50 | 18.06 | 19.30 |
| DCLB 2030-0200 | | 20 | | | | 60 | 6 | 15,000 | 20.61 | 21.23 | 21.90 | 22.61 | 24.20 |
| DCLB 2030-0250 | | 25 | | | | 70 | 6 | 17,000 | 25.77 | 26.56 | 27.40 | 28.30 | 30.31 |
| DCLB 2030-0300 | | 30 | 4.5 | | | 80 | 4 | 13,500 | 30.93 | No Interference | No Interference | No Interference | No Interference |
| DCLB 2030-0300-S6 | | 30 | 2.4 | | | 80 | 6 | 17,000 | 30.93 | 31.88 | 32.90 | 34.00 | No Interference |
| DCLB 2030-0400-S6 | | 40 | | | | 80 | 6 | 18,500 | 41.24 | 42.53 | 43.91 | No Interference | No Interference |
| DCLB 2030-0400 | | 40 | 4.5 | | | 80 | 4 | 15,000 | 41.24 | No Interference | No Interference | No Interference | No Interference |
| DCLB 2040-0160 | R2 | 16 | 3.2 | 3.9 | 16° | 70 | 6 | 16,500 | 16.47 | 16.94 | 17.45 | 17.99 | 19.19 |
| DCLB 2040-0200 | | 20 | | | | 70 | 6 | 16,500 | 20.60 | 21.20 | 21.85 | 22.54 | No Interference |
| DCLB 2040-0250 | | 25 | | | | 70 | 6 | 16,500 | 25.75 | 26.53 | 27.35 | 28.24 | No Interference |
| DCLB 2040-0300 | | 30 | | | | 70 | 6 | 16,500 | 30.91 | 31.85 | 32.85 | No Interference | No Interference |
| DCLB 2040-0300-60 | | 30 | 6 | | – | 100 | 4 | 18,500 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2040-0400-S6 | | 40 | 3.2 | | 16° | 90 | 6 | 18,500 | 41.22 | 42.50 | No Interference | No Interference | No Interference |
| DCLB 2040-0400 | | 40 | 6 | | – | 100 | 4 | 18,500 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2040-0500-S6 | | 50 | 3.2 | | 16° | 100 | 6 | 19,800 | 51.54 | 53.15 | No Interference | No Interference | No Interference |
| DCLB 2040-0500 | | 50 | 6 | | – | 100 | 4 | 19,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2040-0600 | | 60 | | 3.91 | – | 100 | 4 | 19,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2050-0200 | R2.5 | 20 | 4 | 4.8 | 16° | 70 | 6 | 16,500 | 20.76 | 21.36 | 21.99 | No Interference | No Interference |
| DCLB 2050-0300 | | 30 | | | | 80 | 6 | 17,000 | 31.08 | 32.00 | No Interference | No Interference | No Interference |
| DCLB 2060-0300 | R3 | 30 | 4.8 | 5.7 | – | 80 | 6 | 17,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2060-0400 | | 40 | | | | 100 | 6 | 19,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2060-0500 | | 50 | | | | 120 | 6 | 19,800 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2060-0600 | | 60 | | | | 120 | 6 | 23,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2060-0700 | | 70 | | 5.71 | – | 120 | 6 | 23,000 | No Interference | No Interference | No Interference | No Interference | No Interference |
| DCLB 2060-0800 | | 80 | | | | 120 | 6 | 25,300 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for DCLB

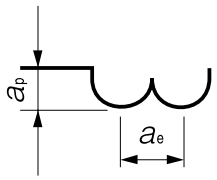
| WORK MATERIAL | | | GRAPHITE | | | |
|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2004-0020** | **R0.2** | 2 | 33,500 | 1,100 | 0.1 | 0.04 |
| **2004-0030** | | 3 | 33,500 | 1,100 | 0.09 | 0.04 |
| **2004-0040** | | 4 | 33,500 | 1,100 | 0.08 | 0.04 |
| **2004-0050** | | 5 | 33,500 | 1,100 | 0.06 | 0.04 |
| **2005-0020** | **R0.25** | 2 | 33,500 | 1,200 | 0.11 | 0.05 |
| **2005-0030** | | 3 | 33,500 | 1,200 | 0.1 | 0.05 |
| **2005-0060** | | 6 | 33,500 | 1,200 | 0.07 | 0.05 |
| **2005-0100** | | 10 | 33,500 | 1,200 | 0.03 | 0.05 |
| **2006-0020** | **R0.3** | 2 | 33,500 | 1,300 | 0.15 | 0.06 |
| **2006-0030** | | 3 | 33,500 | 1,300 | 0.13 | 0.06 |
| **2006-0040** | | 4 | 33,500 | 1,300 | 0.12 | 0.06 |
| **2006-0060** | | 6 | 33,500 | 1,300 | 0.1 | 0.06 |
| **2006-0100** | | 10 | 33,500 | 1,300 | 0.04 | 0.06 |
| **2006-0120** | | 12 | 33,500 | 1,300 | 0.04 | 0.06 |
| **2008-0100** | **R0.4** | 10 | 33,500 | 1,400 | 0.13 | 0.08 |
| **2008-0120** | | 12 | 33,500 | 1,400 | 0.1 | 0.08 |
| **2008-0160** | | 16 | 33,500 | 1,400 | 0.08 | 0.08 |
| **2010-0030** | **R0.5** | 3 | 33,500 | 1,500 | 0.2 | 0.1 |
| **2010-0050** | | 5 | 33,500 | 1,500 | 0.19 | 0.1 |
| **2010-0060** | | 6 | 33,500 | 1,500 | 0.19 | 0.1 |
| **2010-0080** | | 8 | 33,500 | 1,500 | 0.18 | 0.1 |
| **2010-0100(-08)** | | 10 | 33,500 | 1,500 | 0.16 | 0.1 |
| **2010-0120** | | 12 | 33,500 | 1,500 | 0.15 | 0.1 |
| **2010-0160** | | 16 | 33,500 | 1,500 | 0.12 | 0.1 |
| **2010-0200** | | 20 | 33,500 | 1,500 | 0.1 | 0.1 |
| **2015-0060** | **R0.75** | 6 | 30,000 | 1,500 | 0.35 | 0.15 |
| **2015-0100** | | 10 | 30,000 | 1,500 | 0.3 | 0.15 |
| **2015-0160** | | 16 | 30,000 | 1,500 | 0.25 | 0.15 |
| **2020-0040** | **R1** | 4 | 27,000 | 1,500 | 0.5 | 0.2 |
| **2020-0060** | | 6 | 27,000 | 1,500 | 0.49 | 0.2 |
| **2020-0080** | | 8 | 27,000 | 1,500 | 0.48 | 0.2 |
| **2020-0100** | | 10 | 27,000 | 1,500 | 0.46 | 0.2 |
| **2020-0120** | | 12 | 27,000 | 1,500 | 0.43 | 0.2 |
| **2020-0160** | | 16 | 27,000 | 1,500 | 0.38 | 0.2 |
| **2020-0200(-16)** | | 20 | 27,000 | 1,500 | 0.24 | 0.2 |
| **2020-0250(-30)** | | 25 | 27,000 | 1,500 | 0.19 | 0.2 |
| **2020-0300(-16)** | | 30 | 27,000 | 1,500 | 0.12 | 0.2 |
| **2020-0350** | | 35 | 27,000 | 1,500 | 0.11 | 0.2 |
| **2020-0400** | | 40 | 27,000 | 1,500 | 0.09 | 0.2 |

## Milling Conditions for DCLB

| WORK MATERIAL | | | GRAPHITE | | | |
|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2030-0160** | **R1.5** | 16 | 18,000 | 1,650 | 0.5 | 0.45 |
| **2030-0200** | | 20 | 18,000 | 1,650 | 0.44 | 0.45 |
| **2030-0250** | | 25 | 18,000 | 1,650 | 0.36 | 0.45 |
| **2030-0300(-S6)** | | 30 | 18,000 | 1,650 | 0.3 | 0.45 |
| **2030-0400(-S6)** | | 40 | 18,000 | 1,650 | 0.2 | 0.45 |
| **2040-0160** | **R2** | 16 | 13,500 | 1,750 | 0.7 | 0.6 |
| **2040-0200** | | 20 | 13,500 | 1,750 | 0.65 | 0.6 |
| **2040-0250** | | 25 | 13,500 | 1,750 | 0.55 | 0.6 |
| **2040-0300** | | 30 | 13,500 | 1,750 | 0.5 | 0.6 |
| **2040-0300(-60)** | | 30 | 13,500 | 1,750 | 0.5 | 0.6 |
| **2040-0400(-S6)** | | 40 | 13,500 | 1,750 | 0.4 | 0.6 |
| **2040-0500(-S6)** | | 50 | 13,500 | 1,750 | 0.24 | 0.6 |
| **2040-0600** | | 60 | 13,500 | 1,750 | 0.18 | 0.6 |
| **2050-0200** | **R2.5** | 20 | 10,800 | 1,600 | 0.8 | 0.75 |
| **2050-0300** | | 30 | 10,800 | 1,600 | 0.6 | 0.75 |
| **2060-0300** | **R3** | 30 | 9,000 | 1,400 | 0.9 | 0.9 |
| **2060-0400** | | 40 | 9,000 | 1,400 | 0.75 | 0.9 |
| **2060-0500** | | 50 | 9,000 | 1,400 | 0.6 | 0.9 |
| **2060-0600** | | 60 | 9,000 | 1,400 | 0.51 | 0.9 |
| **2060-0700** | | 70 | 9,000 | 1,400 | 0.4 | 0.9 |
| **2060-0800** | | 80 | 9,000 | 1,400 | 0.23 | 0.9 |

Note:
・Use a milling machine dedicated for Graphite.
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Recommend air blow for Graphite.

Milling Amount (mm)
$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)



## Size R0.05～R3

# DLCLB

Super MG | DLC | 30° | R ±0.002 R0.05～R0.2 | R ±0.003 R0.25～R2 | R ±0.004 R3 | Shank Dia 0/-0.004 | Back Taper Geometry

NEW

Back taper geometry does not apply to R0.15 or below.

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

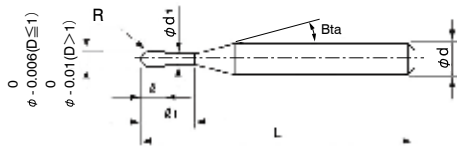
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | | | ☆ | | | | | | |

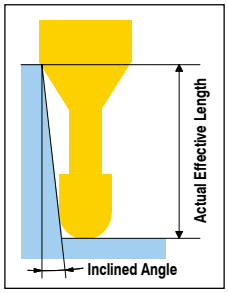
Total 71 models

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| DLCLB 2001-003 | R0.05 | 0.3 | 0.08 | 0.095 | 11° | 45 | 4 | 14,100 |
| DLCLB 2001-005 | | 0.5 | | | | 45 | 4 | 14,700 |
| DLCLB 20015-003 | R0.075 | 0.3 | 0.12 | 0.14 | 11° | 45 | 4 | 15,600 |
| DLCLB 20015-005 | | 0.5 | | | | 45 | 4 | 16,500 |
| DLCLB 20015-010 | | 1 | | | | 45 | 4 | 17,200 |
| DLCLB 2002-003 | R0.1 | 0.3 | 0.16 | 0.19 | 11° | 45 | 4 | 11,300 |
| DLCLB 2002-005 | | 0.5 | | | | 45 | 4 | 11,300 |
| DLCLB 2002-010 | | 1 | | | | 45 | 4 | 11,800 |
| DLCLB 2002-015 | | 1.5 | | | | 45 | 4 | 12,300 |
| DLCLB 2003-006 | R0.15 | 0.6 | 0.24 | 0.29 | 11° | 45 | 4 | 11,800 |
| DLCLB 2003-010 | | 1 | | | | 45 | 4 | 11,800 |
| DLCLB 2003-015 | | 1.5 | | | | 45 | 4 | 12,300 |
| DLCLB 2003-020 | | 2 | | | | 45 | 4 | 12,800 |
| DLCLB 2004-010 | R0.2 | 1 | 0.32 | 0.39 | 11° | 45 | 4 | 10,300 |
| DLCLB 2004-020 | | 2 | | | | 45 | 4 | 10,500 |
| DLCLB 2004-030 | | 3 | | | | 45 | 4 | 10,700 |
| DLCLB 2004-040 | | 4 | | | | 45 | 4 | 10,900 |
| DLCLB 2005-010 | R0.25 | 1 | 0.4 | 0.49 | 11° | 45 | 4 | 10,100 |
| DLCLB 2005-020 | | 2 | | | | 45 | 4 | 10,100 |
| DLCLB 2005-030 | | 3 | | | | 45 | 4 | 10,300 |
| DLCLB 2005-040 | | 4 | | | | 45 | 4 | 10,500 |
| DLCLB 2005-050 | | 5 | | | | 45 | 4 | 10,700 |

## Features

**DLC coating offers excellent welding and wear resistance.**
**The flute geometry specially designed for Copper milling offers outstanding tool life.**
**High-precision outside diameter tolerances and Radius accuracy measurements are printed on labels to improve machining accuracy.**
**High precision shank diameter tolerance of 0/-0.004 mm.**




Label Sample

#001 φ D0.597 R+0.001/−0.001

Diameter and Ball Radius accuracy measurments are printed on the label to support High Precision milling.

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

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|
| | | | 30′ | 1° | 1° 30′ | 2° | 3° |
| DLCLB 2001-003 | R0.05 | 0.3 | 0.34 | 0.36 | 0.39 | 0.41 | 0.46 |
| DLCLB 2001-005 | | 0.5 | 0.55 | 0.59 | 0.62 | 0.65 | 0.73 |
| DLCLB 20015-003 | R0.075 | 0.3 | 0.36 | 0.38 | 0.40 | 0.42 | 0.47 |
| DLCLB 20015-005 | | 0.5 | 0.57 | 0.60 | 0.63 | 0.66 | 0.74 |
| DLCLB 20015-010 | | 1 | 1.09 | 1.15 | 1.21 | 1.27 | 1.43 |
| DLCLB 2002-003 | R0.1 | 0.3 | 0.41 | 0.43 | 0.45 | 0.47 | 0.53 |
| DLCLB 2002-005 | | 0.5 | 0.62 | 0.65 | 0.68 | 0.72 | 0.80 |
| DLCLB 2002-010 | | 1 | 1.14 | 1.20 | 1.26 | 1.33 | 1.49 |
| DLCLB 2002-015 | | 1.5 | 1.67 | 1.75 | 1.84 | 1.94 | 2.17 |
| DLCLB 2003-006 | R0.15 | 0.6 | 0.72 | 0.75 | 0.79 | 0.83 | 0.92 |
| DLCLB 2003-010 | | 1 | 1.14 | 1.19 | 1.25 | 1.32 | 1.47 |
| DLCLB 2003-015 | | 1.5 | 1.67 | 1.74 | 1.83 | 1.93 | 2.15 |
| DLCLB 2003-020 | | 2 | 2.19 | 2.29 | 2.41 | 2.53 | 2.84 |
| DLCLB 2004-010 | R0.2 | 1 | 1.14 | 1.19 | 1.24 | 1.30 | 1.45 |
| DLCLB 2004-020 | | 2 | 2.19 | 2.29 | 2.40 | 2.52 | 2.82 |
| DLCLB 2004-030 | | 3 | 3.23 | 3.39 | 3.56 | 3.74 | 4.19 |
| DLCLB 2004-040 | | 4 | 4.28 | 4.49 | 4.71 | 4.96 | 5.56 |
| DLCLB 2005-010 | R0.25 | 1 | 1.14 | 1.18 | 1.24 | 1.29 | 1.43 |
| DLCLB 2005-020 | | 2 | 2.18 | 2.28 | 2.39 | 2.51 | 2.80 |
| DLCLB 2005-030 | | 3 | 3.23 | 3.38 | 3.55 | 3.73 | 4.17 |
| DLCLB 2005-040 | | 4 | 4.28 | 4.48 | 4.70 | 4.95 | 5.54 |
| DLCLB 2005-050 | | 5 | 5.33 | 5.58 | 5.86 | 6.17 | 6.91 |

Next Page ➡

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| DLCLB 2006-010 | R0.3 | 1 | 0.48 | 0.59 | 11° | 45 | 4 | 7,900 |
| DLCLB 2006-020 | | 2 | | | | 45 | 4 | 7,900 |
| DLCLB 2006-030 | | 3 | | | | 45 | 4 | 8,100 |
| DLCLB 2006-040 | | 4 | | | | 45 | 4 | 8,300 |
| DLCLB 2006-050 | | 5 | | | | 45 | 4 | 8,500 |
| DLCLB 2006-060 | | 6 | | | | 45 | 4 | 8,700 |
| DLCLB 2008-020 | R0.4 | 2 | 0.64 | 0.79 | 11° | 45 | 4 | 8,100 |
| DLCLB 2008-030 | | 3 | | | | 45 | 4 | 8,100 |
| DLCLB 2008-040 | | 4 | | | | 45 | 4 | 8,300 |
| DLCLB 2008-060 | | 6 | | | | 45 | 4 | 8,500 |
| DLCLB 2008-080 | | 8 | | | | 45 | 4 | 8,700 |
| DLCLB 2010-020 | R0.5 | 2 | 0.8 | 0.98 | 11° | 45 | 4 | 7,700 |
| DLCLB 2010-030 | | 3 | | | | 45 | 4 | 7,700 |
| DLCLB 2010-040 | | 4 | | | | 45 | 4 | 7,700 |
| DLCLB 2010-050 | | 5 | | | | 45 | 4 | 7,900 |
| DLCLB 2010-060 | | 6 | | | | 45 | 4 | 7,900 |
| DLCLB 2010-080 | | 8 | | | | 45 | 4 | 8,300 |
| DLCLB 2010-100 | | 10 | | | | 45 | 4 | 8,300 |
| DLCLB 2010-120 | | 12 | | | | 45 | 4 | 8,300 |
| DLCLB 2015-040 | R0.75 | 4 | 1.2 | 1.47 | 11° | 45 | 4 | 7,900 |
| DLCLB 2015-060 | | 6 | | | | 45 | 4 | 7,900 |
| DLCLB 2015-120 | | 12 | | | | 50 | 4 | 8,900 |
| DLCLB 2015-180 | | 18 | | | | 55 | 4 | 9,900 |
| DLCLB 2020-040 | R1 | 4 | 1.6 | 1.98 | 11° | 45 | 4 | 8,100 |
| DLCLB 2020-060 | | 6 | | | | 45 | 4 | 8,100 |
| DLCLB 2020-080 | | 8 | | | | 45 | 4 | 8,300 |
| DLCLB 2020-100 | | 10 | | | | 45 | 4 | 8,300 |
| DLCLB 2020-120 | | 12 | | | | 50 | 4 | 8,300 |
| DLCLB 2020-140 | | 14 | | | | 50 | 4 | 8,300 |
| DLCLB 2020-160 | | 16 | | | | 50 | 4 | 8,300 |
| DLCLB 2020-200 | | 20 | | | | 55 | 4 | 9,200 |
| DLCLB 2020-250 | | 25 | | | | 65 | 4 | 10,200 |

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|
| | | | 30′ | 1° | 1° 30′ | 2° | 3° |
| DLCLB 2006-010 | R0.3 | 1 | 1.14 | 1.18 | 1.23 | 1.28 | 1.41 |
| DLCLB 2006-020 | | 2 | 2.18 | 2.28 | 2.38 | 2.50 | 2.78 |
| DLCLB 2006-030 | | 3 | 3.23 | 3.38 | 3.54 | 3.72 | 4.15 |
| DLCLB 2006-040 | | 4 | 4.28 | 4.48 | 4.70 | 4.94 | 5.52 |
| DLCLB 2006-050 | | 5 | 5.32 | 5.57 | 5.85 | 6.16 | 6.89 |
| DLCLB 2006-060 | | 6 | 6.37 | 6.67 | 7.01 | 7.38 | 8.26 |
| DLCLB 2008-020 | R0.4 | 2 | 2.18 | 2.27 | 2.37 | 2.48 | 2.75 |
| DLCLB 2008-030 | | 3 | 3.22 | 3.37 | 3.52 | 3.70 | 4.12 |
| DLCLB 2008-040 | | 4 | 4.27 | 4.47 | 4.68 | 4.92 | 5.48 |
| DLCLB 2008-060 | | 6 | 6.37 | 6.66 | 6.99 | 7.36 | 8.22 |
| DLCLB 2008-080 | | 8 | 8.46 | 8.86 | 9.30 | 9.79 | 10.96 |
| DLCLB 2010-020 | R0.5 | 2 | 2.19 | 2.28 | 2.37 | 2.48 | 2.73 |
| DLCLB 2010-030 | | 3 | 3.24 | 3.37 | 3.53 | 3.70 | 4.10 |
| DLCLB 2010-040 | | 4 | 4.28 | 4.47 | 4.68 | 4.92 | 5.47 |
| DLCLB 2010-050 | | 5 | 5.33 | 5.57 | 5.84 | 6.14 | 6.84 |
| DLCLB 2010-060 | | 6 | 6.38 | 6.67 | 6.99 | 7.35 | 8.21 |
| DLCLB 2010-080 | | 8 | 8.47 | 8.87 | 9.31 | 9.79 | 10.95 |
| DLCLB 2010-100 | | 10 | 10.57 | 11.07 | 11.62 | 12.23 | 13.68 |
| DLCLB 2010-120 | | 12 | 12.66 | 13.26 | 13.93 | 14.67 | 16.42 |
| DLCLB 2015-040 | R0.75 | 4 | 4.21 | 4.39 | 4.58 | 4.80 | 5.31 |
| DLCLB 2015-060 | | 6 | 6.31 | 6.59 | 6.89 | 7.23 | 8.04 |
| DLCLB 2015-120 | | 12 | 12.59 | 13.18 | 13.83 | 14.55 | 16.26 |
| DLCLB 2015-180 | | 18 | 18.87 | 19.77 | 20.76 | 21.86 | 24.47 |
| DLCLB 2020-040 | R1 | 4 | 4.18 | 4.34 | 4.51 | 4.71 | 5.18 |
| DLCLB 2020-060 | | 6 | 6.27 | 6.53 | 6.82 | 7.15 | 7.92 |
| DLCLB 2020-080 | | 8 | 8.36 | 8.73 | 9.14 | 9.59 | 10.66 |
| DLCLB 2020-100 | | 10 | 10.46 | 10.93 | 11.45 | 12.02 | 13.39 |
| DLCLB 2020-120 | | 12 | 12.55 | 13.12 | 13.76 | 14.46 | 16.13 |
| DLCLB 2020-140 | | 14 | 14.65 | 15.32 | 16.07 | 16.90 | 18.87 |
| DLCLB 2020-160 | | 16 | 16.74 | 17.52 | 18.38 | 19.34 | No Interference |
| DLCLB 2020-200 | | 20 | 20.93 | 21.91 | 23.00 | 24.21 | No Interference |
| DLCLB 2020-250 | | 25 | 26.16 | 27.41 | 28.78 | No Interference | No Interference |

Next Page ➡

| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **DLCLB 2030-100** | R1.5 | 10 | 2.4 | 2.95 | 11° | 60 | 6 | 10,500 |
| **DLCLB 2030-120** | | 12 | | | | 60 | 6 | 10,800 |
| **DLCLB 2030-140** | | 14 | | | | 60 | 6 | 10,800 |
| **DLCLB 2030-160** | | 16 | | | | 60 | 6 | 11,200 |
| **DLCLB 2030-200** | | 20 | | | | 70 | 6 | 11,200 |
| **DLCLB 2030-250** | | 25 | | | | 70 | 6 | 11,200 |
| **DLCLB 2030-300** | | 30 | | | | 70 | 6 | 12,200 |
| **DLCLB 2040-100** | R2 | 10 | 3.2 | 3.95 | 11° | 70 | 6 | 9,700 |
| **DLCLB 2040-150** | | 15 | | | | 70 | 6 | 9,700 |
| **DLCLB 2040-200** | | 20 | | | | 70 | 6 | 11,500 |
| **DLCLB 2040-250** | | 25 | | | | 70 | 6 | 12,200 |
| **DLCLB 2040-300** | | 30 | | | | 70 | 6 | 12,700 |
| **DLCLB 2040-400** | | 40 | | | | 80 | 6 | 13,700 |
| **DLCLB 2060-100** | R3 | 10 | 4.8 | 5.95 | — | 80 | 6 | 12,700 |
| **DLCLB 2060-150** | | 15 | | | | 80 | 6 | 12,700 |
| **DLCLB 2060-200** | | 20 | | | | 80 | 6 | 12,700 |
| **DLCLB 2060-300** | | 30 | | | | 80 | 6 | 13,300 |

Unit (mm)

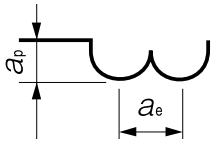
| Model Number | Radius of Ball Nose R | Effective Length $\ell_1$ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|
| | | | 30′ | 1° | 1° 30′ | 2° | 3° |
| **DLCLB 2030-100** | R1.5 | 10 | 10.51 | 10.96 | 11.46 | 12.01 | 13.32 |
| **DLCLB 2030-120** | | 12 | 12.61 | 13.16 | 13.77 | 14.45 | 16.06 |
| **DLCLB 2030-140** | | 14 | 14.70 | 15.36 | 16.08 | 16.89 | 18.80 |
| **DLCLB 2030-160** | | 16 | 16.80 | 17.56 | 18.39 | 19.32 | 21.54 |
| **DLCLB 2030-200** | | 20 | 20.98 | 21.95 | 23.02 | 24.20 | 27.01 |
| **DLCLB 2030-250** | | 25 | 26.22 | 27.44 | 28.79 | 30.30 | No Interference |
| **DLCLB 2030-300** | | 30 | 31.45 | 32.94 | 34.57 | 36.39 | No Interference |
| **DLCLB 2040-100** | R2 | 10 | 10.49 | 10.91 | 11.38 | 11.90 | 13.14 |
| **DLCLB 2040-150** | | 15 | 15.73 | 16.41 | 17.16 | 18.00 | 19.99 |
| **DLCLB 2040-200** | | 20 | 20.96 | 21.90 | 22.94 | 24.09 | No Interference |
| **DLCLB 2040-250** | | 25 | 26.20 | 27.39 | 28.72 | 30.19 | No Interference |
| **DLCLB 2040-300** | | 30 | 31.43 | 32.89 | 34.50 | No Interference | No Interference |
| **DLCLB 2040-400** | | 40 | 41.90 | 43.87 | No Interference | No Interference | No Interference |
| **DLCLB 2060-100** | R3 | 10 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **DLCLB 2060-150** | | 15 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **DLCLB 2060-200** | | 20 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **DLCLB 2060-300** | | 30 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for DLCLB

| WORK MATERIAL | | | COPPER | | | | TUNGSTEN COPPER | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2001-003** | **R0.05** | 0.3 | 43,600 | 220 | 0.01 | 0.01 | 32,700 | 160 | 0.008 | 0.008 |
| **2001-005** | | 0.5 | 43,600 | 160 | 0.007 | 0.007 | 32,700 | 110 | 0.005 | 0.005 |
| **20015-003** | **R0.075** | 0.3 | 43,600 | 250 | 0.015 | 0.02 | 32,700 | 190 | 0.012 | 0.016 |
| **20015-005** | | 0.5 | 43,600 | 220 | 0.015 | 0.02 | 32,700 | 150 | 0.012 | 0.016 |
| **20015-010** | | 1 | 43,600 | 160 | 0.007 | 0.01 | 32,700 | 120 | 0.006 | 0.008 |
| **2002-003** | **R0.1** | 0.3 | 43,600 | 550 | 0.025 | 0.05 | 32,700 | 380 | 0.02 | 0.04 |
| **2002-005** | | 0.5 | 43,600 | 550 | 0.025 | 0.05 | 32,700 | 380 | 0.02 | 0.04 |
| **2002-010** | | 1 | 43,600 | 440 | 0.02 | 0.04 | 32,700 | 270 | 0.015 | 0.03 |
| **2002-015** | | 1.5 | 32,900 | 250 | 0.015 | 0.03 | 24,700 | 120 | 0.008 | 0.02 |
| **2003-006** | **R0.15** | 0.6 | 43,600 | 760 | 0.03 | 0.07 | 32,700 | 550 | 0.03 | 0.07 |
| **2003-010** | | 1 | 43,600 | 760 | 0.03 | 0.07 | 32,700 | 550 | 0.03 | 0.07 |
| **2003-015** | | 1.5 | 43,600 | 550 | 0.025 | 0.05 | 32,700 | 290 | 0.02 | 0.05 |
| **2003-020** | | 2 | 39,200 | 390 | 0.02 | 0.03 | 29,400 | 200 | 0.01 | 0.02 |
| **2004-010** | **R0.2** | 1 | 43,600 | 1,090 | 0.05 | 0.1 | 32,700 | 760 | 0.04 | 0.08 |
| **2004-020** | | 2 | 43,600 | 650 | 0.035 | 0.06 | 32,700 | 380 | 0.02 | 0.05 |
| **2004-030** | | 3 | 35,000 | 470 | 0.02 | 0.04 | 29,200 | 230 | 0.01 | 0.03 |
| **2004-040** | | 4 | 27,300 | 270 | 0.008 | 0.015 | 19,600 | 110 | 0.005 | 0.01 |
| **2005-010** | **R0.25** | 1 | 43,600 | 1,420 | 0.08 | 0.15 | 32,700 | 890 | 0.08 | 0.15 |
| **2005-020** | | 2 | 43,600 | 870 | 0.08 | 0.15 | 32,700 | 550 | 0.08 | 0.15 |
| **2005-030** | | 3 | 38,200 | 650 | 0.06 | 0.1 | 29,500 | 390 | 0.06 | 0.08 |
| **2005-040** | | 4 | 32,700 | 440 | 0.04 | 0.08 | 24,000 | 220 | 0.025 | 0.05 |
| **2005-050** | | 5 | 27,300 | 330 | 0.02 | 0.04 | 19,600 | 160 | 0.01 | 0.02 |
| **2006-010** | **R0.3** | 1 | 43,600 | 1,870 | 0.12 | 0.2 | 32,700 | 1,400 | 0.12 | 0.2 |
| **2006-020** | | 2 | 43,600 | 1,750 | 0.12 | 0.2 | 32,700 | 1,310 | 0.12 | 0.2 |
| **2006-030** | | 3 | 43,600 | 1,090 | 0.1 | 0.14 | 32,700 | 760 | 0.08 | 0.1 |
| **2006-040** | | 4 | 32,700 | 760 | 0.07 | 0.1 | 27,300 | 440 | 0.04 | 0.06 |
| **2006-050** | | 5 | 29,500 | 650 | 0.05 | 0.08 | 24,000 | 330 | 0.02 | 0.04 |
| **2006-060** | | 6 | 27,300 | 550 | 0.04 | 0.06 | 21,800 | 220 | 0.01 | 0.03 |
| **2008-020** | **R0.4** | 2 | 43,600 | 2,820 | 0.15 | 0.3 | 32,700 | 1,980 | 0.15 | 0.3 |
| **2008-030** | | 3 | 43,600 | 2,180 | 0.15 | 0.3 | 32,700 | 1,530 | 0.15 | 0.3 |
| **2008-040** | | 4 | 38,200 | 1,750 | 0.12 | 0.2 | 29,500 | 1,090 | 0.1 | 0.16 |
| **2008-060** | | 6 | 32,700 | 1,090 | 0.08 | 0.15 | 21,800 | 550 | 0.05 | 0.1 |
| **2008-080** | | 8 | 23,800 | 760 | 0.05 | 0.06 | 17,300 | 320 | 0.02 | 0.025 |
| **2010-020** | **R0.5** | 2 | 39,100 | 2,740 | 0.25 | 0.4 | 30,000 | 2,050 | 0.25 | 0.4 |
| **2010-030** | | 3 | 39,100 | 2,740 | 0.25 | 0.4 | 30,000 | 1,960 | 0.25 | 0.4 |
| **2010-040** | | 4 | 39,100 | 2,350 | 0.2 | 0.4 | 29,500 | 1,560 | 0.2 | 0.4 |
| **2010-050** | | 5 | 38,200 | 2,180 | 0.16 | 0.3 | 29,500 | 1,530 | 0.12 | 0.25 |
| **2010-060** | | 6 | 34,500 | 1,840 | 0.14 | 0.3 | 26,200 | 1,150 | 0.1 | 0.25 |
| **2010-080** | | 8 | 27,300 | 1,090 | 0.12 | 0.2 | 19,600 | 550 | 0.06 | 0.1 |
| **2010-100** | | 10 | 20,300 | 810 | 0.08 | 0.15 | 16,200 | 300 | 0.03 | 0.05 |
| **2010-120** | | 12 | 13,100 | 490 | 0.06 | 0.1 | 9,800 | 160 | 0.015 | 0.04 |

## Milling Conditions for DLCLB

| WORK MATERIAL | | | COPPER | | | | TUNGSTEN COPPER | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Effective Length (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) |
| **2015-040** | **R0.75** | 4 | 25,500 | 2,270 | 0.3 | 0.6 | 21,300 | 1,700 | 0.3 | 0.6 |
| **2015-060** | | 6 | 25,500 | 2,040 | 0.3 | 0.6 | 21,300 | 1,530 | 0.3 | 0.6 |
| **2015-120** | | 12 | 17,500 | 1,090 | 0.15 | 0.3 | 13,100 | 550 | 0.1 | 0.2 |
| **2015-180** | | 18 | 8,500 | 590 | 0.08 | 0.12 | 6,800 | 170 | 0.02 | 0.06 |
| **2020-040** | **R1** | 4 | 18,700 | 2,490 | 0.45 | 0.8 | 14,000 | 1,500 | 0.45 | 0.8 |
| **2020-060** | | 6 | 18,700 | 2,080 | 0.45 | 0.8 | 14,000 | 1,250 | 0.45 | 0.8 |
| **2020-080** | | 8 | 18,700 | 1,800 | 0.4 | 0.8 | 13,500 | 1,200 | 0.4 | 0.8 |
| **2020-100** | | 10 | 18,700 | 1,700 | 0.3 | 0.6 | 13,500 | 1,190 | 0.25 | 0.5 |
| **2020-120** | | 12 | 16,800 | 1,470 | 0.3 | 0.6 | 12,600 | 950 | 0.25 | 0.5 |
| **2020-140** | | 14 | 15,000 | 1,250 | 0.28 | 0.5 | 11,200 | 750 | 0.18 | 0.4 |
| **2020-160** | | 16 | 13,100 | 1,090 | 0.25 | 0.5 | 9,800 | 550 | 0.12 | 0.25 |
| **2020-200** | | 20 | 10,000 | 800 | 0.15 | 0.3 | 8,000 | 350 | 0.06 | 0.1 |
| **2020-250** | | 25 | 6,700 | 500 | 0.08 | 0.15 | 5,000 | 170 | 0.03 | 0.05 |
| **2030-100** | **R1.5** | 10 | 15,000 | 2,550 | 0.6 | 1.2 | 12,000 | 1,800 | 0.6 | 1.2 |
| **2030-120** | | 12 | 15,000 | 2,550 | 0.6 | 1.2 | 11,800 | 1,740 | 0.6 | 1.2 |
| **2030-140** | | 14 | 15,000 | 2,510 | 0.6 | 1.2 | 11,700 | 1,670 | 0.6 | 1.2 |
| **2030-160** | | 16 | 14,200 | 2,140 | 0.6 | 1 | 10,700 | 1,600 | 0.5 | 1 |
| **2030-200** | | 20 | 12,700 | 1,910 | 0.5 | 0.8 | 9,500 | 1,110 | 0.4 | 0.6 |
| **2030-250** | | 25 | 10,100 | 1,520 | 0.4 | 0.6 | 8,400 | 760 | 0.2 | 0.3 |
| **2030-300** | | 30 | 8,700 | 1,310 | 0.2 | 0.4 | 6,500 | 550 | 0.08 | 0.15 |
| **2040-100** | **R2** | 10 | 11,500 | 2,880 | 0.8 | 1.6 | 8,600 | 2,010 | 0.8 | 1.6 |
| **2040-150** | | 15 | 11,500 | 2,670 | 0.8 | 1.6 | 8,600 | 1,880 | 0.8 | 1.6 |
| **2040-200** | | 20 | 11,500 | 2,460 | 0.8 | 1.6 | 8,200 | 1,640 | 0.8 | 1.2 |
| **2040-250** | | 25 | 10,300 | 2,210 | 0.6 | 1.2 | 6,700 | 1,270 | 0.5 | 1 |
| **2040-300** | | 30 | 9,000 | 1,800 | 0.5 | 1 | 5,300 | 900 | 0.3 | 0.5 |
| **2040-400** | | 40 | 6,000 | 900 | 0.4 | 0.8 | 3,800 | 380 | 0.15 | 0.3 |
| **2060-100** | **R3** | 10 | 10,000 | 4,190 | 1 | 2.2 | 7,500 | 3,150 | 1 | 2.2 |
| **2060-150** | | 15 | 10,000 | 4,190 | 1 | 2.2 | 7,500 | 2,800 | 1 | 2.2 |
| **2060-200** | | 20 | 10,000 | 3,000 | 1 | 2 | 7,500 | 2,000 | 0.7 | 1.5 |
| **2060-300** | | 30 | 10,000 | 3,000 | 0.8 | 1.6 | 7,000 | 1,800 | 0.4 | 0.8 |

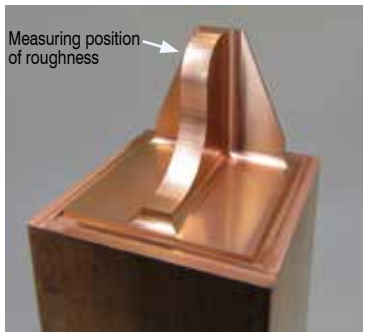



$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

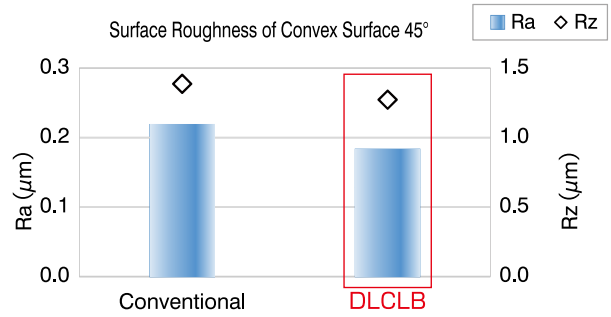
Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when chattering occurs.
・Recommend wet coolant for Copper and Tungsten-Copper.

## Milling Example of Copper Electrode Model DLCLB R1 × Effective Length 16

## Tough Pitch Copper C1100



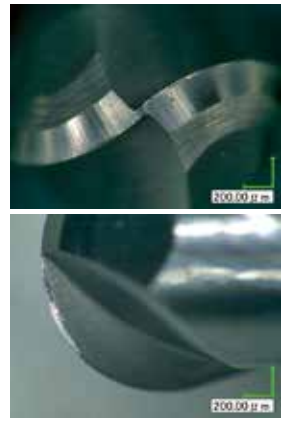

Model Size : 20 x 20 x Depth 16 mm
Coolant : Oil Mist



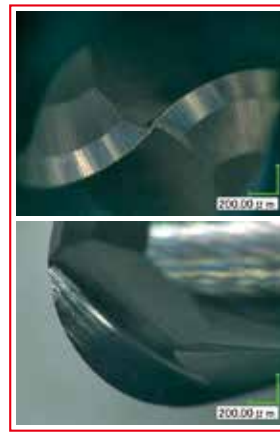

Improved surface roughness compared to the conventional model.

| No | Milling Process | Milling Method | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Overhang Length (mm) | Cycle Time |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | Contour Milling | DLCLB 2020-160 | 10,800 | 1,090 | 0.25 | 0.5 | 24 | 1:31:59 |
| 2 | Semi-finishing | | | 10,800 | 1,090 | 0.05 | 0.05 | | 1:31:15 |
| 3 | Finishing | | | 13,090 | 545 | 0.0001 (Cusp Height) | 0.03 | | 1:15:26 |
| | | | | | | | | Total | 4:18:40 |

Conventional



DLCLB



Tools after milling

DLCLB has less wear and damage after 4 hours of milling, and enables stable milling throughout the long cycle time.

DLCLB series
Introduction Video

DLCLB series
Housing-rib
Electrode Milling Video

**Size R0.2～R3**

# CPRB

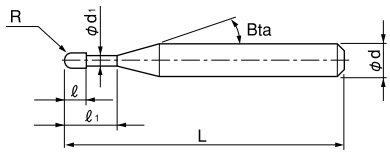
MG | 30° | R ±0.01 | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ~55HRC | Hardened Steels ~60HRC | Hardened Steels ~70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | | ◎ | ☆ | | | | | |

## Features

**Long neck ball design for milling Plastics.**
**Designed especially for deep rib milling using an undercut form.**




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

Total 80 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| CPRB 2004-1 | R0.2 | 1 | 0.4 | 0.36 | 11° | 45 | 4 | 8,000 |
| CPRB 2004-2 | | 2 | | | | 45 | 4 | 8,800 |
| CPRB 2004-3 | | 3 | | | | 45 | 4 | 9,800 |
| CPRB 2005-2 | R0.25 | 2 | 0.8 | 0.46 | 11° | 45 | 4 | 8,000 |
| CPRB 2005-4 | | 4 | | | | 45 | 4 | 8,000 |
| CPRB 2005-6 | | 6 | | | | 45 | 4 | 8,800 |
| CPRB 2005-8 | | 8 | | | | 45 | 4 | 8,800 |
| CPRB 2005-10 | | 10 | | | | 50 | 4 | 9,500 |
| CPRB 2006-2 | R0.3 | 2 | 1 | 0.56 | 11° | 45 | 4 | 7,200 |
| CPRB 2006-4 | | 4 | | | | 45 | 4 | 7,200 |
| CPRB 2006-6 | | 6 | | | | 45 | 4 | 7,200 |
| CPRB 2006-8 | | 8 | | | | 45 | 4 | 7,200 |
| CPRB 2008-2 | R0.4 | 2 | 1.1 | 0.76 | 11° | 45 | 4 | 7,080 |
| CPRB 2008-4 | | 4 | | | | 45 | 4 | 7,080 |
| CPRB 2008-6 | | 6 | | | | 45 | 4 | 7,080 |
| CPRB 2008-8 | | 8 | | | | 45 | 4 | 7,080 |
| CPRB 2008-10 | | 10 | | | | 50 | 4 | 7,080 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| CPRB 2010-3 | R0.5 | 3 | 1.2 | 0.93 | 11° | 45 | 4 | 6,120 |
| CPRB 2010-4 | | 4 | | | | 45 | 4 | 6,120 |
| CPRB 2010-6 | | 6 | | | | 45 | 4 | 6,120 |
| CPRB 2010-8 | | 8 | | | | 45 | 4 | 6,120 |
| CPRB 2010-10 | | 10 | | | | 45 | 4 | 6,120 |
| CPRB 2010-12 | | 12 | | | | 45 | 4 | 6,120 |
| CPRB 2010-14 | | 14 | | | | 50 | 4 | 6,120 |
| CPRB 2010-16 | | 16 | | | | 50 | 4 | 6,120 |
| CPRB 2010-20 | | 20 | | | | 55 | 4 | 7,200 |
| CPRB 2012-8 | R0.6 | 8 | 1.3 | 1.13 | 11° | 45 | 4 | 8,000 |
| CPRB 2012-12 | | 12 | | | | 45 | 4 | 8,000 |
| CPRB 2014-8 | R0.7 | 8 | 1.4 | 1.33 | 11° | 45 | 4 | 8,000 |
| CPRB 2014-12 | | 12 | | | | 45 | 4 | 8,000 |
| CPRB 2014-16 | | 16 | | | | 50 | 4 | 8,000 |
| CPRB 2015-6 | R0.75 | 6 | 1.45 | 1.43 | 11° | 45 | 4 | 6,240 |
| CPRB 2015-8 | | 8 | | | | 45 | 4 | 6,240 |
| CPRB 2015-10 | | 10 | | | | 45 | 4 | 6,240 |
| CPRB 2015-12 | | 12 | | | | 45 | 4 | 6,240 |
| CPRB 2015-16 | | 16 | | | | 50 | 4 | 6,240 |
| CPRB 2015-20 | | 20 | | | | 55 | 4 | 6,240 |
| CPRB 2016-8 | R0.8 | 8 | 1.5 | 1.5 | 11° | 45 | 4 | 8,000 |
| CPRB 2016-12 | | 12 | | | | 45 | 4 | 8,000 |
| CPRB 2016-16 | | 16 | | | | 50 | 4 | 8,000 |
| CPRB 2016-20 | | 20 | | | | 55 | 4 | 8,000 |
| CPRB 2018-8 | R0.9 | 8 | 1.6 | 1.7 | 11° | 45 | 4 | 8,000 |
| CPRB 2018-12 | | 12 | | | | 45 | 4 | 8,000 |
| CPRB 2018-16 | | 16 | | | | 50 | 4 | 8,000 |
| CPRB 2018-20 | | 20 | | | | 55 | 4 | 8,000 |
| CPRB 2020-4 | R1 | 4 | 1.7 | 1.9 | 11° | 45 | 4 | 6,120 |
| CPRB 2020-6 | | 6 | | | | 45 | 4 | 6,120 |
| CPRB 2020-8 | | 8 | | | | 45 | 4 | 6,120 |
| CPRB 2020-10 | | 10 | | | | 45 | 4 | 6,120 |
| CPRB 2020-12 | | 12 | | | | 45 | 4 | 6,120 |
| CPRB 2020-14 | | 14 | | | | 50 | 4 | 6,120 |
| CPRB 2020-16 | | 16 | | | | 50 | 4 | 6,120 |
| CPRB 2020-20 | | 20 | | | | 55 | 4 | 6,120 |
| CPRB 2020-22 | | 22 | | | | 60 | 4 | 6,120 |
| CPRB 2020-25 | | 25 | | | | 65 | 4 | 6,120 |
| CPRB 2020-30 | | 30 | | | | 70 | 4 | 7,440 |

Next Page ➡

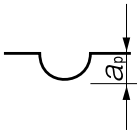
Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|
| **CPRB 2030-8** | R1.5 | 8 | 2.5 | 2.9 | 11° | 60 | 6 | 8,640 |
| **CPRB 2030-10** | | 10 | | | | 60 | 6 | 8,640 |
| **CPRB 2030-12** | | 12 | | | | 60 | 6 | 8,640 |
| **CPRB 2030-16** | | 16 | | | | 60 | 6 | 8,640 |
| **CPRB 2030-20** | | 20 | | | | 70 | 6 | 8,640 |
| **CPRB 2030-25** | | 25 | | | | 70 | 6 | 8,640 |
| **CPRB 2030-30** | | 30 | | | | 70 | 6 | 8,640 |
| **CPRB 2030-35** | | 35 | | | | 80 | 6 | 10,080 |
| **CPRB 2040-10** | R2 | 10 | 3 | 3.8 | 11° | 70 | 6 | 8,640 |
| **CPRB 2040-12** | | 12 | | | | 70 | 6 | 8,640 |
| **CPRB 2040-16** | | 16 | | | | 70 | 6 | 8,640 |
| **CPRB 2040-20** | | 20 | | | | 70 | 6 | 8,640 |
| **CPRB 2040-25** | | 25 | | | | 70 | 6 | 8,640 |
| **CPRB 2040-30** | | 30 | | | | 70 | 6 | 8,640 |
| **CPRB 2040-35** | | 35 | | | | 80 | 6 | 8,880 |
| **CPRB 2040-40** | | 40 | | | | 90 | 6 | 9,120 |
| **CPRB 2040-45** | | 45 | | | | 90 | 6 | 10,320 |
| **CPRB 2040-50** | | 50 | | | | 100 | 6 | 11,280 |
| **CPRB 2050-20** | R2.5 | 20 | 3.5 | 4.8 | 11° | 70 | 6 | 12,080 |
| **CPRB 2050-25** | | 25 | | | | 70 | 6 | 12,080 |
| **CPRB 2050-30** | | 30 | | | | 80 | 6 | 13,130 |
| **CPRB 2050-35** | | 35 | | | | 80 | 6 | 13,130 |
| **CPRB 2060-30** | R3 | 30 | 6 | 5.8 | — | 80 | 6 | 10,080 |
| **CPRB 2060-50** | | 50 | | | — | 120 | 6 | 12,180 |

## Milling Conditions for CPRB

| WORK MATERIAL | | ALUMINUM ALLOYS | | | PLASTICS | | |
|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) |
| **2004** | **R0.2** | 35,000 | 560 | 0.005～0.01 | 35,000 | 1,100 | 0.07～0.2 |
| **2005** | **R0.25** | 35,000 | 700 | 0.003～0.01 | 28,000 | 1,200 | 0.08～0.25 |
| **2006** | **R0.3** | 35,000 | 910 | 0.006～0.03 | 24,000 | 1,200 | 0.1 ～0.3 |
| **2008** | **R0.4** | 26,000 | 940 | 0.006～0.05 | 18,000 | 900 | 0.13～0.4 |
| **2010** | **R0.5** | 21,000 | 970 | 0.005～0.08 | 14,000 | 700 | 0.17～0.5 |
| **2012** | **R0.6** | 18,000 | 1,010 | 0.04 ～0.09 | 12,000 | 600 | 0.2 ～0.6 |
| **2014** | **R0.7** | 15,000 | 1,020 | 0.05 ～0.1 | 10,000 | 500 | 0.23～0.7 |
| **2015** | **R0.75** | 14,000 | 1,010 | 0.06 ～0.12 | 9,500 | 480 | 0.25～0.75 |
| **2016** | **R0.8** | 13,000 | 1,010 | 0.08 ～0.13 | 9,000 | 450 | 0.27～0.8 |
| **2018** | **R0.9** | 12,000 | 1,060 | 0.09 ～0.15 | 8,000 | 400 | 0.3 ～0.9 |
| **2020** | **R1** | 11,000 | 1,100 | 0.03 ～0.21 | 7,000 | 350 | 0.33～1 |
| **2030** | **R1.5** | 6,900 | 760 | 0.03 ～0.23 | 4,800 | 240 | 0.5 ～1.5 |
| **2040** | **R2** | 5,200 | 690 | 0.01 ～0.28 | 3,600 | 180 | 0.6 ～2 |
| **2050** | **R2.5** | 4,200 | 590 | 0.16 ～0.31 | 2,900 | 150 | 0.8 ～2.5 |
| **2060** | **R3** | 3,500 | 550 | 0.22 ～0.36 | 2,400 | 120 | 1 ～3 |

Slotting




$a_p$ : Axial Depth (mm)

Note:
- Adjust the axial depth (ap) based on the effective length and milling condition.
- Recommend water soluble coolant for Aluminum Alloys and Copper.
- Recommend air blow for Plastics.
- Remove chips from the work piece to keep the milling surface quality.
- If chips clog on the tool, stop the operation and remove them accordingly.

## Size R0.3～R3

# CFLB

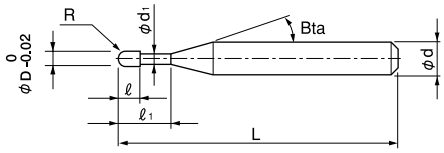
Super MG | UT COAT | 30° | R ±0.005 (R0.3～R1.5) | R ±0.007 (R2～R3) | Shank Dia 0/-0.005 | Variable Pitch

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | ◎ | | ◎ | ○ | | ◎ | ◎ | | |

## Features

**3 flute design that offers higher feed rate milling when compared to a similar specification 2 flute end mill.**
**UTCOAT offers excellent lubricity and longer tool life.**
**Variable pitch design minimizes tool chatter and enables high-precision mold milling.**
**The 3 slots at the tip offers chip evacuation and improved surface finish. (Except R.0.75 or below)**
**Diameter Tolerance: 0/-0.02**




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

Total 47 models　　Unit（mm）

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFLB 3006-020 | R0.3 | 2 | 0.48 | 0.58 | 16° | 50 | 4 | 6,970 | 2.16 | 2.23 | 2.30 | 2.37 | 2.53 |
| CFLB 3006-030 | | 3 | | | | 50 | 4 | 7,130 | 3.20 | 3.30 | 3.40 | 3.51 | 3.76 |
| CFLB 3006-040 | | 4 | | | | 50 | 4 | 7,380 | 4.23 | 4.36 | 4.50 | 4.65 | 4.98 |
| CFLB 3006-060 | | 6 | | | | 50 | 4 | 7,380 | 6.30 | 6.49 | 6.70 | 6.93 | 7.43 |
| CFLB 3008-040 | R0.4 | 4 | 0.64 | 0.78 | 16° | 50 | 4 | 7,380 | 4.23 | 4.36 | 4.49 | 4.64 | 4.96 |
| CFLB 3008-060 | | 6 | | | | 50 | 4 | 7,380 | 6.29 | 6.49 | 6.69 | 6.91 | 7.41 |
| CFLB 3008-080 | | 8 | | | | 50 | 4 | 7,380 | 8.36 | 8.62 | 8.89 | 9.19 | 9.85 |
| CFLB 3010-025 | R0.5 | 2.5 | 0.8 | 0.96 | 16° | 50 | 4 | 6,310 | 2.71 | 2.79 | 2.87 | 2.95 | 3.14 |
| CFLB 3010-030 | | 3 | | | | 50 | 4 | 6,310 | 3.23 | 3.32 | 3.42 | 3.52 | 3.75 |
| CFLB 3010-040 | | 4 | | | | 50 | 4 | 6,560 | 4.26 | 4.38 | 4.52 | 4.66 | 4.98 |
| CFLB 3010-050 | | 5 | | | | 50 | 4 | 6,560 | 5.29 | 5.45 | 5.62 | 5.80 | 6.20 |
| CFLB 3010-060 | | 6 | | | | 50 | 4 | 6,970 | 6.32 | 6.51 | 6.72 | 6.94 | 7.42 |
| CFLB 3010-080 | | 8 | | | | 50 | 4 | 6,970 | 8.39 | 8.64 | 8.92 | 9.21 | 9.87 |
| CFLB 3010-100 | | 10 | | | | 50 | 4 | 6,970 | 10.45 | 10.77 | 11.12 | 11.49 | 12.32 |
| CFLB 3010-120 | | 12 | | | | 50 | 4 | 6,970 | 12.51 | 12.90 | 13.32 | 13.77 | 14.76 |

Next Page ➡

Unit (mm)

| Model Number | Radius of Ball Nose R | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Effective Length by Inclined Angles | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **CFLB 3015-040** | R0.75 | 4 | 1.2 | 1.43 | 16° | 50 | 4 | 6,970 | 4.18 | 4.29 | 4.41 | 4.54 | 4.83 |
| **CFLB 3015-060** | | 6 | | | | 50 | 4 | 6,970 | 6.24 | 6.42 | 6.61 | 6.82 | 7.28 |
| **CFLB 3015-080** | | 8 | | | | 50 | 4 | 7,220 | 8.30 | 8.55 | 8.82 | 9.10 | 9.73 |
| **CFLB 3015-100** | | 10 | | | | 50 | 4 | 7,380 | 10.37 | 10.68 | 11.02 | 11.38 | 12.18 |
| **CFLB 3015-120** | | 12 | | | | 50 | 4 | 7,950 | 12.43 | 12.81 | 13.22 | 13.65 | 14.62 |
| **CFLB 3015-160** | | 16 | | | | 50 | 4 | 7,950 | 16.56 | 17.07 | 17.62 | 18.21 | 19.52 |
| **CFLB 3020-040** | R1 | 4 | 1.6 | 1.83 | 16° | 50 | 4 | 6,300 | 4.35 | 4.46 | 4.58 | 4.71 | 4.99 |
| **CFLB 3020-060** | | 6 | | | | 50 | 4 | 6,810 | 6.41 | 6.59 | 6.78 | 6.99 | 7.44 |
| **CFLB 3020-080** | | 8 | | | | 50 | 4 | 6,970 | 8.48 | 8.72 | 8.98 | 9.26 | 9.89 |
| **CFLB 3020-100** | | 10 | | | | 50 | 4 | 6,970 | 10.54 | 10.85 | 11.18 | 11.54 | 12.33 |
| **CFLB 3020-120** | | 12 | | | | 50 | 4 | 7,220 | 12.60 | 12.98 | 13.38 | 13.82 | 14.78 |
| **CFLB 3020-140** | | 14 | | | | 50 | 4 | 7,220 | 14.66 | 15.11 | 15.59 | 16.09 | 17.23 |
| **CFLB 3020-160** | | 16 | | | | 50 | 4 | 7,220 | 16.73 | 17.24 | 17.79 | 18.37 | 19.68 |
| **CFLB 3020-180** | | 18 | | | | 55 | 4 | 7,220 | 18.79 | 19.37 | 19.99 | 20.65 | No Interference |
| **CFLB 3020-200** | | 20 | | | | 55 | 4 | 7,220 | 20.85 | 21.50 | 22.19 | 22.93 | No Interference |
| **CFLB 3030-080** | R1.5 | 8 | 2.4 | 2.73 | 16° | 60 | 6 | 6,970 | 8.64 | 8.87 | 9.13 | 9.39 | 9.99 |
| **CFLB 3030-100** | | 10 | | | | 60 | 6 | 7,630 | 10.70 | 11.00 | 11.33 | 11.67 | 12.44 |
| **CFLB 3030-120** | | 12 | | | | 60 | 6 | 7,630 | 12.77 | 13.14 | 13.53 | 13.96 | 14.89 |
| **CFLB 3030-160** | | 16 | | | | 60 | 6 | 7,950 | 16.89 | 17.39 | 17.93 | 18.50 | 19.78 |
| **CFLB 3030-200** | | 20 | | | | 70 | 6 | 8,040 | 21.02 | 21.65 | 22.33 | 23.06 | 24.68 |
| **CFLB 3030-250** | | 25 | | | | 70 | 6 | 8,040 | 26.17 | 26.98 | 27.83 | 28.75 | No Interference |
| **CFLB 3040-100** | R2 | 10 | 3.2 | 3.63 | 16° | 70 | 6 | 7,200 | 10.87 | 11.16 | 11.47 | 11.80 | 12.54 |
| **CFLB 3040-120** | | 12 | | | | 70 | 6 | 7,380 | 12.93 | 13.29 | 13.67 | 14.08 | 14.99 |
| **CFLB 3040-160** | | 16 | | | | 70 | 6 | 7,710 | 17.06 | 17.55 | 18.07 | 18.63 | 19.89 |
| **CFLB 3040-200** | | 20 | | | | 70 | 6 | 8,200 | 21.18 | 21.81 | 22.47 | 23.19 | No Interference |
| **CFLB 3040-250** | | 25 | | | | 70 | 6 | 8,200 | 26.34 | 27.13 | 27.98 | 28.88 | No Interference |
| **CFLB 3040-300** | | 30 | | | | 70 | 6 | 8,200 | 31.50 | 32.45 | 33.48 | No Interference | No Interference |
| **CFLB 3060-200** | R3 | 20 | 4.8 | 5.42 | — | 80 | 6 | 9,840 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CFLB 3060-250** | | 25 | | | | 80 | 6 | 9,840 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CFLB 3060-300** | | 30 | | | | 80 | 6 | 10,090 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CFLB 3060-350** | | 35 | | | | 80 | 6 | 10,500 | No Interference | No Interference | No Interference | No Interference | No Interference |
| **CFLB 3060-400** | | 40 | | | | 90 | 6 | 11,070 | No Interference | No Interference | No Interference | No Interference | No Interference |

## Milling Conditions for CFLB

| WORK MATERIAL | | | COPPER ALUMINUM ALLOYS C1100 / A5052 / A7075 etc. | | | | CARBON STEELS / ALLOY STEELS / HARDENED STEELS S50C / NAK80 etc. (~45HRC) | | | | HARDENED STEELS STAVAX / SKD61 etc. (~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coolant | | | WET | | | | WET／DRY | | | | WET／DRY | | | |
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **3006-020** | **R0.3** | 2 | 30,000 | 1,000 | 0.03 | 0.13 | 30,000 | 1,000 | 0.03 | 0.13 | 30,000 | 700 | 0.03 | 0.13 |
| **3006-030** | | 3 | 30,000 | 1,000 | 0.03 | 0.13 | 30,000 | 1,000 | 0.03 | 0.13 | 30,000 | 700 | 0.03 | 0.13 |
| **3006-040** | | 4 | 30,000 | 700 | 0.02 | 0.1 | 30,000 | 700 | 0.02 | 0.1 | 30,000 | 480 | 0.02 | 0.1 |
| **3006-060** | | 6 | 30,000 | 475 | 0.01 | 0.05 | 30,000 | 475 | 0.01 | 0.05 | 30,000 | 300 | 0.01 | 0.05 |
| **3008-040** | **R0.4** | 4 | 30,000 | 1,250 | 0.04 | 0.17 | 30,000 | 1,250 | 0.04 | 0.17 | 30,000 | 850 | 0.04 | 0.17 |
| **3008-060** | | 6 | 30,000 | 1,000 | 0.03 | 0.14 | 30,000 | 1,000 | 0.03 | 0.14 | 30,000 | 680 | 0.03 | 0.14 |
| **3008-080** | | 8 | 27,000 | 770 | 0.018 | 0.12 | 27,000 | 770 | 0.018 | 0.12 | 27,000 | 510 | 0.018 | 0.12 |
| **3010-025** | **R0.5** | 2.5 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,000 | 0.05 | 0.21 |
| **3010-030** | | 3 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,000 | 0.05 | 0.21 |
| **3010-040** | | 4 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,000 | 0.05 | 0.21 |
| **3010-050** | | 5 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,500 | 0.05 | 0.21 | 30,000 | 1,000 | 0.05 | 0.21 |
| **3010-060** | | 6 | 30,000 | 1,500 | 0.04 | 0.19 | 30,000 | 1,500 | 0.04 | 0.19 | 30,000 | 1,000 | 0.04 | 0.19 |
| **3010-080** | | 8 | 25,200 | 1,200 | 0.03 | 0.17 | 25,200 | 1,200 | 0.03 | 0.17 | 25,200 | 800 | 0.03 | 0.17 |
| **3010-100** | | 10 | 24,100 | 930 | 0.023 | 0.15 | 24,100 | 930 | 0.023 | 0.15 | 24,100 | 620 | 0.023 | 0.155 |
| **3010-120** | | 12 | 23,000 | 660 | 0.017 | 0.135 | 23,000 | 660 | 0.017 | 0.135 | 23,000 | 440 | 0.017 | 0.135 |
| **3015-040** | **R0.75** | 4 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 1,700 | 0.075 | 0.32 |
| **3015-060** | | 6 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 1,700 | 0.075 | 0.32 |
| **3015-080** | | 8 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 2,500 | 0.075 | 0.32 | 30,000 | 1,700 | 0.075 | 0.32 |
| **3015-100** | | 10 | 24,000 | 2,000 | 0.05 | 0.26 | 24,000 | 2,000 | 0.05 | 0.26 | 24,000 | 1,350 | 0.05 | 0.26 |
| **3015-120** | | 12 | 20,800 | 1,400 | 0.035 | 0.25 | 20,800 | 1,400 | 0.035 | 0.25 | 20,800 | 925 | 0.035 | 0.23 |
| **3015-160** | | 16 | 17,500 | 800 | 0.025 | 0.24 | 17,500 | 800 | 0.025 | 0.24 | 17,500 | 500 | 0.017 | 0.2 |
| **3020-040** | **R1** | 4 | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 2,500 | 0.2 | 0.6 |
| **3020-060** | | 6 | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 2,500 | 0.2 | 0.6 |
| **3020-080** | | 8 | 30,000 | 3,200 | 0.2 | 0.6 | 30,000 | 3,200 | 0.2 | 0.6 | 29,150 | 2,400 | 0.2 | 0.6 |
| **3020-100** | | 10 | 27,000 | 3,000 | 0.2 | 0.6 | 27,000 | 3,000 | 0.2 | 0.6 | 24,300 | 2,000 | 0.2 | 0.6 |
| **3020-120** | | 12 | 21,600 | 2,400 | 0.15 | 0.5 | 21,600 | 2,400 | 0.15 | 0.5 | 21,000 | 1,600 | 0.14 | 0.5 |
| **3020-140** | | 14 | 16,200 | 1,600 | 0.12 | 0.45 | 16,200 | 1,600 | 0.12 | 0.45 | 16,200 | 1,200 | 0.08 | 0.35 |
| **3020-160** | | 16 | 12,600 | 1,200 | 0.1 | 0.4 | 12,600 | 1,200 | 0.1 | 0.4 | 12,600 | 1,200 | 0.05 | 0.3 |
| **3020-180** | | 18 | 12,350 | 1,060 | 0.07 | 0.375 | 12,350 | 1,060 | 0.07 | 0.375 | 12,350 | 900 | 0.035 | 0.285 |
| **3020-200** | | 20 | 12,050 | 930 | 0.04 | 0.35 | 12,050 | 930 | 0.04 | 0.35 | 12,050 | 600 | 0.017 | 0.27 |
| **3030-080** | **R1.5** | 8 | 24,000 | 4,000 | 0.3 | 0.9 | 24,000 | 4,000 | 0.3 | 0.9 | 21,600 | 2,700 | 0.3 | 0.9 |
| **3030-100** | | 10 | 24,000 | 4,000 | 0.3 | 0.9 | 24,000 | 4,000 | 0.3 | 0.9 | 21,600 | 2,700 | 0.3 | 0.9 |
| **3030-120** | | 12 | 24,000 | 3,600 | 0.3 | 0.9 | 24,000 | 3,600 | 0.3 | 0.9 | 21,600 | 2,450 | 0.3 | 0.9 |
| **3030-160** | | 16 | 16,800 | 2,800 | 0.27 | 0.85 | 16,800 | 2,800 | 0.27 | 0.85 | 15,100 | 1,900 | 0.27 | 0.85 |
| **3030-200** | | 20 | 12,000 | 2,000 | 0.24 | 0.75 | 12,000 | 2,000 | 0.24 | 0.75 | 10,800 | 1,350 | 0.24 | 0.75 |
| **3030-250** | | 25 | 8,400 | 1,200 | 0.15 | 0.65 | 8,400 | 1,200 | 0.15 | 0.65 | 7,500 | 800 | 0.15 | 0.65 |

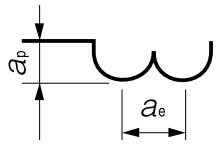
# Milling Conditions for CFLB

| WORK MATERIAL | | | TITANIUM ALLOYS STAINLESS STEELS Ti-6Al-4V / SUS etc. | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Coolant | | | WET | | | | WET | | | |
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **3006-020** | **R0.3** | 2 | 20,000 | 1,000 | 0.015 | 0.09 | 9,000 | 225 | 0.015 | 0.09 |
| **3006-030** | | 3 | 20,000 | 1,000 | 0.015 | 0.09 | 7,500 | 185 | 0.012 | 0.08 |
| **3006-040** | | 4 | 20,000 | 700 | 0.01 | 0.07 | 4,500 | 100 | 0.01 | 0.07 |
| **3006-060** | | 6 | 20,000 | 200 | 0.005 | 0.035 | 2,400 | 30 | 0.004 | 0.035 |
| **3008-040** | **R0.4** | 4 | 20,000 | 1,250 | 0.02 | 0.12 | 10,000 | 310 | 0.02 | 0.12 |
| **3008-060** | | 6 | 20,000 | 950 | 0.013 | 0.075 | 7,200 | 200 | 0.013 | 0.075 |
| **3008-080** | | 8 | 18,000 | 600 | 0.007 | 0.06 | 4,450 | 95 | 0.007 | 0.06 |
| **3010-025** | **R0.5** | 2.5 | 20,000 | 1,500 | 0.025 | 0.15 | 10,000 | 375 | 0.025 | 0.15 |
| **3010-030** | | 3 | 20,000 | 1,500 | 0.025 | 0.15 | 10,000 | 375 | 0.025 | 0.15 |
| **3010-040** | | 4 | 20,000 | 1,500 | 0.025 | 0.15 | 9,000 | 330 | 0.025 | 0.15 |
| **3010-050** | | 5 | 20,000 | 1,500 | 0.025 | 0.15 | 7,500 | 280 | 0.02 | 0.14 |
| **3010-060** | | 6 | 20,000 | 1,500 | 0.02 | 0.14 | 6,000 | 220 | 0.02 | 0.13 |
| **3010-080** | | 8 | 16,800 | 1,200 | 0.015 | 0.12 | 3,500 | 110 | 0.015 | 0.11 |
| **3010-100** | | 10 | 16,050 | 930 | 0.011 | 0.1 | 3,350 | 85 | 0.011 | 0.095 |
| **3010-120** | | 12 | 15,300 | 660 | 0.008 | 0.095 | 3,200 | 60 | 0.008 | 0.085 |
| **3015-040** | **R0.75** | 4 | 20,000 | 2,500 | 0.035 | 0.22 | 9,000 | 380 | 0.03 | 0.22 |
| **3015-060** | | 6 | 20,000 | 2,500 | 0.035 | 0.22 | 9,000 | 380 | 0.03 | 0.22 |
| **3015-080** | | 8 | 20,000 | 2,500 | 0.035 | 0.22 | 6,000 | 250 | 0.025 | 0.18 |
| **3015-100** | | 10 | 16,000 | 2,000 | 0.025 | 0.19 | 4,500 | 170 | 0.02 | 0.17 |
| **3015-120** | | 12 | 14,000 | 1,370 | 0.02 | 0.18 | 4,100 | 135 | 0.017 | 0.17 |
| **3015-160** | | 16 | 12,000 | 730 | 0.013 | 0.17 | 3,600 | 100 | 0.013 | 0.165 |
| **3020-040** | **R1** | 4 | 20,000 | 3,200 | 0.1 | 0.43 | 12,000 | 1,000 | 0.1 | 0.4 |
| **3020-060** | | 6 | 20,000 | 3,200 | 0.1 | 0.43 | 12,000 | 1,000 | 0.1 | 0.4 |
| **3020-080** | | 8 | 20,000 | 3,200 | 0.1 | 0.43 | 10,800 | 900 | 0.1 | 0.4 |
| **3020-100** | | 10 | 18,000 | 3,000 | 0.1 | 0.43 | 9,000 | 750 | 0.08 | 0.36 |
| **3020-120** | | 12 | 14,400 | 2,400 | 0.075 | 0.38 | 7,200 | 600 | 0.08 | 0.34 |
| **3020-140** | | 14 | 10,800 | 1,600 | 0.06 | 0.34 | 5,400 | 400 | 0.07 | 0.32 |
| **3020-160** | | 16 | 8,400 | 1,200 | 0.05 | 0.34 | 4,200 | 300 | 0.06 | 0.3 |
| **3020-180** | | 18 | 8,250 | 1,000 | 0.035 | 0.26 | 4,100 | 250 | 0.035 | 0.26 |
| **3020-200** | | 20 | 8,050 | 800 | 0.017 | 0.245 | 4,000 | 200 | 0.015 | 0.23 |
| **3030-080** | **R1.5** | 8 | 16,000 | 4,000 | 0.15 | 0.65 | 8,000 | 1,000 | 0.15 | 0.65 |
| **3030-100** | | 10 | 16,000 | 4,000 | 0.15 | 0.65 | 7,200 | 900 | 0.15 | 0.65 |
| **3030-120** | | 12 | 16,000 | 3,600 | 0.15 | 0.65 | 7,200 | 800 | 0.15 | 0.65 |
| **3030-160** | | 16 | 11,200 | 2,800 | 0.135 | 0.62 | 4,800 | 600 | 0.12 | 0.55 |
| **3030-200** | | 20 | 8,000 | 2,000 | 0.12 | 0.58 | 3,600 | 400 | 0.1 | 0.52 |
| **3030-250** | | 25 | 5,600 | 1,200 | 0.075 | 0.46 | 2,800 | 300 | 0.09 | 0.48 |

## Milling Conditions for CFLB

| WORK MATERIAL | | | COPPER ALUMINUM ALLOYS C1100 / A5052 / A7075 etc. | | | | CARBON STEELS / ALLOY STEELS / HARDENED STEELS S50C / NAK80 etc (~45HRC) | | | | HARDENED STEELS STAVAX / SKD61 etc. (~55HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coolant | | | WET | | | | WET／DRY | | | | WET／DRY | | | |
| Model Number | Outside Diameter (mm) | Effective Length (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) |
| **3040-100** | R2 | 10 | 18,000 | 4,000 | 0.4 | 1.2 | 18,000 | 4,000 | 0.4 | 1.2 | 16,200 | 2,700 | 0.4 | 1.2 |
| **3040-120** | | 12 | 18,000 | 4,000 | 0.4 | 1.2 | 18,000 | 4,000 | 0.4 | 1.2 | 16,200 | 2,700 | 0.4 | 1.2 |
| **3040-160** | | 16 | 16,200 | 3,600 | 0.4 | 1.2 | 16,200 | 3,600 | 0.4 | 1.2 | 14,600 | 2,450 | 0.4 | 1.2 |
| **3040-200** | | 20 | 13,500 | 3,000 | 0.4 | 1.2 | 13,500 | 3,000 | 0.4 | 1.2 | 12,200 | 2,000 | 0.4 | 1.2 |
| **3040-250** | | 25 | 9,900 | 2,200 | 0.32 | 1.05 | 9,900 | 2,200 | 0.32 | 1.05 | 8,900 | 1,450 | 0.32 | 1.05 |
| **3040-300** | | 30 | 7,200 | 1,400 | 0.2 | 0.85 | 7,200 | 1,400 | 0.2 | 0.85 | 6,500 | 950 | 0.2 | 0.85 |
| **3060-200** | R3 | 20 | 12,000 | 4,000 | 0.6 | 1.8 | 12,000 | 4,000 | 0.6 | 1.8 | 10,800 | 2,700 | 0.6 | 1.8 |
| **3060-250** | | 25 | 10,500 | 3,500 | 0.6 | 1.8 | 10,500 | 3,500 | 0.6 | 1.8 | 9,450 | 2,350 | 0.6 | 1.8 |
| **3060-300** | | 30 | 9,000 | 3,000 | 0.6 | 1.8 | 9,000 | 3,000 | 0.6 | 1.8 | 8,100 | 2,000 | 0.6 | 1.8 |
| **3060-350** | | 35 | 7,500 | 2,500 | 0.6 | 1.8 | 7,500 | 2,500 | 0.5 | 1.6 | 6,750 | 1,650 | 0.5 | 1.6 |
| **3060-400** | | 40 | 6,000 | 2,000 | 0.4 | 1.4 | 6,000 | 2,000 | 0.4 | 1.4 | 5,400 | 1,350 | 0.4 | 1.4 |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)




Note:
・Decrease the feed rate more than 50% from the milling parameters when slot milling.
・Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machines maximum speed, or when the tool is chattering and heats up to a red color.
・Recommend wet coolant for Copper.
・DRY: air blow, WET: water soluble or oil coolant.

## Milling Conditions for CFLB

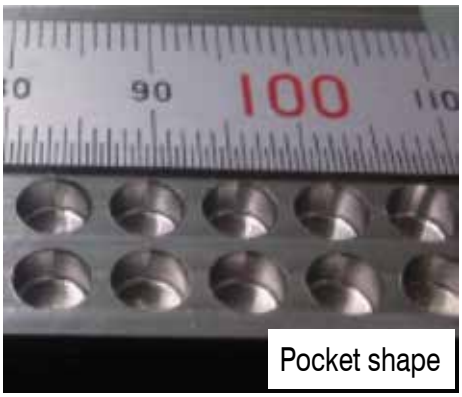
| WORK MATERIAL | | | TITANIUM ALLOYS STAINLESS STEELS Ti-6Al-4V / SUS etc. | | | | HEAT RESISTANT ALLOYS Inconel718 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Coolant | | | WET | | | | WET | | | |
| Model Number | Outside Diameter (mm) | Effective Length (mm) | Spindle Speed ($min^{-1}$) | 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) |
| **3040-100** | **R2** | 10 | 12,000 | 4,000 | 0.2 | 0.87 | 6,000 | 1,000 | 0.2 | 0.85 |
| **3040-120** | | 12 | 12,000 | 4,000 | 0.2 | 0.87 | 6,000 | 1,000 | 0.2 | 0.85 |
| **3040-160** | | 16 | 10,800 | 3,600 | 0.2 | 0.87 | 5,400 | 900 | 0.2 | 0.85 |
| **3040-200** | | 20 | 9,000 | 3,000 | 0.2 | 0.87 | 4,500 | 750 | 0.17 | 0.76 |
| **3040-250** | | 25 | 6,600 | 2,200 | 0.16 | 0.78 | 2,700 | 400 | 0.14 | 0.68 |
| **3040-300** | | 30 | 4,800 | 1,400 | 0.1 | 0.62 | 2,100 | 300 | 0.12 | 0.63 |
| **3060-200** | **R3** | 20 | 8,000 | 4,000 | 0.3 | 1.3 | 3,600 | 900 | 0.3 | 1.3 |
| **3060-250** | | 25 | 7,000 | 3,500 | 0.3 | 1.3 | 3,300 | 820 | 0.27 | 1.2 |
| **3060-300** | | 30 | 6,000 | 3,000 | 0.3 | 1.3 | 3,000 | 750 | 0.25 | 1.17 |
| **3060-350** | | 35 | 5,000 | 2,500 | 0.25 | 1.15 | 2,400 | 570 | 0.23 | 1.1 |
| **3060-400** | | 40 | 4,000 | 2,000 | 0.2 | 1.05 | 1,800 | 400 | 0.21 | 1.04 |

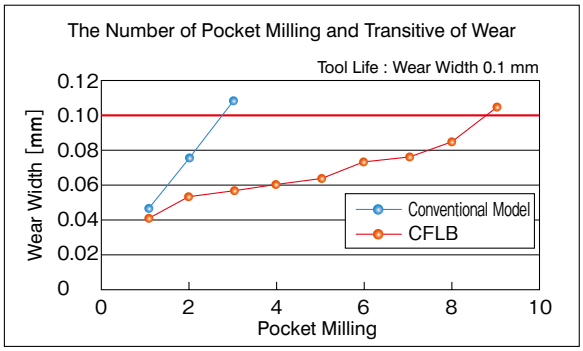
## Tool Life Comparison with Conventional Model（2 flutes） R0.3 x Effective Length 3mm

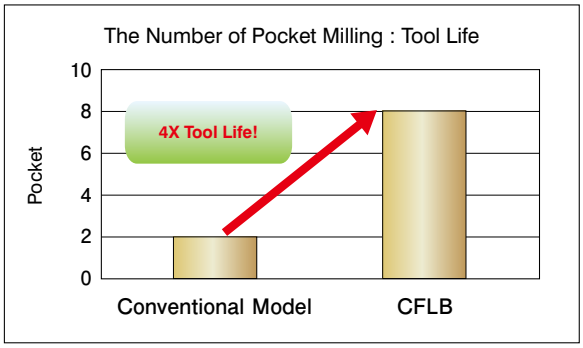
### S50C Pocket Milling

■ Milling Conditions

| | |
|---|---|
| Spindle Speed | 30,000 $min^{-1}$ |
| Feed Rate | 1,000 mm/min |
| Axial Depth $a_p$ | 0.03 mm |
| Radial Depth $a_e$ | 0.13 mm |
| Coolant | Air Blow (Through Spindle) |
| Overhang Length | 12 mm |
| Pocket Size | $\phi$5 × 3 mm |
| Cycle Time | 14 min/pocket |



## Size R0.1～R2

# HTNB

Super MG | HARD MAX | 30° | R ±0.005 | Shank Dia 0/-0.005 | Back Taper Geometry

Additional 48 models

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

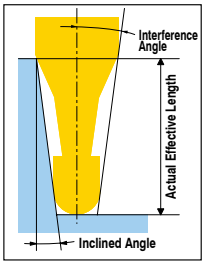
| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ◎ ～65HRC | ○ | | | ◎ | | | ○ | ○ | | |

Total 245 models

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HTNB 2002-015-1 | R0.1 | 30′ | 1.5 | — | 0.16 | — | 16° | 50 | 4 | A | 11,520 |
| HTNB 2002-020-1 | | | 2 | | | | | 50 | 4 | | 12,120 |
| HTNB 2002-030-1 | | | 3 | | | | | 50 | 4 | | 14,400 |
| HTNB 2002-015-2 | | 1° | 1.5 | | | | | 50 | 4 | | 11,520 |
| HTNB 2002-020-2 | | | 2 | | | | | 50 | 4 | | 12,120 |
| HTNB 2002-030-2 | | | 3 | | | | | 50 | 4 | | 14,400 |
| HTNB 2002-015-3 | | 1°30′ | 1.5 | | | | | 50 | 4 | | 11,520 |
| HTNB 2002-020-3 | | | 2 | | | | | 50 | 4 | | 12,120 |
| HTNB 2002-030-3 | | | 3 | | | | | 50 | 4 | | 14,400 |
| HTNB 2003-020-1 | R0.15 | 30′ | 2 | — | 0.24 | — | 16° | 50 | 4 | A | 11,520 |
| HTNB 2003-030-1 | | | 3 | | | | | 50 | 4 | | 12,120 |
| HTNB 2003-020-2 | | 1° | 2 | | | | | 50 | 4 | | 11,520 |
| HTNB 2003-030-2 | | | 3 | | | | | 50 | 4 | | 12,120 |
| HTNB 2003-020-3 | | 1°30′ | 2 | | | | | 50 | 4 | | 11,520 |
| HTNB 2003-030-3 | | | 3 | | | | | 50 | 4 | | 12,120 |
| HTNB 2004-030-1 | R0.2 | 30′ | 3 | — | 0.32 | — | 16° | 50 | 4 | A | 8,880 |
| HTNB 2004-040-1 | | | 4 | | | | | 50 | 4 | | 8,880 |
| HTNB 2004-060-1 | | | 6 | | | | | 50 | 4 | | 9,600 |
| HTNB 2004-030-2 | | 1° | 3 | | | | | 50 | 4 | | 8,880 |
| HTNB 2004-040-2 | | | 4 | | | | | 50 | 4 | | 8,880 |
| HTNB 2004-060-2 | | | 6 | | | | | 50 | 4 | | 9,600 |
| HTNB 2004-030-3 | | 1°30′ | 3 | | | | | 50 | 4 | | 8,880 |
| HTNB 2004-040-3 | | | 4 | | | | | 50 | 4 | | 8,880 |
| HTNB 2004-060-3 | | | 6 | | | | | 50 | 4 | | 9,600 |

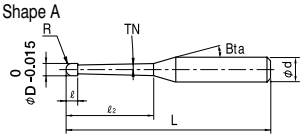
## Features

**Taper Neck design offers high rigidity.**
**Stable milling and excellent surface even on deep milling.**
**HARDMAX coat offers heat resistance, toughness and lubricity at a high level.**
**Suitable for hard materials up to 65HRC.**

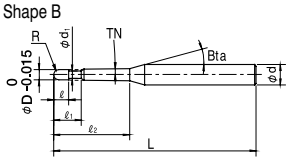



The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

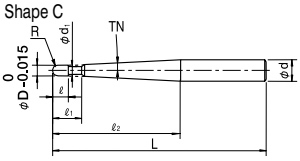
Shape A




Shape B




Shape C




Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HTNB 2002-015-1** | RO.1 | 30′ | 1.5 | 13.36° | — | 1.50 | 1.55 | 1.60 | 1.72 |
| **HTNB 2002-020-1** | | | 2 | 12.63° | — | 2.01 | 2.08 | 2.15 | 2.31 |
| **HTNB 2002-030-1** | | | 3 | 11.37° | — | 3.05 | 3.15 | 3.26 | 3.50 |
| **HTNB 2002-015-2** | | 1° | 1.5 | 13.41° | — | — | 1.51 | 1.56 | 1.68 |
| **HTNB 2002-020-2** | | | 2 | 12.69° | — | — | 2.03 | 2.10 | 2.25 |
| **HTNB 2002-030-2** | | | 3 | 11.46° | — | — | 3.06 | 3.17 | 3.40 |
| **HTNB 2002-015-3** | | 1°30′ | 1.5 | 13.46° | — | — | — | 1.53 | 1.64 |
| **HTNB 2002-020-3** | | | 2 | 12.76° | — | — | — | 2.04 | 2.19 |
| **HTNB 2002-030-3** | | | 3 | 11.56° | — | — | — | 3.08 | 3.31 |
| **HTNB 2003-020-1** | RO.15 | 30′ | 2 | 12.62° | — | 2.01 | 2.08 | 2.15 | 2.30 |
| **HTNB 2003-030-1** | | | 3 | 11.34° | — | 3.05 | 3.15 | 3.25 | 3.49 |
| **HTNB 2003-020-2** | | 1° | 2 | 12.68° | — | — | 2.03 | 2.10 | 2.25 |
| **HTNB 2003-030-2** | | | 3 | 11.43° | — | — | 3.06 | 3.17 | 3.40 |
| **HTNB 2003-020-3** | | 1°30′ | 2 | 12.75° | — | — | — | 2.05 | 2.19 |
| **HTNB 2003-030-3** | | | 3 | 11.52° | — | — | — | 3.08 | 3.31 |
| **HTNB 2004-030-1** | RO.2 | 30′ | 3 | 11.30° | — | 3.04 | 3.14 | 3.25 | 3.48 |
| **HTNB 2004-040-1** | | | 4 | 10.23° | — | 4.08 | 4.21 | 4.35 | 4.67 |
| **HTNB 2004-060-1** | | | 6 | 8.60° | — | 6.14 | 6.34 | 6.56 | 7.04 |
| **HTNB 2004-030-2** | | 1° | 3 | 11.38° | — | — | 3.06 | 3.17 | 3.39 |
| **HTNB 2004-040-2** | | | 4 | 10.33° | — | — | 4.10 | 4.23 | 4.54 |
| **HTNB 2004-060-2** | | | 6 | 8.72° | — | — | 6.16 | 6.37 | 6.84 |
| **HTNB 2004-030-3** | | 1°30′ | 3 | 11.48° | — | — | — | 3.08 | 3.30 |
| **HTNB 2004-040-3** | | | 4 | 10.44° | — | — | — | 4.12 | 4.42 |
| **HTNB 2004-060-3** | | | 6 | 8.84° | — | — | — | 6.19 | 6.64 |

Next Page ➡

| | Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HTNB 2005-040-1 | R0.25 | 30′ | 4 | — | 0.4 | — | 16° | 50 | 4 | A | 8,400 |
| | HTNB 2005-060-1 | | | 6 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2005-080-1 | | | 8 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2005-100-1 | | | 10 | | | | | 50 | 4 | | 9,600 |
| | HTNB 2005-040-2 | | 1° | 4 | | | | | 50 | 4 | | 8,400 |
| | HTNB 2005-060-2 | | | 6 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2005-080-2 | | | 8 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2005-100-2 | | | 10 | | | | | 50 | 4 | | 9,600 |
| | HTNB 2005-040-3 | | 1°30′ | 4 | | | | | 50 | 4 | | 8,640 |
| | HTNB 2005-060-3 | | | 6 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2005-080-3 | | | 8 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2005-100-3 | | | 10 | | | | | 50 | 4 | | 9,600 |
| | HTNB 2006-040-1 | R0.3 | 30′ | 4 | 0.9 | 0.48 | 0.56 | 16° | 50 | 4 | B | 8,280 |
| | HTNB 2006-060-1 | | | 6 | | | | | 50 | 4 | | 8,520 |
| | HTNB 2006-080-1 | | | 8 | | | | | 50 | 4 | | 8,520 |
| | HTNB 2006-100-1 | | | 10 | | | | | 50 | 4 | | 8,640 |
| | HTNB 2006-120-1 | | | 12 | | | | | 50 | 4 | | 9,360 |
| ※ | HTNB 2006-140-1 | | | 14 | | | | | 50 | 4 | | 9,360 |
| | HTNB 2006-160-1 | | | 16 | | | | | 50 | 4 | | 9,360 |
| | HTNB 2006-200-1 | | | 20 | | | | | 50 | 4 | | 12,500 |
| | HTNB 2006-040-2 | | 1° | 4 | | | | | 50 | 4 | | 8,280 |
| | HTNB 2006-060-2 | | | 6 | | | | | 50 | 4 | | 8,520 |
| | HTNB 2006-080-2 | | | 8 | | | | | 50 | 4 | | 8,520 |
| | HTNB 2006-100-2 | | | 10 | | | | | 50 | 4 | | 8,640 |
| | HTNB 2006-120-2 | | | 12 | | | | | 50 | 4 | | 9,360 |
| | HTNB 2006-140-2 | | | 14 | | | | | 50 | 4 | | 9,360 |
| | HTNB 2006-160-2 | | | 16 | | | | | 50 | 4 | | 9,360 |
| | HTNB 2006-200-2 | | | 20 | | | | | 50 | 4 | | 12,500 |
| | HTNB 2006-040-3 | | 1°30′ | 4 | | | | | 50 | 4 | | 8,280 |
| | HTNB 2006-060-3 | | | 6 | | | | | 50 | 4 | | 8,520 |
| | HTNB 2006-080-3 | | | 8 | | | | | 50 | 4 | | 8,520 |
| | HTNB 2006-100-3 | | | 10 | | | | | 50 | 4 | | 8,640 |
| | HTNB 2006-120-3 | | | 12 | | | | | 50 | 4 | | 9,360 |
| ※ | HTNB 2006-140-3 | | | 14 | | | | | 50 | 4 | | 9,360 |
| | HTNB 2006-160-3 | | | 16 | | | | | 50 | 4 | | 9,360 |
| ※ | HTNB 2006-200-3 | | | 20 | | | | | 50 | 4 | | 12,500 |
| ※ | HTNB 2006-080-4 | | 2° | 8 | | | | | 50 | 4 | | 8,520 |
| ※ | HTNB 2006-120-4 | | | 12 | | | | | 50 | 4 | | 9,360 |
| ※ | HTNB 2006-200-4 | | | 20 | | | | | 50 | 4 | | 12,500 |
| ※ | HTNB 2006-080-6 | | 3° | 8 | | | | | 50 | 4 | | 8,520 |
| ※ | HTNB 2006-120-6 | | | 12 | | | | | 50 | 4 | | 9,360 |
| ※ | HTNB 2006-200-6 | | | 20 | | | | | 50 | 4 | | 12,500 |
| ※ | HTNB 2006-120-10 | | 5° | 12 | | | | | 50 | 4 | | 9,360 |
| ※ | HTNB 2006-200-10 | | | 20 | | | | | 50 | 4 | | 12,500 |

※Additional model

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HTNB 2005-040-1 | R0.25 | 30′ | 4 | 10.17° | — | 4.08 | 4.21 | 4.35 | 4.66 |
| HTNB 2005-060-1 | | | 6 | 8.52° | — | 6.14 | 6.34 | 6.55 | 7.03 |
| HTNB 2005-080-1 | | | 8 | 7.33° | — | 8.21 | 8.48 | 8.76 | 9.41 |
| HTNB 2005-100-1 | | | 10 | 6.43° | — | 10.27 | 10.61 | 10.97 | 11.78 |
| HTNB 2005-040-2 | | 1° | 4 | 10.27° | — | — | 4.10 | 4.23 | 4.54 |
| HTNB 2005-060-2 | | | 6 | 8.64° | — | — | 6.16 | 6.37 | 6.84 |
| HTNB 2005-080-2 | | | 8 | 7.45° | — | — | 8.23 | 8.51 | 9.13 |
| HTNB 2005-100-2 | | | 10 | 6.55° | — | — | 10.30 | 10.65 | 11.43 |
| HTNB 2005-040-3 | | 1°30′ | 4 | 10.38° | — | — | — | 4.12 | 4.41 |
| HTNB 2005-060-3 | | | 6 | 8.76° | — | — | — | 6.19 | 6.64 |
| HTNB 2005-080-3 | | | 8 | 7.57° | — | — | — | 8.26 | 8.86 |
| HTNB 2005-100-3 | | | 10 | 6.67° | — | — | — | 10.33 | 11.09 |
| HTNB 2006-040-1 | R0.3 | 30′ | 4 | 10.10° | — | 4.08 | 4.21 | 4.34 | 4.65 |
| HTNB 2006-060-1 | | | 6 | 8.44° | — | 6.14 | 6.34 | 6.55 | 7.03 |
| HTNB 2006-080-1 | | | 8 | 7.24° | — | 8.21 | 8.47 | 8.76 | 9.40 |
| HTNB 2006-100-1 | | | 10 | 6.33° | — | 10.27 | 10.61 | 10.97 | 11.77 |
| HTNB 2006-120-1 | | | 12 | 5.63° | — | 12.34 | 12.74 | 13.18 | 14.14 |
| HTNB 2006-140-1 | | | 14 | 5.07° | — | 14.39 | 14.87 | 15.37 | 16.51 |
| HTNB 2006-160-1 | | | 16 | 4.61° | — | 16.46 | 17.01 | 17.59 | 18.89 |
| HTNB 2006-200-1 | | | 20 | 3.90° | — | 20.60 | 21.28 | 22.01 | 23.64 |
| HTNB 2006-040-2 | | 1° | 4 | 10.21° | — | — | 4.10 | 4.23 | 4.53 |
| HTNB 2006-060-2 | | | 6 | 8.55° | — | — | 6.17 | 6.37 | 6.83 |
| HTNB 2006-080-2 | | | 8 | 7.36° | — | — | 8.23 | 8.51 | 9.13 |
| HTNB 2006-100-2 | | | 10 | 6.45° | — | — | 10.30 | 10.65 | 11.43 |
| HTNB 2006-120-2 | | | 12 | 5.74° | — | — | 12.37 | 12.79 | 13.72 |
| HTNB 2006-140-2 | | | 14 | 5.18° | — | — | 14.43 | 14.93 | 16.03 |
| HTNB 2006-160-2 | | | 16 | 4.71° | — | — | 16.50 | 17.07 | 18.32 |
| HTNB 2006-200-2 | | | 20 | 3.99° | — | — | 20.64 | 21.34 | 22.92 |
| HTNB 2006-040-3 | | 1°30′ | 4 | 10.31° | — | — | — | 4.12 | 4.41 |
| HTNB 2006-060-3 | | | 6 | 8.67° | — | — | — | 6.19 | 6.64 |
| HTNB 2006-080-3 | | | 8 | 7.48° | — | — | — | 8.26 | 8.86 |
| HTNB 2006-100-3 | | | 10 | 6.57° | — | — | — | 10.34 | 11.09 |
| HTNB 2006-120-3 | | | 12 | 5.86° | — | — | — | 12.40 | 13.31 |
| HTNB 2006-140-3 | | | 14 | 5.29° | — | — | — | 14.46 | 15.52 |
| HTNB 2006-160-3 | | | 16 | 4.82° | — | — | — | 16.54 | 17.76 |
| HTNB 2006-200-3 | | | 20 | 4.09° | — | — | — | 20.67 | 22.19 |
| HTNB 2006-080-4 | | 2° | 8 | 7.60° | — | — | — | — | 8.59 |
| HTNB 2006-120-4 | | | 12 | 5.98° | — | — | — | — | 12.89 |
| HTNB 2006-200-4 | | | 20 | 4.19° | — | — | — | — | 21.49 |
| HTNB 2006-080-6 | | 3° | 8 | 7.86° | — | — | — | — | — |
| HTNB 2006-120-6 | | | 12 | 6.23° | — | — | — | — | — |
| HTNB 2006-200-6 | | | 20 | 4.41° | — | — | — | — | — |
| HTNB 2006-120-10 | | 5° | 12 | 6.82° | — | — | — | — | — |
| HTNB 2006-200-10 | | | 20 | 4.92° | — | — | — | — | — |

Next Page ➡

| | Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HTNB 2008-060-1 | R0.4 | 30' | 6 | 1.2 | 0.64 | 0.76 | 16° | 50 | 4 | B | 8,880 |
| | HTNB 2008-080-1 | | | 8 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2008-120-1 | | | 12 | | | | | 60 | 4 | | 9,360 |
| | HTNB 2008-160-1 | | | 16 | | | | | 60 | 4 | | 11,500 |
| | HTNB 2008-060-2 | | 1° | 6 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2008-080-2 | | | 8 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2008-120-2 | | | 12 | | | | | 60 | 4 | | 9,360 |
| | HTNB 2008-160-2 | | | 16 | | | | | 60 | 4 | | 11,500 |
| | HTNB 2008-060-3 | | 1°30′ | 6 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2008-080-3 | | | 8 | | | | | 50 | 4 | | 8,880 |
| | HTNB 2008-120-3 | | | 12 | | | | | 60 | 4 | | 9,360 |
| | HTNB 2008-160-3 | | | 16 | | | | | 60 | 4 | | 11,500 |
| | HTNB 2010-060-1 | R0.5 | 30′ | 6 | 1.5 | 0.8 | 0.95 | 16° | 50 | 4 | B | 7,560 |
| | HTNB 2010-080-1 | | | 8 | | | | | 50 | 4 | | 7,560 |
| | HTNB 2010-100-1 | | | 10 | | | | | 50 | 4 | | 7,560 |
| | HTNB 2010-120-1 | | | 12 | | | | | 50 | 4 | | 7,560 |
| ※ | HTNB 2010-140-1 | | | 14 | | | | | 50 | 4 | | 7,560 |
| | HTNB 2010-160-1 | | | 16 | | | | | 50 | 4 | | 7,560 |
| ※ | HTNB 2010-180-1 | | | 18 | | | | | 50 | 4 | | 7,560 |
| | HTNB 2010-200-1 | | | 20 | | | | | 60 | 4 | | 9,600 |
| | HTNB 2010-220-1 | | | 22 | | | | | 60 | 4 | | 9,600 |
| | HTNB 2010-260-1 | | | 26 | | | | | 65 | 4 | | 10,080 |
| ※ | HTNB 2010-300-1 | | | 30 | | | | | 70 | 4 | | 10,560 |
| | HTNB 2010-320-1 | | | 32 | | | | | 70 | 4 | | 10,560 |
| | HTNB 2010-360-1 | | | 36 | | | | | 80 | 4 | | 11,040 |

※Additional model

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HTNB 2008-060-1** | R0.4 | 30′ | 6 | 8.26° | — | 6.14 | 6.34 | 6.54 | 7.01 |
| **HTNB 2008-080-1** | | | 8 | 7.04° | — | 8.21 | 8.47 | 8.75 | 9.38 |
| **HTNB 2008-120-1** | | | 12 | 5.44° | — | 12.33 | 12.74 | 13.17 | 14.13 |
| **HTNB 2008-160-1** | | | 16 | 4.43° | — | 16.47 | 17.01 | 17.59 | 18.88 |
| **HTNB 2008-060-2** | | 1° | 6 | 8.37° | — | — | 6.17 | 6.37 | 6.82 |
| **HTNB 2008-080-2** | | | 8 | 7.16° | — | — | 8.23 | 8.51 | 9.12 |
| **HTNB 2008-120-2** | | | 12 | 5.55° | — | — | 12.37 | 12.79 | 13.72 |
| **HTNB 2008-160-2** | | | 16 | 4.53° | — | — | 16.50 | 17.06 | 18.31 |
| **HTNB 2008-060-3** | | 1°30′ | 6 | 8.49° | — | — | — | 6.20 | 6.64 |
| **HTNB 2008-080-3** | | | 8 | 7.28° | — | — | — | 8.26 | 8.86 |
| **HTNB 2008-120-3** | | | 12 | 5.67° | — | — | — | 12.40 | 13.30 |
| **HTNB 2008-160-3** | | | 16 | 4.63° | — | — | — | 16.54 | 17.75 |
| **HTNB 2010-060-1** | R0.5 | 30′ | 6 | 8.06° | — | 6.14 | 6.33 | 6.54 | 7.00 |
| **HTNB 2010-080-1** | | | 8 | 6.84° | — | 8.21 | 8.47 | 8.75 | 9.37 |
| **HTNB 2010-100-1** | | | 10 | 5.93° | — | 10.27 | 10.60 | 10.96 | 11.74 |
| **HTNB 2010-120-1** | | | 12 | 5.24° | — | 12.33 | 12.73 | 13.16 | 14.11 |
| **HTNB 2010-140-1** | | | 14 | 4.69° | — | 14.39 | 14.85 | 15.35 | 16.47 |
| **HTNB 2010-160-1** | | | 16 | 4.25° | — | 16.46 | 17.00 | 17.58 | 18.86 |
| **HTNB 2010-180-1** | | | 18 | 3.88° | — | 18.51 | 19.12 | 19.77 | 21.21 |
| **HTNB 2010-200-1** | | | 20 | 3.57° | — | 20.60 | 21.27 | 22.00 | 23.61 |
| **HTNB 2010-220-1** | | | 22 | 3.31° | — | 22.66 | 23.41 | 24.20 | 25.98 |
| **HTNB 2010-260-1** | | | 26 | 2.88° | — | 26.79 | 27.67 | 28.62 | No Interference |
| **HTNB 2010-300-1** | | | 30 | 2.55° | — | 30.90 | 31.93 | 33.02 | No Interference |
| **HTNB 2010-320-1** | | | 32 | 2.41° | — | 32.98 | 34.07 | 35.24 | No Interference |
| **HTNB 2010-360-1** | | | 36 | 2.18° | — | 37.11 | 38.34 | 39.66 | No Interference |

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| | Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **HTNB 2010-060-2** | R0.5 | 1° | 6 | 1.5 | 0.8 | 0.95 | 16° | 50 | 4 | B | 7,560 |
| | **HTNB 2010-080-2** | | | 8 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-100-2** | | | 10 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-120-2** | | | 12 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-140-2** | | | 14 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-160-2** | | | 16 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-180-2** | | | 18 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-200-2** | | | 20 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2010-220-2** | | | 22 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2010-260-2** | | | 26 | | | | | 65 | 4 | | 10,080 |
| ※ | **HTNB 2010-300-2** | | | 30 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2010-320-2** | | | 32 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2010-360-2** | | | 36 | | | | | 80 | 4 | | 11,040 |
| | **HTNB 2010-060-3** | | 1°30′ | 6 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-080-3** | | | 8 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-100-3** | | | 10 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-120-3** | | | 12 | | | | | 50 | 4 | | 7,560 |
| ※ | **HTNB 2010-140-3** | | | 14 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-160-3** | | | 16 | | | | | 50 | 4 | | 7,560 |
| ※ | **HTNB 2010-180-3** | | | 18 | | | | | 50 | 4 | | 7,560 |
| | **HTNB 2010-200-3** | | | 20 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2010-220-3** | | | 22 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2010-260-3** | | | 26 | | | | | 65 | 4 | | 10,080 |
| ※ | **HTNB 2010-300-3** | | | 30 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2010-320-3** | | | 32 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2010-360-3** | | | 36 | | | | | 80 | 4 | | 11,040 |
| ※ | **HTNB 2010-120-4** | | 2° | 12 | | | | | 50 | 4 | | 7,560 |
| ※ | **HTNB 2010-160-4** | | | 16 | | | | | 50 | 4 | | 7,560 |
| ※ | **HTNB 2010-200-4** | | | 20 | | | | | 60 | 4 | | 9,600 |
| ※ | **HTNB 2010-300-4** | | | 30 | | | | | 70 | 4 | | 10,560 |
| ※ | **HTNB 2010-120-6** | | 3° | 12 | | | | | 50 | 4 | | 7,560 |
| ※ | **HTNB 2010-160-6** | | | 16 | | | | | 50 | 4 | | 7,560 |
| ※ | **HTNB 2010-200-6** | | | 20 | | | | | 60 | 4 | | 9,600 |
| ※ | **HTNB 2010-298-6** | | | 29.8 | | | | — | 70 | 4 | C | 10,560 |
| ※ | **HTNB 2010-120-10** | | 5° | 12 | | | | 16° | 50 | 4 | B | 7,560 |
| ※ | **HTNB 2010-200-10** | | | 20 | | | | | 70 | 6 | | 9,600 |

※Additional model

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HTNB 2010-060-2** | R0.5 | 1° | 6 | 8.17° | — | — | 6.18 | 6.38 | 6.82 |
| **HTNB 2010-080-2** | | | 8 | 6.95° | — | — | 8.24 | 8.51 | 9.12 |
| **HTNB 2010-100-2** | | | 10 | 6.04° | — | — | 10.31 | 10.66 | 11.42 |
| **HTNB 2010-120-2** | | | 12 | 5.35° | — | — | 12.38 | 12.79 | 13.72 |
| **HTNB 2010-140-2** | | | 14 | 4.79° | — | — | 14.45 | 14.93 | 16.02 |
| **HTNB 2010-160-2** | | | 16 | 4.34° | — | — | 16.51 | 17.07 | 18.31 |
| **HTNB 2010-180-2** | | | 18 | 3.97° | — | — | 18.58 | 19.21 | 20.61 |
| **HTNB 2010-200-2** | | | 20 | 3.65° | — | — | 20.64 | 21.35 | 22.91 |
| **HTNB 2010-220-2** | | | 22 | 3.39° | — | — | 22.71 | 23.48 | 25.21 |
| **HTNB 2010-260-2** | | | 26 | 2.95° | — | — | 26.85 | 27.76 | No Interference |
| **HTNB 2010-300-2** | | | 30 | 2.62° | — | — | 30.97 | 32.03 | No Interference |
| **HTNB 2010-320-2** | | | 32 | 2.48° | — | — | 33.05 | 34.18 | No Interference |
| **HTNB 2010-360-2** | | | 36 | 2.24° | — | — | 37.18 | 38.46 | No Interference |
| **HTNB 2010-060-3** | | 1°30′ | 6 | 8.28° | — | — | — | 6.21 | 6.65 |
| **HTNB 2010-080-3** | | | 8 | 7.06° | — | — | — | 8.28 | 8.87 |
| **HTNB 2010-100-3** | | | 10 | 6.16° | — | — | — | 10.35 | 11.10 |
| **HTNB 2010-120-3** | | | 12 | 5.45° | — | — | — | 12.42 | 13.32 |
| **HTNB 2010-140-3** | | | 14 | 4.90° | — | — | — | 14.47 | 15.52 |
| **HTNB 2010-160-3** | | | 16 | 4.44° | — | — | — | 16.56 | 17.77 |
| **HTNB 2010-180-3** | | | 18 | 4.06° | — | — | — | 18.61 | 19.97 |
| **HTNB 2010-200-3** | | | 20 | 3.74° | — | — | — | 20.70 | 22.21 |
| **HTNB 2010-220-3** | | | 22 | 3.47° | — | — | — | 22.77 | 24.44 |
| **HTNB 2010-260-3** | | | 26 | 3.03° | — | — | — | 26.91 | 28.88 |
| **HTNB 2010-300-3** | | | 30 | 2.69° | — | — | — | 31.03 | No Interference |
| **HTNB 2010-320-3** | | | 32 | 2.55° | — | — | — | 33.11 | No Interference |
| **HTNB 2010-360-3** | | | 36 | 2.30° | — | — | — | 37.25 | No Interference |
| **HTNB 2010-120-4** | | 2° | 12 | 5.57° | — | — | — | — | 12.88 |
| **HTNB 2010-160-4** | | | 16 | 4.55° | — | — | — | — | 17.18 |
| **HTNB 2010-200-4** | | | 20 | 3.84° | — | — | — | — | 21.48 |
| **HTNB 2010-300-4** | | | 30 | 2.77° | — | — | — | — | No Interference |
| **HTNB 2010-120-6** | | 3° | 12 | 5.82° | — | — | — | — | — |
| **HTNB 2010-160-6** | | | 16 | 4.77° | — | — | — | — | — |
| **HTNB 2010-200-6** | | | 20 | 4.05° | — | — | — | — | — |
| **HTNB 2010-298-6** | | | 29.8 | — | — | — | — | — | — |
| **HTNB 2010-120-10** | | 5° | 12 | 6.38° | — | — | — | — | — |
| **HTNB 2010-200-10** | | | 20 | 6.35° | — | — | — | — | — |

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| | Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Effective Length $\ell_1$ | Length of Cut $\ell$ | Neck Diameter $\phi d_1$ | Shank Taper Angle Bta | Overall Length L | Shank Diameter $\phi d$ | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **HTNB 2015-100-1** | R0.75 | 30′ | 10 | 2.25 | 1.2 | 1.42 | 16° | 60 | 4 | B | 7,920 |
| | **HTNB 2015-120-1** | | | 12 | | | | | 60 | 4 | | 7,920 |
| | **HTNB 2015-160-1** | | | 16 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-200-1** | | | 20 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-220-1** | | | 22 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-260-1** | | | 26 | | | | | 70 | 4 | | 9,360 |
| | **HTNB 2015-300-1** | | | 30 | | | | | 70 | 4 | | 9,360 |
| | **HTNB 2015-360-1** | | | 36 | | | | | 80 | 4 | | 11,040 |
| | **HTNB 2015-100-2** | | 1° | 10 | | | | | 60 | 4 | | 7,920 |
| | **HTNB 2015-120-2** | | | 12 | | | | | 60 | 4 | | 7,920 |
| | **HTNB 2015-160-2** | | | 16 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-200-2** | | | 20 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-260-2** | | | 26 | | | | | 70 | 4 | | 9,360 |
| | **HTNB 2015-300-2** | | | 30 | | | | | 70 | 4 | | 9,360 |
| | **HTNB 2015-360-2** | | | 36 | | | | | 80 | 4 | | 11,040 |
| | **HTNB 2015-100-3** | | 1°30′ | 10 | | | | | 60 | 4 | | 7,920 |
| | **HTNB 2015-120-3** | | | 12 | | | | | 60 | 4 | | 7,920 |
| | **HTNB 2015-160-3** | | | 16 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-200-3** | | | 20 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2015-260-3** | | | 26 | | | | | 70 | 4 | | 9,360 |
| | **HTNB 2015-300-3** | | | 30 | | | | | 70 | 4 | | 9,360 |
| | **HTNB 2015-360-3** | | | 36 | | | | | 80 | 4 | | 11,040 |
| ※ | **HTNB 2015-120-4** | | 2° | 12 | | | | | 60 | 4 | | 7,920 |
| ※ | **HTNB 2015-160-4** | | | 16 | | | | | 60 | 4 | | 8,640 |
| ※ | **HTNB 2015-200-4** | | | 20 | | | | | 60 | 4 | | 8,640 |
| ※ | **HTNB 2015-300-4** | | | 30 | | | | | 70 | 6 | | 11,040 |
| ※ | **HTNB 2015-120-6** | | 3° | 12 | | | | | 60 | 4 | | 7,920 |
| ※ | **HTNB 2015-160-6** | | | 16 | | | | | 60 | 4 | | 8,640 |
| ※ | **HTNB 2015-200-6** | | | 20 | | | | | 60 | 4 | | 8,640 |
| ※ | **HTNB 2015-300-6** | | | 30 | | | | | 70 | 6 | | 11,040 |

※Additional model

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HTNB 2015-100-1** | R0.75 | 30′ | 10 | 5.36° | — | 10.27 | 10.59 | 10.93 | 11.70 |
| **HTNB 2015-120-1** | | | 12 | 4.69° | — | 12.33 | 12.72 | 13.14 | 14.08 |
| **HTNB 2015-160-1** | | | 16 | 3.75° | — | 16.46 | 16.99 | 17.56 | 18.82 |
| **HTNB 2015-200-1** | | | 20 | 3.12° | — | 20.59 | 21.26 | 21.98 | 23.57 |
| **HTNB 2015-220-1** | | | 22 | 2.88° | — | 22.66 | 23.39 | 24.18 | No Interference |
| **HTNB 2015-260-1** | | | 26 | 2.50° | — | 26.79 | 27.66 | 28.60 | No Interference |
| **HTNB 2015-300-1** | | | 30 | 2.20° | — | 30.92 | 31.93 | 33.01 | No Interference |
| **HTNB 2015-360-1** | | | 36 | 1.87° | — | 37.11 | 38.33 | No Interference | No Interference |
| **HTNB 2015-100-2** | | 1° | 10 | 5.46° | — | — | 10.31 | 10.65 | 11.39 |
| **HTNB 2015-120-2** | | | 12 | 4.79° | — | — | 12.38 | 12.78 | 13.69 |
| **HTNB 2015-160-2** | | | 16 | 3.83° | — | — | 16.51 | 17.06 | 18.29 |
| **HTNB 2015-200-2** | | | 20 | 3.20° | — | — | 20.65 | 21.34 | 22.89 |
| **HTNB 2015-260-2** | | | 26 | 2.56° | — | — | 26.85 | 27.76 | No Interference |
| **HTNB 2015-300-2** | | | 30 | 2.26° | — | — | 30.98 | 32.03 | No Interference |
| **HTNB 2015-360-2** | | | 36 | 1.92° | — | — | 37.18 | No Interference | No Interference |
| **HTNB 2015-100-3** | | 1°30′ | 10 | 5.57° | — | — | — | 10.36 | 11.09 |
| **HTNB 2015-120-3** | | | 12 | 4.89° | — | — | — | 12.43 | 13.31 |
| **HTNB 2015-160-3** | | | 16 | 3.92° | — | — | — | 16.57 | 17.76 |
| **HTNB 2015-200-3** | | | 20 | 3.28° | — | — | — | 20.71 | 22.21 |
| **HTNB 2015-260-3** | | | 26 | 2.63° | — | — | — | 26.91 | No Interference |
| **HTNB 2015-300-3** | | | 30 | 2.32° | — | — | — | 31.05 | No Interference |
| **HTNB 2015-360-3** | | | 36 | 1.98° | — | — | — | No Interference | No Interference |
| **HTNB 2015-120-4** | | 2° | 12 | 4.98° | — | — | — | — | 12.90 |
| **HTNB 2015-160-4** | | | 16 | 4.02° | — | — | — | — | 17.20 |
| **HTNB 2015-200-4** | | | 20 | 3.36° | — | — | — | — | 21.50 |
| **HTNB 2015-300-4** | | | 30 | 3.84° | — | — | — | — | 32.25 |
| **HTNB 2015-120-6** | | 3° | 12 | 5.21° | — | — | — | — | — |
| **HTNB 2015-160-6** | | | 16 | 4.22° | — | — | — | — | — |
| **HTNB 2015-200-6** | | | 20 | 3.55° | — | — | — | — | — |
| **HTNB 2015-300-6** | | | 30 | 4.04° | — | — | — | — | — |

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| | Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **HTNB 2020-120-1** | R1 | 30′ | 12 | 3 | 1.6 | 1.91 | 16° | 60 | 4 | B | 8,100 |
| | **HTNB 2020-160-1** | | | 16 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-200-1** | | | 20 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2020-220-1** | | | 22 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2020-240-1** | | | 24 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2020-260-1** | | | 26 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2020-280-1** | | | 28 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-300-1** | | | 30 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-320-1** | | | 32 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-340-1** | | | 34 | | | | | 70 | 4 | | 11,040 |
| | **HTNB 2020-360-1** | | | 36 | | | | | 80 | 4 | | 11,040 |
| | **HTNB 2020-400-1** | | | 40 | | | | | 80 | 4 | | 12,480 |
| | **HTNB 2020-100-2** | | 1° | 10 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-120-2** | | | 12 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-160-2** | | | 16 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-200-2** | | | 20 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2020-220-2** | | | 22 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2020-240-2** | | | 24 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2020-260-2** | | | 26 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2020-280-2** | | | 28 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-300-2** | | | 30 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-320-2** | | | 32 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-340-2** | | | 34 | | | | | 70 | 4 | | 11,040 |
| | **HTNB 2020-360-2** | | | 36 | | | | | 80 | 4 | | 11,040 |
| | **HTNB 2020-400-2** | | | 40 | | | | | 80 | 4 | | 13,100 |
| ※ | **HTNB 2020-100-3** | | 1°30′ | 10 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-120-3** | | | 12 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-160-3** | | | 16 | | | | | 60 | 4 | | 8,100 |
| | **HTNB 2020-200-3** | | | 20 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2020-220-3** | | | 22 | | | | | 60 | 4 | | 8,640 |
| | **HTNB 2020-240-3** | | | 24 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2020-260-3** | | | 26 | | | | | 60 | 4 | | 9,600 |
| | **HTNB 2020-280-3** | | | 28 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-300-3** | | | 30 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-320-3** | | | 32 | | | | | 70 | 4 | | 10,560 |
| | **HTNB 2020-340-3** | | | 34 | | | | | 70 | 4 | | 11,040 |
| | **HTNB 2020-360-3** | | | 36 | | | | | 80 | 4 | | 11,040 |
| | **HTNB 2020-400-3** | | | 40 | | | | | 80 | 4 | | 13,100 |
| ※ | **HTNB 2020-120-4** | | 2° | 12 | | | | | 60 | 4 | | 8,100 |
| ※ | **HTNB 2020-160-4** | | | 16 | | | | | 60 | 4 | | 8,100 |
| ※ | **HTNB 2020-200-4** | | | 20 | | | | | 60 | 4 | | 8,640 |
| ※ | **HTNB 2020-300-4** | | | 30 | | | | | 70 | 6 | | 11,440 |
| ※ | **HTNB 2020-400-4** | | | 40 | | | | | 80 | 6 | | 13,980 |
| ※ | **HTNB 2020-120-6** | | 3° | 12 | | | | | 60 | 4 | | 8,100 |
| ※ | **HTNB 2020-160-6** | | | 16 | | | | | 60 | 4 | | 8,100 |
| ※ | **HTNB 2020-200-6** | | | 20 | | | | | 60 | 4 | | 8,640 |
| ※ | **HTNB 2020-300-6** | | | 30 | | | | | 70 | 6 | | 11,440 |
| ※ | **HTNB 2020-400-6** | | | 40 | | | | | 80 | 6 | | 13,980 |

※Additional model

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| HTNB 2020-120-1 | R1 | 30′ | 12 | 4.05° | — | 12.34 | 12.72 | 13.14 | 14.05 |
| HTNB 2020-160-1 | | | 16 | 3.19° | — | 16.47 | 16.99 | 17.55 | 18.80 |
| HTNB 2020-200-1 | | | 20 | 2.63° | — | 20.60 | 21.26 | 21.97 | No Interference |
| HTNB 2020-220-1 | | | 22 | 2.42° | — | 22.66 | 23.39 | 24.17 | No Interference |
| HTNB 2020-240-1 | | | 24 | 2.23° | — | 24.73 | 25.53 | 26.38 | No Interference |
| HTNB 2020-260-1 | | | 26 | 2.08° | — | 26.79 | 27.66 | 28.59 | No Interference |
| HTNB 2020-280-1 | | | 28 | 1.94° | — | 28.86 | 29.80 | No Interference | No Interference |
| HTNB 2020-300-1 | | | 30 | 1.83° | — | 30.92 | 31.93 | No Interference | No Interference |
| HTNB 2020-320-1 | | | 32 | 1.72° | — | 32.99 | 34.07 | No Interference | No Interference |
| HTNB 2020-340-1 | | | 34 | 1.63° | — | 35.05 | 36.20 | No Interference | No Interference |
| HTNB 2020-360-1 | | | 36 | 1.54° | — | 37.12 | 38.33 | No Interference | No Interference |
| HTNB 2020-400-1 | | | 40 | 1.40° | — | 41.25 | No Interference | No Interference | No Interference |
| HTNB 2020-100-2 | | 1° | 10 | 4.77° | — | — | 10.34 | 10.66 | 11.40 |
| HTNB 2020-120-2 | | | 12 | 4.13° | — | — | 12.40 | 12.80 | 13.69 |
| HTNB 2020-160-2 | | | 16 | 3.26° | — | — | 16.53 | 17.08 | 18.29 |
| HTNB 2020-200-2 | | | 20 | 2.69° | — | — | 20.67 | 21.35 | No Interference |
| HTNB 2020-220-2 | | | 22 | 2.48° | — | — | 22.73 | 23.49 | No Interference |
| HTNB 2020-240-2 | | | 24 | 2.29° | — | — | 24.80 | 25.63 | No Interference |
| HTNB 2020-260-2 | | | 26 | 2.13° | — | — | 26.87 | 27.77 | No Interference |
| HTNB 2020-280-2 | | | 28 | 2.00° | — | — | 28.94 | 29.91 | No Interference |
| HTNB 2020-300-2 | | | 30 | 1.88° | — | — | 31.00 | No Interference | No Interference |
| HTNB 2020-320-2 | | | 32 | 1.77° | — | — | 33.07 | No Interference | No Interference |
| HTNB 2020-340-2 | | | 34 | 1.67° | — | — | 35.14 | No Interference | No Interference |
| HTNB 2020-360-2 | | | 36 | 1.59° | — | — | 37.20 | No Interference | No Interference |
| HTNB 2020-400-2 | | | 40 | 1.44° | — | — | No Interference | No Interference | No Interference |
| HTNB 2020-100-3 | | 1°30′ | 10 | 4.83° | — | — | — | 10.38 | 11.09 |
| HTNB 2020-120-3 | | | 12 | 4.22° | — | — | — | 12.46 | 13.33 |
| HTNB 2020-160-3 | | | 16 | 3.34° | — | — | — | 16.60 | 17.78 |
| HTNB 2020-200-3 | | | 20 | 2.76° | — | — | — | 20.74 | No Interference |
| HTNB 2020-220-3 | | | 22 | 2.54° | — | — | — | 22.81 | No Interference |
| HTNB 2020-240-3 | | | 24 | 2.35° | — | — | — | 24.88 | No Interference |
| HTNB 2020-260-3 | | | 26 | 2.19° | — | — | — | 26.95 | No Interference |
| HTNB 2020-280-3 | | | 28 | 2.05° | — | — | — | 29.02 | No Interference |
| HTNB 2020-300-3 | | | 30 | 1.93° | — | — | — | No Interference | No Interference |
| HTNB 2020-320-3 | | | 32 | 1.82° | — | — | — | No Interference | No Interference |
| HTNB 2020-340-3 | | | 34 | 1.72° | — | — | — | No Interference | No Interference |
| HTNB 2020-360-3 | | | 36 | 1.63° | — | — | — | No Interference | No Interference |
| HTNB 2020-400-3 | | | 40 | 1.48° | — | — | — | No Interference | No Interference |
| HTNB 2020-120-4 | | 2° | 12 | 4.29° | — | — | — | — | 12.97 |
| HTNB 2020-160-4 | | | 16 | 3.41° | — | — | — | — | 17.26 |
| HTNB 2020-200-4 | | | 20 | 2.83° | — | — | — | — | No Interference |
| HTNB 2020-300-4 | | | 30 | 3.52° | — | — | — | — | 32.31 |
| HTNB 2020-400-4 | | | 40 | 2.78° | — | — | — | — | No Interference |
| HTNB 2020-120-6 | | 3° | 12 | 4.48° | — | — | — | — | — |
| HTNB 2020-160-6 | | | 16 | 3.58° | — | — | — | — | — |
| HTNB 2020-200-6 | | | 20 | 2.98° | — | — | — | — | — |
| HTNB 2020-300-6 | | | 30 | 3.71° | — | — | — | — | — |
| HTNB 2020-400-6 | | | 40 | 2.94° | — | — | — | — | — |

Next Page ➡

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **HTNB 2030-200-1** | R1.5 | 30′ | 20 | 4.5 | 2.4 | 2.89 | 16° | 60 | 6 | B | 9,740 |
| **HTNB 2030-220-1** | | | 22 | | | | | 60 | 6 | | 9,740 |
| **HTNB 2030-260-1** | | | 26 | | | | | 70 | 6 | | 10,400 |
| **HTNB 2030-300-1** | | | 30 | | | | | 70 | 6 | | 11,880 |
| **HTNB 2030-320-1** | | | 32 | | | | | 70 | 6 | | 12,480 |
| **HTNB 2030-360-1** | | | 36 | | | | | 80 | 6 | | 13,000 |
| **HTNB 2030-400-1** | | | 40 | | | | | 80 | 6 | | 13,200 |
| **HTNB 2030-420-1** | | | 42 | | | | | 90 | 6 | | 13,680 |
| **HTNB 2030-520-1** | | | 52 | | | | | 100 | 6 | | 15,360 |
| **HTNB 2030-200-2** | | 1° | 20 | | | | | 60 | 6 | | 9,740 |
| **HTNB 2030-260-2** | | | 26 | | | | | 70 | 6 | | 10,400 |
| **HTNB 2030-300-2** | | | 30 | | | | | 70 | 6 | | 11,880 |
| **HTNB 2030-320-2** | | | 32 | | | | | 70 | 6 | | 12,480 |
| **HTNB 2030-360-2** | | | 36 | | | | | 80 | 6 | | 13,000 |
| **HTNB 2030-400-2** | | | 40 | | | | | 80 | 6 | | 13,200 |
| **HTNB 2030-420-2** | | | 42 | | | | | 90 | 6 | | 13,680 |
| **HTNB 2030-480-2** | | | 48 | | | | | 100 | 6 | | 15,360 |
| **HTNB 2030-520-2** | | | 52 | | | | | 100 | 6 | | 15,360 |
| **HTNB 2030-620-2** | | | 62 | | | | | 100 | 6 | | 18,230 |
| **HTNB 2030-200-3** | | 1°30′ | 20 | | | | | 60 | 6 | | 9,740 |
| **HTNB 2030-260-3** | | | 26 | | | | | 70 | 6 | | 10,400 |
| **HTNB 2030-300-3** | | | 30 | | | | | 70 | 6 | | 11,880 |
| **HTNB 2030-320-3** | | | 32 | | | | | 70 | 6 | | 12,480 |
| **HTNB 2030-360-3** | | | 36 | | | | | 80 | 6 | | 13,000 |
| **HTNB 2030-400-3** | | | 40 | | | | | 80 | 6 | | 13,200 |
| **HTNB 2030-420-3** | | | 42 | | | | | 90 | 6 | | 13,680 |
| **HTNB 2030-580-3** | | | 58 | | | | | 100 | 6 | | 15,360 |
| **HTNB 2040-300-1** | R2 | 30′ | 30 | 6 | 3.2 | 3.87 | 16° | 80 | 6 | B | 11,590 |
| **HTNB 2040-400-1** | | | 40 | | | | | 80 | 6 | | 15,000 |
| **HTNB 2040-620-1** | | | 62 | | | | | 120 | 6 | | 19,200 |
| **HTNB 2040-200-2** | | 1° | 20 | | | | | 80 | 6 | | 11,590 |
| **HTNB 2040-300-2** | | | 30 | | | | | 80 | 6 | | 11,590 |
| **HTNB 2040-360-2** | | | 36 | | | | | 80 | 6 | | 13,420 |
| **HTNB 2040-400-2** | | | 40 | | | | | 80 | 6 | | 15,000 |
| **HTNB 2040-600-2** | | | 60 | | | | | 120 | 6 | | 19,200 |
| **HTNB 2040-410-3** | | 1°30′ | 41 | | | | | 80 | 6 | | 15,000 |
| ※ **HTNB 2040-600-3** | | | 60 | | | | | 120 | 8 | | 28,000 |
| **HTNB 2040-800-3** | | | 80 | | | | — | 130 | 8 | C | 30,360 |

※Additional model

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length $\ell_2$ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HTNB 2030-200-1** | R1.5 | 30′ | 20 | 3.71° | — | 20.59 | 21.23 | 21.92 | 23.46 |
| **HTNB 2030-220-1** | | | 22 | 3.43° | — | 22.65 | 23.36 | 24.13 | 25.83 |
| **HTNB 2030-260-1** | | | 26 | 2.97° | — | 26.78 | 27.63 | 28.54 | No Interference |
| **HTNB 2030-300-1** | | | 30 | 2.62° | — | 30.91 | 31.90 | 32.96 | No Interference |
| **HTNB 2030-320-1** | | | 32 | 2.48° | — | 32.98 | 34.04 | 35.17 | No Interference |
| **HTNB 2030-360-1** | | | 36 | 2.23° | — | 37.11 | 38.30 | 39.58 | No Interference |
| **HTNB 2030-400-1** | | | 40 | 2.03° | — | 41.23 | 42.57 | 44.00 | No Interference |
| **HTNB 2030-420-1** | | | 42 | 1.94° | — | 43.30 | 44.70 | No Interference | No Interference |
| **HTNB 2030-520-1** | | | 52 | 1.60° | — | 53.62 | 55.38 | No Interference | No Interference |
| **HTNB 2030-200-2** | | 1° | 20 | 3.79° | — | — | 20.66 | 21.33 | 22.83 |
| **HTNB 2030-260-2** | | | 26 | 3.04° | — | — | 26.87 | 27.75 | 29.72 |
| **HTNB 2030-300-2** | | | 30 | 2.69° | — | — | 31.00 | 32.03 | No Interference |
| **HTNB 2030-320-2** | | | 32 | 2.54° | — | — | 33.07 | 34.17 | No Interference |
| **HTNB 2030-360-2** | | | 36 | 2.29° | — | — | 37.20 | 38.44 | No Interference |
| **HTNB 2030-400-2** | | | 40 | 2.08° | — | — | 41.33 | 42.72 | No Interference |
| **HTNB 2030-420-2** | | | 42 | 1.99° | — | — | 43.40 | No Interference | No Interference |
| **HTNB 2030-480-2** | | | 48 | 1.77° | — | — | 49.60 | No Interference | No Interference |
| **HTNB 2030-520-2** | | | 52 | 1.64° | — | — | 53.74 | No Interference | No Interference |
| **HTNB 2030-620-2** | | | 62 | 1.39° | — | — | No Interference | No Interference | No Interference |
| **HTNB 2030-200-3** | | 1°30′ | 20 | 3.88° | — | — | — | 20.75 | 22.20 |
| **HTNB 2030-260-3** | | | 26 | 3.12° | — | — | — | 26.96 | 28.87 |
| **HTNB 2030-300-3** | | | 30 | 2.76° | — | — | — | 31.09 | No Interference |
| **HTNB 2030-320-3** | | | 32 | 2.61° | — | — | — | 33.16 | No Interference |
| **HTNB 2030-360-3** | | | 36 | 2.35° | — | — | — | 37.30 | No Interference |
| **HTNB 2030-400-3** | | | 40 | 2.14° | — | — | — | 41.44 | No Interference |
| **HTNB 2030-420-3** | | | 42 | 2.05° | — | — | — | 43.51 | No Interference |
| **HTNB 2030-580-3** | | | 58 | 1.53° | — | — | — | No Interference | No Interference |
| **HTNB 2040-300-1** | R2 | 30′ | 30 | 1.88° | — | 30.91 | 31.88 | No Interference | No Interference |
| **HTNB 2040-400-1** | | | 40 | 1.43° | — | 41.23 | No Interference | No Interference | No Interference |
| **HTNB 2040-620-1** | | | 62 | 0.94° | — | No Interference | No Interference | No Interference | No Interference |
| **HTNB 2040-200-2** | | 1° | 20 | 2.81° | — | — | 20.67 | 21.32 | No Interference |
| **HTNB 2040-300-2** | | | 30 | 1.93° | — | — | 31.00 | No Interference | No Interference |
| **HTNB 2040-360-2** | | | 36 | 1.63° | — | — | 37.21 | No Interference | No Interference |
| **HTNB 2040-400-2** | | | 40 | 1.47° | — | — | No Interference | No Interference | No Interference |
| **HTNB 2040-600-2** | | | 60 | 1.00° | — | — | No Interference | No Interference | No Interference |
| **HTNB 2040-410-3** | | 1°30′ | 41 | 1.48° | — | — | — | No Interference | No Interference |
| **HTNB 2040-600-3** | | | 60 | 1.92° | — | — | — | No Interference | No Interference |
| **HTNB 2040-800-3** | | | 80 | — | — | — | — | No Interference | No Interference |

## Milling Conditions for HTNB

| WORK MATERIAL | | | COPPER / CARBON STEELS Cu / S45C / S50C | | | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | |
| | | | | | | Roughing (mm) | Finishing (mm) | | | | Roughing (mm) | Finishing (mm) |
| **2002** | **R0.1** | 1.5 | 42,000 | 640 | 0.008 | 0.02 | 0.015 | 29,000 | 430 | 0.006 | 0.02 | 0.015 |
| | | 2 | 33,000 | 370 | 0.006 | 0.02 | 0.011 | 23,500 | 260 | 0.005 | 0.02 | 0.011 |
| | | 3 | 27,000 | 270 | 0.002 | 0.02 | 0.01 | 19,000 | 165 | 0.001 | 0.02 | 0.009 |
| **2003** | **R0.15** | 2 | 36,000 | 650 | 0.009 | 0.03 | 0.018 | 25,200 | 400 | 0.007 | 0.03 | 0.016 |
| | | 3 | 33,000 | 500 | 0.004 | 0.03 | 0.015 | 23,000 | 330 | 0.003 | 0.03 | 0.014 |
| **2004** | **R0.2** | 3 | 42,000 | 1,300 | 0.018 | 0.04 | 0.031 | 29,000 | 800 | 0.014 | 0.04 | 0.028 |
| | | 4 | 33,000 | 800 | 0.008 | 0.04 | 0.024 | 23,000 | 520 | 0.006 | 0.04 | 0.023 |
| | | 6 | 27,000 | 550 | 0.005 | 0.04 | 0.02 | 19,000 | 330 | 0.004 | 0.04 | 0.017 |
| **2005** | **R0.25** | 4 | 36,000 | 1,330 | 0.02 | 0.05 | 0.037 | 28,000 | 870 | 0.016 | 0.05 | 0.031 |
| | | 6 | 29,000 | 900 | 0.012 | 0.05 | 0.031 | 23,000 | 650 | 0.009 | 0.05 | 0.028 |
| | | 8 | 23,500 | 600 | 0.007 | 0.05 | 0.026 | 19,000 | 450 | 0.006 | 0.05 | 0.024 |
| | | 10 | 20,000 | 480 | 0.004 | 0.05 | 0.024 | 18,000 | 380 | 0.003 | 0.05 | 0.021 |
| **2006** | **R0.3** | 4 | 44,000 | 2,340 | 0.032 | 0.06 | 0.053 | 32,500 | 1,500 | 0.025 | 0.06 | 0.046 |
| | | 6 | 36,000 | 1,500 | 0.018 | 0.06 | 0.042 | 29,000 | 1,100 | 0.014 | 0.06 | 0.038 |
| | | 8 | 28,500 | 1,150 | 0.018 | 0.06 | 0.04 | 24,000 | 770 | 0.014 | 0.06 | 0.032 |
| | | 10 | 28,500 | 950 | 0.014 | 0.06 | 0.033 | 24,000 | 720 | 0.011 | 0.06 | 0.03 |
| | | 12 | 28,500 | 950 | 0.009 | 0.06 | 0.033 | 24,000 | 720 | 0.007 | 0.06 | 0.03 |
| | | 14 | 26,500 | 800 | 0.007 | 0.06 | 0.03 | 23,000 | 660 | 0.005 | 0.06 | 0.029 |
| | | 16 | 25,000 | 700 | 0.005 | 0.06 | 0.028 | 22,000 | 600 | 0.004 | 0.06 | 0.027 |
| | | 20 | 20,000 | 400 | 0.003 | 0.06 | 0.02 | 17,000 | 330 | 0.002 | 0.06 | 0.019 |
| **2008** | **R0.4** | 6 | 36,000 | 2,000 | 0.023 | 0.08 | 0.056 | 24,000 | 1,300 | 0.019 | 0.08 | 0.054 |
| | | 8 | 28,500 | 1,500 | 0.023 | 0.08 | 0.053 | 20,000 | 950 | 0.019 | 0.08 | 0.048 |
| | | 12 | 28,500 | 1,200 | 0.018 | 0.08 | 0.042 | 16,500 | 600 | 0.014 | 0.08 | 0.036 |
| | | 16 | 25,000 | 900 | 0.01 | 0.08 | 0.036 | 15,000 | 500 | 0.008 | 0.08 | 0.033 |
| **2010** | **R0.5** | 6 | 35,000 | 2,900 | 0.05 | 0.1 | 0.083 | 23,000 | 1,850 | 0.04 | 0.1 | 0.08 |
| | | 8 | 28,000 | 2,200 | 0.05 | 0.1 | 0.079 | 19,000 | 1,500 | 0.04 | 0.1 | 0.079 |
| | | 10 | 24,000 | 1,800 | 0.035 | 0.1 | 0.075 | 17,000 | 1,300 | 0.03 | 0.1 | 0.076 |
| | | 12 | 19,000 | 1,360 | 0.027 | 0.1 | 0.072 | 14,000 | 1,000 | 0.022 | 0.1 | 0.071 |
| | | 14 | 18,000 | 1,200 | 0.025 | 0.1 | 0.067 | 13,000 | 900 | 0.02 | 0.1 | 0.069 |
| | | 16 | 18,000 | 1,150 | 0.025 | 0.1 | 0.064 | 13,000 | 850 | 0.02 | 0.1 | 0.065 |
| | | 18 | 17,500 | 1,120 | 0.018 | 0.1 | 0.064 | 12,500 | 800 | 0.013 | 0.1 | 0.064 |
| | | 20 | 17,000 | 1,080 | 0.016 | 0.1 | 0.064 | 12,000 | 780 | 0.013 | 0.1 | 0.064 |
| | | 22 | 17,000 | 1,080 | 0.016 | 0.1 | 0.064 | 12,000 | 780 | 0.013 | 0.1 | 0.064 |
| | | 26 | 16,000 | 1,000 | 0.015 | 0.1 | 0.063 | 11,000 | 700 | 0.012 | 0.1 | 0.064 |
| | | 29.8 | 13,400 | 840 | 0.012 | 0.1 | 0.063 | 10,000 | 620 | 0.01 | 0.1 | 0.062 |
| | | 30 | 13,400 | 840 | 0.012 | 0.1 | 0.063 | 10,000 | 620 | 0.01 | 0.1 | 0.062 |
| | | 32 | 12,000 | 750 | 0.011 | 0.1 | 0.063 | 9,000 | 550 | 0.009 | 0.1 | 0.061 |
| | | 36 | 10,000 | 620 | 0.009 | 0.1 | 0.062 | 7,000 | 420 | 0.007 | 0.1 | 0.06 |
| **2015** | **R0.75** | 10 | 20,000 | 2,300 | 0.065 | 0.15 | 0.115 | 13,000 | 1,600 | 0.05 | 0.15 | 0.123 |
| | | 12 | 18,000 | 2,000 | 0.055 | 0.15 | 0.111 | 13,000 | 1,500 | 0.045 | 0.15 | 0.115 |
| | | 16 | 16,000 | 1,600 | 0.05 | 0.15 | 0.1 | 12,000 | 1,200 | 0.03 | 0.15 | 0.1 |
| | | 20 | 14,000 | 1,400 | 0.035 | 0.15 | 0.1 | 10,000 | 950 | 0.025 | 0.15 | 0.095 |
| | | 22 | 14,000 | 1,400 | 0.035 | 0.15 | 0.1 | 10,000 | 950 | 0.025 | 0.15 | 0.095 |
| | | 26 | 12,000 | 1,200 | 0.025 | 0.15 | 0.1 | 10,000 | 900 | 0.02 | 0.15 | 0.09 |
| | | 30 | 10,000 | 950 | 0.02 | 0.15 | 0.095 | 8,000 | 700 | 0.015 | 0.15 | 0.088 |
| | | 36 | 10,000 | 950 | 0.02 | 0.15 | 0.095 | 7,000 | 600 | 0.015 | 0.15 | 0.086 |

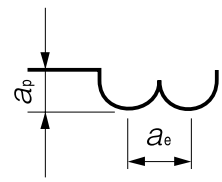
## Milling Conditions for HTNB

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT (45~55HRC) | | | | | HARDENED STEELS SKD / SKS (55~65HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | |
| | | | | | | Roughing (mm) | Finishing (mm) | | | | Roughing (mm) | Finishing (mm) |
| 2002 | R0.1 | 1.5 | 28,000 | 330 | 0.006 | 0.016 | 0.012 | 28,000 | 260 | 0.005 | 0.012 | 0.009 |
| | | 2 | 22,000 | 210 | 0.004 | 0.016 | 0.01 | 22,000 | 190 | 0.004 | 0.012 | 0.009 |
| | | 3 | 17,500 | 150 | 0.001 | 0.016 | 0.009 | 17,500 | 130 | 0.001 | 0.012 | 0.007 |
| 2003 | R0.15 | 2 | 23,500 | 350 | 0.006 | 0.024 | 0.015 | 23,500 | 300 | 0.005 | 0.018 | 0.013 |
| | | 3 | 21,500 | 250 | 0.003 | 0.024 | 0.012 | 21,500 | 200 | 0.002 | 0.018 | 0.009 |
| 2004 | R0.2 | 3 | 27,000 | 670 | 0.012 | 0.032 | 0.025 | 27,000 | 500 | 0.01 | 0.024 | 0.019 |
| | | 4 | 22,000 | 430 | 0.006 | 0.032 | 0.02 | 22,000 | 380 | 0.005 | 0.024 | 0.017 |
| | | 6 | 18,000 | 300 | 0.004 | 0.032 | 0.017 | 18,000 | 260 | 0.003 | 0.024 | 0.014 |
| 2005 | R0.25 | 4 | 27,500 | 650 | 0.014 | 0.04 | 0.024 | 27,500 | 625 | 0.011 | 0.03 | 0.023 |
| | | 6 | 22,000 | 530 | 0.008 | 0.04 | 0.024 | 22,000 | 500 | 0.007 | 0.03 | 0.023 |
| | | 8 | 17,000 | 380 | 0.005 | 0.04 | 0.022 | 17,000 | 350 | 0.004 | 0.03 | 0.021 |
| | | 10 | 16,000 | 330 | 0.002 | 0.04 | 0.021 | 16,000 | 300 | 0.002 | 0.03 | 0.019 |
| 2006 | R0.3 | 4 | 25,500 | 850 | 0.022 | 0.048 | 0.033 | 25,500 | 713 | 0.018 | 0.036 | 0.028 |
| | | 6 | 21,000 | 700 | 0.012 | 0.048 | 0.033 | 21,000 | 550 | 0.01 | 0.036 | 0.026 |
| | | 8 | 17,000 | 510 | 0.012 | 0.048 | 0.03 | 17,000 | 425 | 0.01 | 0.036 | 0.025 |
| | | 10 | 17,000 | 470 | 0.009 | 0.048 | 0.028 | 16,000 | 390 | 0.008 | 0.036 | 0.024 |
| | | 12 | 16,000 | 400 | 0.006 | 0.048 | 0.025 | 15,000 | 350 | 0.005 | 0.036 | 0.023 |
| | | 14 | 15,500 | 370 | 0.004 | 0.048 | 0.024 | 14,500 | 320 | 0.004 | 0.036 | 0.022 |
| | | 16 | 15,000 | 350 | 0.003 | 0.048 | 0.023 | 14,500 | 300 | 0.003 | 0.036 | 0.021 |
| | | 20 | 12,000 | 200 | 0.001 | 0.048 | 0.017 | 11,000 | 180 | 0.001 | 0.036 | 0.016 |
| 2008 | R0.4 | 6 | 21,000 | 900 | 0.016 | 0.064 | 0.043 | 21,000 | 800 | 0.013 | 0.048 | 0.038 |
| | | 8 | 17,000 | 680 | 0.016 | 0.064 | 0.04 | 17,000 | 600 | 0.013 | 0.048 | 0.035 |
| | | 12 | 14,000 | 480 | 0.012 | 0.064 | 0.034 | 14,000 | 420 | 0.01 | 0.048 | 0.03 |
| | | 16 | 13,000 | 420 | 0.006 | 0.064 | 0.032 | 12,500 | 350 | 0.006 | 0.048 | 0.028 |
| 2010 | R0.5 | 6 | 23,000 | 1,500 | 0.034 | 0.08 | 0.065 | 22,000 | 1,200 | 0.028 | 0.06 | 0.055 |
| | | 8 | 19,000 | 1,130 | 0.034 | 0.08 | 0.059 | 18,000 | 920 | 0.028 | 0.06 | 0.051 |
| | | 10 | 16,000 | 950 | 0.027 | 0.08 | 0.059 | 15,500 | 770 | 0.022 | 0.06 | 0.05 |
| | | 12 | 12,600 | 760 | 0.019 | 0.08 | 0.06 | 12,600 | 615 | 0.015 | 0.06 | 0.049 |
| | | 14 | 12,000 | 700 | 0.017 | 0.08 | 0.058 | 12,000 | 540 | 0.014 | 0.06 | 0.045 |
| | | 16 | 12,000 | 700 | 0.017 | 0.08 | 0.058 | 12,000 | 540 | 0.014 | 0.06 | 0.045 |
| | | 18 | 11,000 | 640 | 0.011 | 0.08 | 0.058 | 11,000 | 490 | 0.01 | 0.06 | 0.045 |
| | | 20 | 11,000 | 640 | 0.011 | 0.08 | 0.058 | 11,000 | 490 | 0.009 | 0.06 | 0.045 |
| | | 22 | 11,000 | 640 | 0.011 | 0.08 | 0.058 | 11,000 | 490 | 0.009 | 0.06 | 0.045 |
| | | 26 | 10,000 | 570 | 0.01 | 0.08 | 0.057 | 10,000 | 460 | 0.009 | 0.06 | 0.046 |
| | | 29.8 | 9,500 | 530 | 0.009 | 0.08 | 0.055 | 9,500 | 410 | 0.008 | 0.06 | 0.043 |
| | | 30 | 9,500 | 530 | 0.009 | 0.08 | 0.055 | 9,500 | 410 | 0.008 | 0.06 | 0.043 |
| | | 32 | 9,000 | 490 | 0.008 | 0.08 | 0.054 | 9,000 | 380 | 0.007 | 0.06 | 0.042 |
| | | 36 | 7,000 | 380 | 0.006 | 0.08 | 0.054 | 7,000 | 280 | 0.005 | 0.06 | 0.04 |
| 2015 | R0.75 | 10 | 13,000 | 1,200 | 0.04 | 0.12 | 0.092 | 13,000 | 950 | 0.035 | 0.09 | 0.073 |
| | | 12 | 11,000 | 950 | 0.035 | 0.12 | 0.086 | 11,000 | 750 | 0.03 | 0.09 | 0.068 |
| | | 16 | 11,000 | 900 | 0.03 | 0.12 | 0.082 | 11,000 | 750 | 0.025 | 0.09 | 0.068 |
| | | 20 | 10,000 | 800 | 0.02 | 0.12 | 0.08 | 10,000 | 650 | 0.018 | 0.09 | 0.065 |
| | | 22 | 10,000 | 800 | 0.02 | 0.12 | 0.08 | 10,000 | 650 | 0.018 | 0.09 | 0.065 |
| | | 26 | 9,000 | 700 | 0.017 | 0.12 | 0.078 | 9,000 | 600 | 0.015 | 0.09 | 0.067 |
| | | 30 | 8,000 | 600 | 0.013 | 0.12 | 0.075 | 8,000 | 500 | 0.013 | 0.09 | 0.063 |
| | | 36 | 7,000 | 500 | 0.013 | 0.12 | 0.071 | 7,000 | 400 | 0.013 | 0.09 | 0.057 |

## Milling Conditions for HTNB

| WORK MATERIAL | | | COPPER / CARBON STEELS Cu / S45C / S50C | | | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | |
| | | | | | | Roughing (mm) | Finishing (mm) | | | | Roughing (mm) | Finishing (mm) |
| **2020** | **R1** | 10 | 19,000 | 3,300 | 0.11 | 0.2 | 0.174 | 12,000 | 2,100 | 0.1 | 0.2 | 0.175 |
| | | 12 | 17,000 | 2,900 | 0.09 | 0.2 | 0.171 | 12,000 | 2,000 | 0.095 | 0.2 | 0.167 |
| | | 16 | 15,000 | 2,350 | 0.081 | 0.2 | 0.157 | 11,000 | 1,700 | 0.065 | 0.2 | 0.155 |
| | | 20 | 11,000 | 1,600 | 0.068 | 0.2 | 0.145 | 8,400 | 1,100 | 0.055 | 0.2 | 0.131 |
| | | 22 | 11,000 | 1,600 | 0.063 | 0.2 | 0.145 | 8,400 | 1,050 | 0.05 | 0.2 | 0.125 |
| | | 24 | 11,000 | 1,500 | 0.063 | 0.2 | 0.136 | 8,400 | 1,050 | 0.05 | 0.2 | 0.125 |
| | | 26 | 10,000 | 1,350 | 0.063 | 0.2 | 0.135 | 7,350 | 900 | 0.05 | 0.2 | 0.122 |
| | | 28 | 10,000 | 1,350 | 0.05 | 0.2 | 0.135 | 7,350 | 870 | 0.038 | 0.2 | 0.118 |
| | | 30 | 10,000 | 1,350 | 0.05 | 0.2 | 0.135 | 7,350 | 870 | 0.038 | 0.2 | 0.118 |
| | | 32 | 10,000 | 1,350 | 0.041 | 0.2 | 0.135 | 7,350 | 850 | 0.032 | 0.2 | 0.116 |
| | | 34 | 10,000 | 1,350 | 0.041 | 0.2 | 0.135 | 7,000 | 800 | 0.032 | 0.2 | 0.114 |
| | | 36 | 10,000 | 1,350 | 0.041 | 0.2 | 0.135 | 7,000 | 800 | 0.032 | 0.2 | 0.114 |
| | | 40 | 10,000 | 1,350 | 0.041 | 0.2 | 0.135 | 7,000 | 800 | 0.032 | 0.2 | 0.114 |
| **2030** | **R1.5** | 20 | 11,000 | 2,350 | 0.095 | 0.3 | 0.214 | 8,400 | 1,500 | 0.075 | 0.3 | 0.179 |
| | | 22 | 11,000 | 2,350 | 0.09 | 0.3 | 0.214 | 8,400 | 1,500 | 0.071 | 0.3 | 0.179 |
| | | 26 | 10,000 | 2,050 | 0.085 | 0.3 | 0.205 | 7,600 | 1,300 | 0.068 | 0.3 | 0.171 |
| | | 30 | 10,000 | 2,000 | 0.081 | 0.3 | 0.2 | 7,500 | 1,250 | 0.065 | 0.3 | 0.167 |
| | | 32 | 10,000 | 1,900 | 0.081 | 0.3 | 0.19 | 7,500 | 1,200 | 0.065 | 0.3 | 0.16 |
| | | 36 | 9,000 | 1,700 | 0.073 | 0.3 | 0.189 | 6,000 | 950 | 0.058 | 0.3 | 0.158 |
| | | 40 | 8,500 | 1,600 | 0.065 | 0.3 | 0.188 | 6,000 | 950 | 0.053 | 0.3 | 0.158 |
| | | 42 | 8,500 | 1,600 | 0.063 | 0.3 | 0.188 | 6,000 | 950 | 0.05 | 0.3 | 0.158 |
| | | 48 | 8,500 | 1,570 | 0.052 | 0.3 | 0.185 | 6,000 | 920 | 0.042 | 0.3 | 0.153 |
| | | 52 | 8,500 | 1,550 | 0.045 | 0.3 | 0.182 | 6,000 | 900 | 0.036 | 0.3 | 0.15 |
| | | 62 | 5,600 | 930 | 0.035 | 0.3 | 0.166 | 5,000 | 700 | 0.025 | 0.3 | 0.14 |
| **2040** | **R2** | 20 | 8,400 | 1,900 | 0.125 | 0.4 | 0.226 | 5,400 | 1,030 | 0.096 | 0.4 | 0.191 |
| | | 30 | 7,600 | 1,600 | 0.1 | 0.4 | 0.211 | 4,800 | 850 | 0.083 | 0.4 | 0.177 |
| | | 36 | 6,900 | 1,400 | 0.094 | 0.4 | 0.203 | 3,900 | 650 | 0.074 | 0.4 | 0.167 |
| | | 40 | 6,500 | 1,300 | 0.086 | 0.4 | 0.2 | 3,900 | 650 | 0.068 | 0.4 | 0.167 |
| | | 41 | 6,500 | 1,300 | 0.086 | 0.4 | 0.2 | 3,900 | 650 | 0.068 | 0.4 | 0.167 |
| | | 60 | 4,300 | 780 | 0.063 | 0.4 | 0.181 | 3,300 | 500 | 0.05 | 0.4 | 0.152 |
| | | 62 | 4,300 | 750 | 0.063 | 0.4 | 0.174 | 3,300 | 480 | 0.05 | 0.4 | 0.145 |
| | | 80 | 4,300 | 750 | 0.063 | 0.4 | 0.174 | 3,300 | 480 | 0.05 | 0.4 | 0.145 |
| Radial Depth (mm) | | Roughing | $a_e \leqq 0.1D$ | | | | | $a_e \leqq 0.1D$ | | | | |
| | | Finishing | $a_e \leqq V_f / n$ | | | | | | | | | |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)



## Milling Conditions for HTNB

| WORK MATERIAL | | | HARDENED STEELS SKD / SKT (45~55HRC) | | | | | HARDENED STEELS SKD / SKS (55~65HRC) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth | |
| | | | | | | Roughing (mm) | Finishing (mm) | | | | Roughing (mm) | Finishing (mm) |
| **2020** | **R1** | 10 | 12,000 | 1,800 | 0.074 | 0.16 | 0.15 | 12,000 | 1,350 | 0.064 | 0.12 | 0.113 |
| | | 12 | 10,500 | 1,430 | 0.065 | 0.16 | 0.136 | 10,500 | 1,070 | 0.055 | 0.12 | 0.102 |
| | | 16 | 10,500 | 1,360 | 0.056 | 0.16 | 0.13 | 10,500 | 1,070 | 0.046 | 0.12 | 0.102 |
| | | 20 | 9,450 | 1,150 | 0.048 | 0.16 | 0.122 | 9,450 | 920 | 0.038 | 0.12 | 0.097 |
| | | 22 | 9,450 | 1,150 | 0.043 | 0.16 | 0.122 | 9,450 | 920 | 0.036 | 0.12 | 0.097 |
| | | 24 | 8,400 | 1,020 | 0.043 | 0.16 | 0.121 | 8,400 | 800 | 0.036 | 0.12 | 0.095 |
| | | 26 | 8,400 | 1,020 | 0.043 | 0.16 | 0.121 | 8,400 | 800 | 0.036 | 0.12 | 0.095 |
| | | 28 | 7,350 | 850 | 0.033 | 0.16 | 0.116 | 7,350 | 690 | 0.028 | 0.12 | 0.094 |
| | | 30 | 7,350 | 850 | 0.033 | 0.16 | 0.116 | 7,350 | 690 | 0.028 | 0.12 | 0.094 |
| | | 32 | 7,350 | 850 | 0.028 | 0.16 | 0.116 | 7,350 | 690 | 0.023 | 0.12 | 0.094 |
| | | 34 | 6,500 | 745 | 0.028 | 0.16 | 0.115 | 6,500 | 610 | 0.023 | 0.12 | 0.094 |
| | | 36 | 6,500 | 745 | 0.028 | 0.16 | 0.115 | 6,500 | 610 | 0.023 | 0.12 | 0.094 |
| | | 40 | 6,500 | 745 | 0.028 | 0.16 | 0.115 | 6,500 | 610 | 0.023 | 0.12 | 0.094 |
| **2030** | **R1.5** | 20 | 8,000 | 1,400 | 0.065 | 0.24 | 0.175 | 8,000 | 1,200 | 0.053 | 0.18 | 0.15 |
| | | 22 | 8,000 | 1,400 | 0.062 | 0.24 | 0.175 | 8,000 | 1,200 | 0.05 | 0.18 | 0.15 |
| | | 26 | 7,500 | 1,200 | 0.06 | 0.24 | 0.16 | 7,500 | 1,050 | 0.048 | 0.18 | 0.14 |
| | | 30 | 7,000 | 1,100 | 0.057 | 0.24 | 0.157 | 7,000 | 980 | 0.047 | 0.18 | 0.14 |
| | | 32 | 7,000 | 1,100 | 0.056 | 0.24 | 0.157 | 7,000 | 950 | 0.046 | 0.18 | 0.136 |
| | | 36 | 6,000 | 950 | 0.05 | 0.24 | 0.158 | 6,000 | 800 | 0.042 | 0.18 | 0.133 |
| | | 40 | 5,500 | 850 | 0.045 | 0.24 | 0.155 | 5,500 | 750 | 0.038 | 0.18 | 0.136 |
| | | 42 | 5,500 | 850 | 0.043 | 0.24 | 0.155 | 5,500 | 750 | 0.036 | 0.18 | 0.136 |
| | | 48 | 5,500 | 820 | 0.035 | 0.24 | 0.149 | 5,500 | 720 | 0.03 | 0.18 | 0.131 |
| | | 52 | 5,500 | 800 | 0.031 | 0.24 | 0.145 | 5,500 | 700 | 0.026 | 0.18 | 0.127 |
| | | 62 | 4,700 | 600 | 0.023 | 0.24 | 0.128 | 4,700 | 530 | 0.021 | 0.18 | 0.113 |
| **2040** | **R2** | 20 | 5,200 | 980 | 0.085 | 0.32 | 0.188 | 5,200 | 840 | 0.066 | 0.24 | 0.162 |
| | | 30 | 4,500 | 770 | 0.074 | 0.32 | 0.171 | 4,500 | 690 | 0.059 | 0.24 | 0.153 |
| | | 36 | 3,900 | 670 | 0.065 | 0.32 | 0.172 | 3,900 | 560 | 0.052 | 0.24 | 0.144 |
| | | 40 | 3,600 | 600 | 0.059 | 0.32 | 0.167 | 3,600 | 530 | 0.048 | 0.24 | 0.147 |
| | | 41 | 3,600 | 600 | 0.059 | 0.32 | 0.167 | 3,600 | 530 | 0.048 | 0.24 | 0.147 |
| | | 60 | 3,100 | 450 | 0.043 | 0.32 | 0.145 | 3,100 | 400 | 0.036 | 0.24 | 0.129 |
| | | 62 | 3,100 | 420 | 0.043 | 0.32 | 0.135 | 3,100 | 380 | 0.036 | 0.24 | 0.123 |
| | | 80 | 2,900 | 340 | 0.035 | 0.32 | 0.117 | 2,500 | 200 | 0.02 | 0.24 | 0.08 |
| Radial Depth (mm) | | Roughing | $a_e \leqq 0.08D$ | | | | | $a_e \leqq 0.06D$ | | | | |
| | | Finishing | $a_e \leqq V_f / n$ | | | | | | | | | |

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- The neck length and taper angle may affect the milling parameters. In operation, fine adjustments may be required.
- Recommend air blow or oil mist.
- Recommend oil coolant for Stainless Steels and Heat Resistant Alloys.
- Recommend water soluble or oil base coolant for Copper.

## Size R0.5～R1

# DCTNB

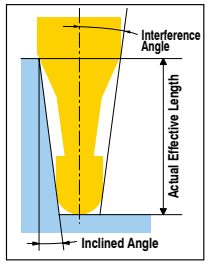
MG DIA 35° R ±0.01 Shank Dia 0/-0.005

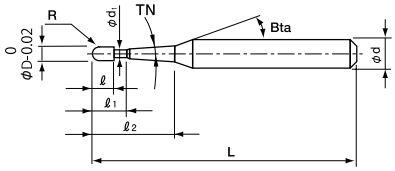
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ○ | ☆ | ○ | ○ | ◎ | | | | ○ |

## Features

**2 Flute Diamond coated Taper Neck Ball End Mills for Graphite Electrodes.**
**Taper Neck design improves the tool rigidity and provides high-efficiency & high-precision milling.**
**Original and optimized Diamond coating offers outstanding resistance to wear on Graphite.**
**Excellent adhesion coating with long-life tool design.**




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

Total 15 models

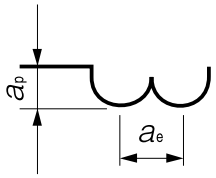
Unit（mm）

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Effective Length ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ | Interference Angle | Effective Length by Inclined Angles －: Interference 30′ | 1° | 1°30′ | 2° | 3° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DCTNB 2010-200-1.8 | R0.5 | 0.9° | 20 | 4 | 0.8 | 0.96 | 16° | 80 | 6 | 18,730 | 5.25° | － | 20.24 | 20.90 | 21.61 | 23.20 |
| DCTNB 2010-250-1.8 | | | 25 | | | | | 80 | 6 | 21,850 | 4.48° | － | 25.27 | 26.10 | 26.99 | 28.98 |
| DCTNB 2010-400-1.8 | | | 40 | | | | | 100 | 6 | 25,470 | 3.11° | － | 40.36 | 41.70 | 43.13 | 46.32 |
| DCTNB 2010-600-1.8 | | | 60 | | | | | 120 | 6 | 33,220 | 2.21° | － | 60.49 | 62.50 | 64.65 | No Interference |
| DCTNB 2010-700-1.8 | | | 70 | | | | | 120 | 6 | 33,220 | 1.93° | － | 70.55 | 72.90 | No Interference | No Interference |
| DCTNB 2010-800-1.8 | | | 80 | | | | | 140 | 6 | 33,490 | 1.72° | － | 80.62 | 83.30 | No Interference | No Interference |
| DCTNB 2010-900-1.8 | | | 90 | | | | | 150 | 6 | 35,230 | 1.54° | － | 90.68 | 93.71 | No Interference | No Interference |
| DCTNB 2020-200-1.8 | R1 | 0.9° | 20 | 7 | 1.6 | 1.9 | 16° | 80 | 6 | 18,730 | 4.55° | － | 20.34 | 21.00 | 21.69 | 23.25 |
| DCTNB 2020-250-1.8 | | | 25 | | | | | 80 | 6 | 21,850 | 3.84° | － | 25.38 | 26.20 | 27.08 | 29.03 |
| DCTNB 2020-400-1.8 | | | 40 | | | | | 100 | 6 | 25,470 | 2.61° | － | 40.47 | 41.80 | 43.22 | No Interference |
| DCTNB 2020-450-1.8 | | | 45 | | | | | 100 | 6 | 25,470 | 2.36° | － | 45.51 | 47.00 | 48.60 | No Interference |
| DCTNB 2020-600-1.8 | | | 60 | | | | | 120 | 6 | 33,220 | 1.83° | － | 60.59 | 62.59 | No Interference | No Interference |
| DCTNB 2020-700-1.8 | | | 70 | | | | | 120 | 6 | 33,220 | 1.59° | － | 70.66 | 73.00 | No Interference | No Interference |
| DCTNB 2020-800-1.8 | | | 80 | | | | | 140 | 6 | 33,490 | 1.41° | － | 80.72 | No Interference | No Interference | No Interference |
| DCTNB 2020-10001.8 | | | 100 | | | | | 150 | 6 | 37,910 | 1.15° | － | 100.85 | No Interference | No Interference | No Interference |

## Milling Conditions for DCTNB

| WORK MATERIAL | | | GRAPHITE | | | |
|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) |
| **2010-200-1.8** | **R0.5** | 20 | 30,000 | 1,500 | 0.1 | 0.12 |
| **2010-250-1.8** | | 25 | 30,000 | 1,500 | 0.08 | 0.12 |
| **2010-400-1.8** | | 40 | 27,000 | 1,200 | 0.07 | 0.12 |
| **2010-600-1.8** | | 60 | 23,000 | 800 | 0.06 | 0.12 |
| **2010-700-1.8** | | 70 | 20,000 | 600 | 0.05 | 0.12 |
| **2010-800-1.8** | | 80 | 18,000 | 500 | 0.04 | 0.12 |
| **2010-900-1.8** | | 90 | 15,000 | 400 | 0.03 | 0.12 |
| **2020-200-1.8** | **R1** | 20 | 27,000 | 2,000 | 0.24 | 0.5 |
| **2020-250-1.8** | | 25 | 27,000 | 2,000 | 0.19 | 0.5 |
| **2020-400-1.8** | | 40 | 27,000 | 2,000 | 0.13 | 0.4 |
| **2020-450-1.8** | | 45 | 27,000 | 2,000 | 0.11 | 0.4 |
| **2020-600-1.8** | | 60 | 23,000 | 1,500 | 0.1 | 0.3 |
| **2020-700-1.8** | | 70 | 20,000 | 1,200 | 0.09 | 0.3 |
| **2020-800-1.8** | | 80 | 17,000 | 900 | 0.09 | 0.2 |
| **2020-10001.8** | | 100 | 14,000 | 600 | 0.09 | 0.2 |

Note:
- Use a milling machine dedicated for Graphite.
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Recommend air blow for Graphite.




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

Size **R0.5～R2**

# HFTNB

Super MG | HARD MAX | 40° | R ±0.005 (R0.5～R1.5) | R ±0.007 (R2) | Shank Dia 0/-0.005 | Back Taper Geometry | Variable Pitch

Additional 2 models

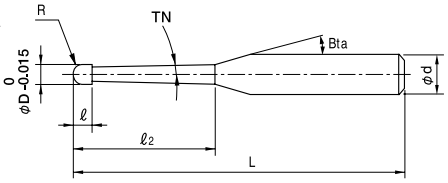
Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | ○ | ◎ | ◎ | ◎ | ◎ ～65HRC | ○ | | | | | | ○ | ○ | | |

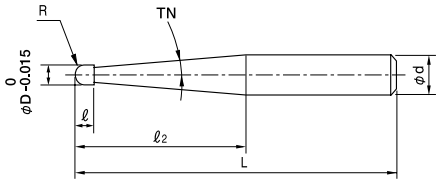
## Features

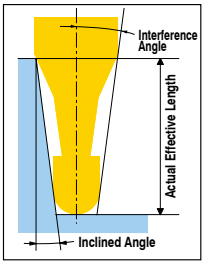
**3 Flute Taper Neck Ball End Mills for Hard Materials.**
**The negative rake angle design improves wear resistance.**
**Back taper design reduces cutting resistance.**
**Suitable for both roughing and finishing. Diameter Tolerance : 0/-0.015.**

Shape A



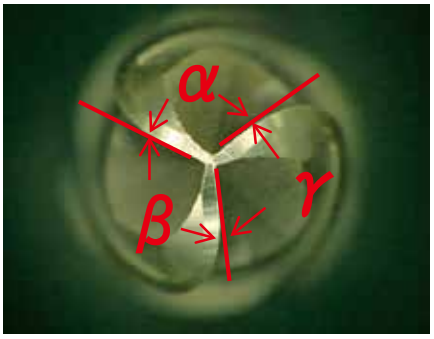

Shape B




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

■ **Variable Pitch design**
Minimizing vibration and chattering




※Variable Pitch $\alpha \neq \beta \neq \gamma$

■ **A wide choice of Taper Neck Angles**
Useful sizes: 0.4° · 0.9° · 1.4° · 1.9° · 2.9°
Using with HTNRS, Taper Neck Radius End Mill, offers higher efficient milling.
Refer to page 386 for HTNRS.

Total 75 models

Unit (mm)

| Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| **HFTNB 3010-080-08** | R0.5 | 0.4° | 8 | 0.8 | 16° | 60 | 6 | A | 8,690 | 8.82° | 8.05 | 8.30 | 8.57 | 8.85 | 9.48 |
| **HFTNB 3010-100-08** | | | 10 | | | 60 | 6 | | 8,690 | 7.89° | 10.07 | 10.38 | 10.71 | 11.07 | 11.87 |
| **HFTNB 3010-120-08** | | | 12 | | | 60 | 6 | | 8,690 | 7.13° | 12.08 | 12.46 | 12.86 | 13.29 | 14.26 |
| **HFTNB 3010-160-08** | | | 16 | | | 60 | 6 | | 8,690 | 5.98° | 16.10 | 16.61 | 17.16 | 17.74 | 19.03 |
| **HFTNB 3010-200-08** | | | 20 | | | 60 | 6 | | 11,040 | 5.15° | 20.13 | 20.77 | 21.45 | 22.18 | 23.81 |
| **HFTNB 3010-260-08** | | | 26 | | | 70 | 6 | | 11,590 | 4.26° | 26.17 | 27.00 | 27.89 | 28.85 | 30.97 |
| **HFTNB 3010-300-08** | | | 30 | | | 70 | 6 | | 12,140 | 3.82° | 30.19 | 31.16 | 32.19 | 33.29 | 35.75 |
| **HFTNB 3010-060-18** | | 0.9° | 6 | | | 60 | 6 | | 8,690 | 10.11° | — | 6.06 | 6.25 | 6.45 | 6.90 |
| **HFTNB 3010-080-18** | | | 8 | | | 60 | 6 | | 8,690 | 8.94° | — | 8.07 | 8.33 | 8.60 | 9.21 |
| **HFTNB 3010-100-18** | | | 10 | | | 60 | 6 | | 8,690 | 8.01° | — | 10.08 | 10.41 | 10.75 | 11.53 |
| **HFTNB 3010-120-18** | | | 12 | | | 60 | 6 | | 8,690 | 7.25° | — | 12.10 | 12.49 | 12.91 | 13.84 |
| **HFTNB 3010-160-18** | | | 16 | | | 60 | 6 | | 8,690 | 6.10° | — | 16.12 | 16.65 | 17.21 | 18.47 |
| **HFTNB 3010-200-18** | | | 20 | | | 60 | 6 | | 11,040 | 5.26° | — | 20.15 | 20.81 | 21.52 | 23.09 |
| **HFTNB 3010-260-18** | | | 26 | | | 70 | 6 | | 11,590 | 4.36° | — | 26.19 | 27.05 | 27.98 | 30.03 |
| **HFTNB 3010-300-18** | | | 30 | | | 70 | 6 | | 12,140 | 3.91° | — | 30.21 | 31.21 | 32.28 | 34.66 |
| **HFTNB 3010-100-28** | | 1.4° | 10 | | | 60 | 6 | | 8,690 | 8.13° | — | — | 10.10 | 10.43 | 11.18 |
| **HFTNB 3010-120-28** | | | 12 | | | 60 | 6 | | 8,690 | 7.38° | — | — | 12.11 | 12.52 | 13.42 |
| **HFTNB 3010-160-28** | | | 16 | | | 60 | 6 | | 8,690 | 6.22° | — | — | 16.14 | 16.68 | 17.90 |
| **HFTNB 3010-200-28** | | | 20 | | | 60 | 6 | | 11,040 | 5.37° | — | — | 20.17 | 20.85 | 22.38 |
| **HFTNB 3010-260-28** | | | 26 | | | 70 | 6 | | 11,590 | 4.46° | — | — | 26.21 | 27.10 | 29.09 |
| **HFTNB 3015-100-08** | R0.75 | 0.4° | 10 | 1.2 | 16° | 60 | 6 | A | 9,110 | 7.55° | 10.11 | 10.41 | 10.74 | 11.09 | 11.87 |
| **HFTNB 3015-160-08** | | | 16 | | | 60 | 6 | | 9,940 | 5.64° | 16.14 | 16.65 | 17.18 | 17.75 | 19.03 |
| **HFTNB 3015-200-08** | | | 20 | | | 60 | 6 | | 9,940 | 4.82° | 20.17 | 20.80 | 21.48 | 22.20 | 23.81 |
| **HFTNB 3015-300-08** | | | 30 | | | 70 | 6 | | 10,760 | 3.54° | 30.23 | 31.19 | 32.21 | 33.31 | 35.75 |
| **HFTNB 3015-100-18** | | 0.9° | 10 | | | 60 | 6 | | 9,110 | 7.66° | — | 10.13 | 10.45 | 10.79 | 11.54 |
| **HFTNB 3015-160-18** | | | 16 | | | 60 | 6 | | 9,940 | 5.75° | — | 16.17 | 16.69 | 17.24 | 18.48 |
| **HFTNB 3015-200-18** | | | 20 | | | 60 | 6 | | 9,940 | 4.93° | — | 20.19 | 20.85 | 21.55 | 23.11 |
| **HFTNB 3015-300-18** | | | 30 | | | 70 | 6 | | 10,760 | 3.63° | — | 30.26 | 31.25 | 32.31 | 34.67 |
| **HFTNB 3015-100-28** | | 1.4° | 10 | | | 60 | 6 | | 9,110 | 7.79° | — | — | 10.15 | 10.48 | 11.21 |
| **HFTNB 3015-160-28** | | | 16 | | | 60 | 6 | | 9,940 | 5.87° | — | — | 16.19 | 16.73 | 17.93 |
| **HFTNB 3015-200-28** | | | 20 | | | 60 | 6 | | 9,940 | 5.03° | — | — | 20.22 | 20.90 | 22.41 |
| **HFTNB 3015-300-28** | | | 30 | | | 80 | 6 | | 10,760 | 3.72° | — | — | 30.28 | 31.31 | 33.60 |

Next Page ➡

Unit (mm)

| | Model Number | Radius of Ball Nose R | Neck Taper Angle TN | Neck Length ℓ2 | Length of Cut ℓ | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Shape | Price ¥ | Interference Angle | Effective Length by Inclined Angles — : Interference | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 30′ | 1° | 1°30′ | 2° | 3° |
| | HFTNB 3020-120-08 | R1 | 0.4° | 12 | 1.6 | 16° | 60 | 6 | A | 9,100 | 6.40° | 12.12 | 12.49 | 12.87 | 13.29 | 14.22 |
| | HFTNB 3020-160-08 | | | 16 | | | 60 | 6 | | 9,320 | 5.27° | 16.15 | 16.64 | 17.17 | 17.73 | 18.99 |
| | HFTNB 3020-200-08 | | | 20 | | | 60 | 6 | | 9,940 | 4.47° | 20.17 | 20.80 | 21.46 | 22.18 | 23.77 |
| | HFTNB 3020-220-08 | | | 22 | | | 70 | 6 | | 9,940 | 4.16° | 22.18 | 22.87 | 23.61 | 24.40 | 26.16 |
| | HFTNB 3020-260-08 | | | 26 | | | 70 | 6 | | 11,040 | 3.65° | 26.21 | 27.03 | 27.90 | 28.84 | 30.93 |
| | HFTNB 3020-300-08 | | | 30 | | | 70 | 6 | | 12,140 | 3.25° | 30.23 | 31.18 | 32.20 | 33.29 | 35.71 |
| | HFTNB 3020-320-08 | | | 32 | | | 80 | 6 | | 12,140 | 3.08° | 32.25 | 33.26 | 34.35 | 35.51 | 38.09 |
| ※ | HFTNB 3020-360-08 | | | 36 | | | 80 | 6 | | 12,140 | 2.79° | 36.26 | 37.40 | 38.63 | 39.94 | No Interference |
| | HFTNB 3020-400-08 | | | 40 | | | 80 | 6 | | 14,350 | 2.55° | 40.30 | 41.57 | 42.94 | 44.40 | No Interference |
| | HFTNB 3020-120-18 | | 0.9° | 12 | | | 60 | 6 | | 9,100 | 6.52° | — | 12.15 | 12.52 | 12.93 | 13.83 |
| | HFTNB 3020-160-18 | | | 16 | | | 60 | 6 | | 9,320 | 5.38° | — | 16.17 | 16.68 | 17.23 | 18.46 |
| | HFTNB 3020-200-18 | | | 20 | | | 60 | 6 | | 9,940 | 4.57° | — | 20.20 | 20.85 | 21.54 | 23.08 |
| | HFTNB 3020-260-18 | | | 26 | | | 70 | 6 | | 11,040 | 3.74° | — | 26.24 | 27.09 | 28.00 | 30.02 |
| | HFTNB 3020-300-18 | | | 30 | | | 70 | 6 | | 12,140 | 3.33° | — | 30.26 | 31.25 | 32.30 | 34.65 |
| | HFTNB 3020-360-18 | | | 36 | | | 80 | 6 | | 12,140 | 2.86° | — | 36.30 | 37.49 | 38.76 | No Interference |
| | HFTNB 3020-400-18 | | | 40 | | | 80 | 6 | | 14,350 | 2.62° | — | 40.33 | 41.65 | 43.06 | No Interference |
| | HFTNB 3020-500-18 | | | 50 | | | 100 | 6 | | 16,000 | 2.16° | — | 50.39 | 52.05 | 53.83 | No Interference |
| | HFTNB 3020-160-28 | | 1.4° | 16 | | | 60 | 6 | | 9,320 | 5.49° | — | — | 16.20 | 16.73 | 17.92 |
| | HFTNB 3020-200-28 | | | 20 | | | 60 | 6 | | 9,940 | 4.68° | — | — | 20.23 | 20.90 | 22.40 |
| | HFTNB 3020-260-28 | | | 26 | | | 70 | 6 | | 11,040 | 3.83° | — | — | 26.27 | 27.15 | 29.11 |
| | HFTNB 3020-300-28 | | | 30 | | | 70 | 6 | | 12,140 | 3.41° | — | — | 30.30 | 31.32 | 33.59 |
| | HFTNB 3020-400-28 | | | 40 | | | 80 | 6 | | 15,070 | 2.69° | — | — | 40.36 | 41.73 | No Interference |
| | HFTNB 3020-620-38 | | 1.9° | 62 | | — | 100 | 6 | B | 18,000 | — | — | — | — | No Interference | No Interference |
| | HFTNB 3020-410-58 | | 2.9° | 41 | | | 80 | 6 | | 17,000 | — | — | — | — | — | No Interference |
| | HFTNB 3030-200-08 | R1.5 | 0.4° | 20 | 2.4 | 16° | 60 | 6 | A | 11,200 | 3.67° | 20.23 | 20.84 | 21.49 | 22.19 | 23.75 |
| | HFTNB 3030-260-08 | | | 26 | | | 70 | 6 | | 11,960 | 2.94° | 26.27 | 27.07 | 27.93 | 28.86 | No Interference |
| | HFTNB 3030-300-08 | | | 30 | | | 70 | 6 | | 13,660 | 2.60° | 30.29 | 31.23 | 32.23 | 33.30 | No Interference |
| | HFTNB 3030-320-08 | | | 32 | | | 80 | 6 | | 14,350 | 2.46° | 32.31 | 33.31 | 34.38 | 35.52 | No Interference |
| ※ | HFTNB 3030-360-08 | | | 36 | | | 80 | 6 | | 14,950 | 2.21° | 36.31 | 37.45 | 38.65 | 39.95 | No Interference |
| | HFTNB 3030-400-08 | | | 40 | | | 80 | 6 | | 15,180 | 2.01° | 40.36 | 41.62 | 42.97 | 44.41 | No Interference |
| | HFTNB 3030-200-18 | | 0.9° | 20 | | | 60 | 6 | | 11,200 | 3.76° | — | 20.27 | 20.90 | 21.58 | 23.09 |
| | HFTNB 3030-300-18 | | | 30 | | | 70 | 6 | | 13,660 | 2.67° | — | 30.34 | 31.31 | 32.34 | No Interference |
| | HFTNB 3030-400-18 | | | 40 | | | 80 | 6 | | 15,180 | 2.07° | — | 40.40 | 41.71 | 43.11 | No Interference |
| | HFTNB 3030-500-18 | | | 50 | | | 100 | 6 | | 17,500 | 1.69° | — | 50.46 | 52.11 | No Interference | No Interference |
| | HFTNB 3030-600-18 | | | 60 | | | 100 | 6 | | 19,000 | 1.43° | — | 60.52 | No Interference | No Interference | No Interference |
| | HFTNB 3030-400-28 | | 1.4° | 40 | | | 80 | 6 | | 15,180 | 2.12° | — | — | 40.45 | 41.80 | No Interference |
| | HFTNB 3030-500-28 | | | 50 | | | 100 | 6 | | 17,000 | 1.74° | — | — | 50.51 | No Interference | No Interference |
| | HFTNB 3030-650-28 | | | 65 | | — | 100 | 6 | B | 19,000 | — | — | — | No Interference | No Interference | No Interference |
| | HFTNB 3040-300-18 | R2 | 0.9° | 30 | 6 | 16° | 80 | 6 | A | 13,330 | 1.90° | — | 30.51 | 31.47 | No Interference | No Interference |
| | HFTNB 3040-400-18 | | | 40 | | | 80 | 6 | | 17,250 | 1.45° | — | 40.58 | No Interference | No Interference | No Interference |
| | HFTNB 3040-500-18 | | | 50 | | | 100 | 6 | | 19,000 | 1.18° | — | 50.64 | No Interference | No Interference | No Interference |
| | HFTNB 3040-600-18 | | | 60 | | | 100 | 6 | | 20,200 | 0.99° | — | No Interference | No Interference | No Interference | No Interference |
| | HFTNB 3040-480-28 | | 1.4° | 48 | | — | 80 | 6 | B | 17,250 | — | — | — | No Interference | No Interference | No Interference |

※Additional model

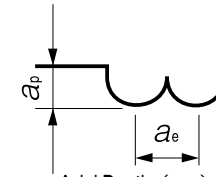
# Milling Conditions for HFTNB

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC) | | | | HARDENED STEELS SKD / SKT (45~55HRC) | | | | HARDENED STEELS SKD / SKH (55~65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (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) |
| **3010** | **R0.5** | 6 | 14,500 | 1,300 | 0.1 | 0.2 | 14,500 | 1,250 | 0.06 | 0.12 | 14,500 | 1,200 | 0.04 | 0.08 |
| | | 8 | 14,000 | 1,200 | 0.09 | 0.18 | 13,750 | 1,160 | 0.06 | 0.1 | 13,500 | 1,120 | 0.04 | 0.06 |
| | | 10 | 13,300 | 1,000 | 0.08 | 0.16 | 12,650 | 1,000 | 0.05 | 0.09 | 12,000 | 1,000 | 0.04 | 0.05 |
| | | 12 | 13,000 | 870 | 0.07 | 0.14 | 12,000 | 850 | 0.04 | 0.08 | 11,000 | 880 | 0.03 | 0.05 |
| | | 16 | 12,500 | 680 | 0.05 | 0.1 | 10,250 | 600 | 0.04 | 0.06 | 8,000 | 550 | 0.03 | 0.04 |
| | | 20 | 12,000 | 600 | 0.04 | 0.08 | 9,500 | 500 | 0.03 | 0.06 | 7,000 | 400 | 0.02 | 0.04 |
| | | 26 | 11,700 | 520 | 0.03 | 0.06 | 8,600 | 370 | 0.02 | 0.04 | 5,500 | 220 | 0.02 | 0.03 |
| | | 30 | 11,500 | 500 | 0.02 | 0.05 | 8,250 | 350 | 0.02 | 0.04 | 5,000 | 200 | 0.02 | 0.03 |
| **3015** | **R0.75** | 10 | 12,000 | 1,230 | 0.13 | 0.3 | 11,500 | 1,100 | 0.09 | 0.2 | 11,000 | 1,100 | 0.06 | 0.14 |
| | | 16 | 11,200 | 930 | 0.1 | 0.25 | 10,600 | 910 | 0.07 | 0.16 | 10,000 | 900 | 0.05 | 0.11 |
| | | 20 | 10,800 | 750 | 0.08 | 0.22 | 9,500 | 700 | 0.06 | 0.14 | 8,200 | 680 | 0.04 | 0.09 |
| | | 30 | 10,000 | 550 | 0.06 | 0.16 | 8,300 | 450 | 0.04 | 0.1 | 6,600 | 380 | 0.03 | 0.08 |
| **3020** | **R1** | 12 | 10,300 | 1,200 | 0.16 | 0.38 | 10,150 | 1,130 | 0.12 | 0.25 | 10,000 | 1,100 | 0.1 | 0.18 |
| | | 16 | 10,000 | 1,100 | 0.15 | 0.35 | 9,900 | 1,100 | 0.1 | 0.23 | 9,800 | 1,050 | 0.09 | 0.16 |
| | | 20 | 9,500 | 950 | 0.15 | 0.32 | 9,300 | 940 | 0.1 | 0.21 | 9,000 | 930 | 0.08 | 0.15 |
| | | 22 | 9,400 | 900 | 0.14 | 0.3 | 9,100 | 850 | 0.09 | 0.2 | 8,600 | 840 | 0.08 | 0.14 |
| | | 26 | 9,300 | 750 | 0.12 | 0.28 | 8,700 | 730 | 0.08 | 0.2 | 8,000 | 700 | 0.07 | 0.13 |
| | | 30 | 9,200 | 630 | 0.11 | 0.25 | 8,400 | 590 | 0.08 | 0.17 | 7,500 | 550 | 0.05 | 0.1 |
| | | 32 | 8,800 | 580 | 0.1 | 0.24 | 8,200 | 550 | 0.07 | 0.16 | 7,300 | 480 | 0.04 | 0.1 |
| | | 36 | 8,700 | 570 | 0.09 | 0.22 | 7,900 | 510 | 0.07 | 0.16 | 7,000 | 450 | 0.04 | 0.1 |
| | | 40 | 8,300 | 500 | 0.08 | 0.2 | 7,500 | 450 | 0.06 | 0.15 | 6,600 | 400 | 0.04 | 0.1 |
| | | 41 | 8,300 | 500 | 0.08 | 0.2 | 7,500 | 450 | 0.06 | 0.15 | 6,600 | 400 | 0.04 | 0.1 |
| | | 50 | 8,000 | 430 | 0.06 | 0.15 | 6,700 | 340 | 0.04 | 0.12 | 5,300 | 250 | 0.03 | 0.1 |
| | | 62 | 7,500 | 350 | 0.04 | 0.1 | 6,000 | 350 | 0.04 | 0.13 | 5,000 | 300 | 0.02 | 0.05 |
| **3030** | **R1.5** | 20 | 9,000 | 1,150 | 0.25 | 0.48 | 8,900 | 1,100 | 0.18 | 0.36 | 8,800 | 1,100 | 0.12 | 0.25 |
| | | 26 | 8,600 | 1,000 | 0.22 | 0.42 | 8,300 | 1,000 | 0.16 | 0.32 | 8,200 | 980 | 0.11 | 0.22 |
| | | 30 | 8,400 | 950 | 0.21 | 0.4 | 8,100 | 930 | 0.15 | 0.3 | 7,800 | 920 | 0.1 | 0.21 |
| | | 32 | 8,300 | 900 | 0.2 | 0.37 | 7,800 | 860 | 0.14 | 0.28 | 7,400 | 840 | 0.09 | 0.2 |
| | | 36 | 8,100 | 800 | 0.18 | 0.35 | 7,400 | 720 | 0.13 | 0.26 | 6,800 | 680 | 0.08 | 0.2 |
| | | 40 | 8,000 | 720 | 0.17 | 0.33 | 7,000 | 630 | 0.12 | 0.24 | 6,000 | 550 | 0.08 | 0.19 |
| | | 50 | 7,600 | 570 | 0.14 | 0.28 | 6,400 | 450 | 0.09 | 0.2 | 5,200 | 400 | 0.06 | 0.17 |
| | | 60 | 7,200 | 480 | 0.12 | 0.24 | 6,000 | 400 | 0.07 | 0.18 | 4,700 | 320 | 0.05 | 0.16 |
| | | 65 | 7,200 | 480 | 0.12 | 0.24 | 6,000 | 400 | 0.07 | 0.18 | 4,700 | 320 | 0.05 | 0.16 |

## Milling Conditions for HFTNB

| WORK MATERIAL | | | PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30～45HRC) | | | | HARDENED STEELS SKD / SKT (45～55HRC) | | | | HARDENED STEELS SKD / SKH (55～65HRC) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Radius of Ball Nose (mm) | Neck Length (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) |
| **3040** | **R2** | 30 | 8,000 | 1,100 | 0.35 | 0.55 | 7,800 | 1,050 | 0.24 | 0.4 | 7,600 | 1,000 | 0.16 | 0.33 |
| | | 40 | 7,500 | 930 | 0.3 | 0.48 | 7,300 | 900 | 0.2 | 0.35 | 7,000 | 900 | 0.15 | 0.3 |
| | | 48 | 7,200 | 750 | 0.26 | 0.42 | 6,500 | 650 | 0.16 | 0.3 | 5,800 | 600 | 0.13 | 0.27 |
| | | 50 | 7,200 | 750 | 0.26 | 0.42 | 6,500 | 650 | 0.16 | 0.3 | 5,800 | 600 | 0.13 | 0.27 |
| | | 60 | 7,000 | 600 | 0.22 | 0.36 | 6,000 | 520 | 0.13 | 0.26 | 5,000 | 440 | 0.11 | 0.25 |

Note:
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Every coolant offers stable milling.




$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)

## Roughness Comparison
HFTNB R1 × Neck Length 20 × Neck Taper Angle 0.4° SKD61 (48HRC)

Work Size : 30 x 50 x 40 mm

| Measurement Spot | Surface Roughness Ra (μm) | |
|---|---|---|
| | HFTNB | Competitor |
| ① | **0.353** | 0.451 |
| ② | **0.480** | 0.865 |
| ③ | **0.200** | 0.270 |
| ④ | **0.168** | 0.248 |

**Better surface roughness compared to competitor's!**

| No. | Milling Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth $a_p$ (mm) | Radial Depth $a_e$ (mm) | Allowance (mm) | Coolant | Cycle Time |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | HSLB 2060-200 (R3 x Effective Length 20) | 13,000 | 3,500 | 0.6 | 0.6 | 0.05 | Air Blow | 0:25:33 |
| 2 | Semi-finishing | HSLB 2030-200 (R1.5 x Effective Length 20) | 14,500 | 1,360 | 0.18 | 0.1 | 0.02 | | 0:49:48 |
| 3 | Finishing | HFTNB 3020-200-08 / Competitor (R1 x Neck Length 20 x Neck Taper Angle 0.4°) | 4,650 | 940 | 0.05 | 0.05 | 0 | | 2:29:29 |
| | | | | | | | | Total | 3:44:50 |

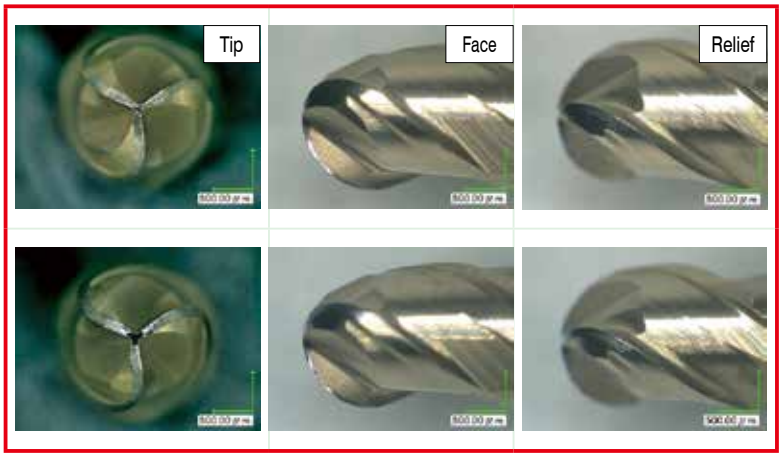
## Taper Pocket Milling Examples
## HFTNB R1 × Neck Length 30 ×Neck Taper Angle 0.9° SKD61 (50HRC)



Milling Shape：Taper Pocket 25 x 5 x Depth 4 mm Vertical Wall Inclined Angle 1°

Tools after milling

**HFTNB**




After 40 min

After 120 min

**Normal wear condition after 120 min milling. No chipping or any damages.**

Competitor A After 40 min

Chipping on the cutting edges of all 3 flutes after 40 min.

Competitor B After 40 min

Large chipping on the cutting edge after 40 min. Chipping also on the other 2 flutes.

**High durability throughout the long cycle time.**

| Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Axial Depth $a_p$ (mm) | Radial Depth $a_e$ (mm) | Coolant | Cycle Time |
|---|---|---|---|---|---|---|
| HFTNB 3020-300-18 | 8,400 | 590 | 0.08 | 0.17 | Air Blow | 40 min / pocket |

Size φ0.2～φ2.5

# C-CTE2000

Super MG | UT COAT | 25° φ0.2～φ0.4 | 30° φ0.5～φ2.5 | Flatland | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | | | ○ | | | | | | |

## Features

**Extensive line up of tapered design from 30´ to 15° of half included angle.**
**Refer to page 538 for 4 flute C-CTE.**

Total 108 models

Unit（mm）

| Model Number | Tip Diameter | Half Included Angle | Length of Cut | Dia. at Large End | Overall Length | Shank Diameter | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CTE 2002-1 | 0.2 | 30´ | 0.8 | 0.21 | 38 | 3 | 15,500 |
| C-CTE 2002-2 | | 1° | | 0.23 | 38 | 3 | 15,500 |
| C-CTE 2002-3 | | 1°30´ | | 0.24 | 38 | 3 | 15,500 |
| C-CTE 2002-4 | | 2° | | 0.26 | 38 | 3 | 15,500 |
| C-CTE 2002-6 | | 3° | | 0.28 | 38 | 3 | 15,500 |
| C-CTE 2002-8 | | 4° | | 0.31 | 38 | 3 | 16,500 |
| C-CTE 2002-10 | | 5° | | 0.34 | 38 | 3 | 18,500 |
| C-CTE 2002-14 | | 7° | | 0.40 | 38 | 3 | 20,000 |
| C-CTE 2002-20 | | 10° | | 0.48 | 38 | 3 | 22,000 |
| C-CTE 2003-1 | 0.3 | 30´ | 1.2 | 0.32 | 38 | 3 | 13,000 |
| C-CTE 2003-2 | | 1° | | 0.34 | 38 | 3 | 13,000 |
| C-CTE 2003-3 | | 1°30´ | | 0.36 | 38 | 3 | 13,000 |
| C-CTE 2003-4 | | 2° | | 0.38 | 38 | 3 | 13,000 |
| C-CTE 2003-6 | | 3° | | 0.43 | 38 | 3 | 13,000 |
| C-CTE 2003-8 | | 4° | | 0.47 | 38 | 3 | 14,000 |
| C-CTE 2003-10 | | 5° | | 0.51 | 38 | 3 | 15,000 |
| C-CTE 2003-14 | | 7° | | 0.59 | 38 | 3 | 16,500 |
| C-CTE 2003-20 | | 10° | | 0.72 | 38 | 3 | 18,500 |

Next Page ➡

Unit (mm)

| Model Number | Tip Diameter | Half Included Angle | Length of Cut | Dia. at Large End | Overall Length | Shank Diameter | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CTE 2004-1 | 0.4 | 30′ | 1.6 | 0.43 | 38 | 3 | 13,000 |
| C-CTE 2004-2 | | 1° | | 0.46 | 38 | 3 | 13,000 |
| C-CTE 2004-3 | | 1°30′ | | 0.48 | 38 | 3 | 13,000 |
| C-CTE 2004-4 | | 2° | | 0.51 | 38 | 3 | 13,000 |
| C-CTE 2004-6 | | 3° | | 0.57 | 38 | 3 | 13,000 |
| C-CTE 2004-8 | | 4° | | 0.62 | 38 | 3 | 14,000 |
| C-CTE 2004-10 | | 5° | | 0.68 | 38 | 3 | 15,000 |
| C-CTE 2004-14 | | 7° | | 0.79 | 38 | 3 | 16,500 |
| C-CTE 2004-20 | | 10° | | 0.96 | 38 | 3 | 18,500 |
| C-CTE 2005-1 | 0.5 | 30′ | 2 | 0.53 | 38 | 3 | 12,960 |
| C-CTE 2005-2 | | 1° | | 0.57 | 38 | 3 | 12,960 |
| C-CTE 2005-3 | | 1°30′ | | 0.60 | 38 | 3 | 12,960 |
| C-CTE 2005-4 | | 2° | | 0.64 | 38 | 3 | 12,960 |
| C-CTE 2005-6 | | 3° | | 0.71 | 38 | 3 | 12,960 |
| C-CTE 2005-8 | | 4° | | 0.78 | 38 | 3 | 14,040 |
| C-CTE 2005-10 | | 5° | | 0.85 | 38 | 3 | 15,120 |
| C-CTE 2005-14 | | 7° | | 0.99 | 38 | 3 | 17,280 |
| C-CTE 2005-20 | | 10° | | 1.21 | 38 | 3 | 18,360 |
| C-CTE 2005-24 | | 12° | | 1.35 | 38 | 3 | 18,960 |
| C-CTE 2005-30 | | 15° | | 1.57 | 38 | 3 | 19,680 |
| C-CTE 2006-1 | 0.6 | 30′ | 2 | 0.63 | 38 | 3 | 12,120 |
| C-CTE 2006-2 | | 1° | | 0.67 | 38 | 3 | 12,120 |
| C-CTE 2006-3 | | 1°30′ | | 0.70 | 38 | 3 | 12,120 |
| C-CTE 2006-4 | | 2° | | 0.74 | 38 | 3 | 12,120 |
| C-CTE 2006-5 | | 2°30′ | | 0.77 | 38 | 3 | 12,120 |
| C-CTE 2006-6 | | 3° | | 0.81 | 38 | 3 | 12,120 |
| C-CTE 2006-10 | | 5° | | 0.95 | 38 | 3 | 14,280 |
| C-CTE 2006-14 | | 7° | | 1.09 | 38 | 3 | 16,440 |
| C-CTE 2006-20 | | 10° | | 1.31 | 38 | 3 | 17,520 |
| C-CTE 2006-24 | | 12° | | 1.45 | 38 | 3 | 18,000 |
| C-CTE 2006-30 | | 15° | | 1.67 | 38 | 3 | 18,600 |
| C-CTE 2008-1 | 0.8 | 30′ | 3 | 0.85 | 38 | 3 | 12,120 |
| C-CTE 2008-2 | | 1° | | 0.90 | 38 | 3 | 12,120 |
| C-CTE 2008-3 | | 1°30′ | | 0.96 | 38 | 3 | 12,120 |
| C-CTE 2008-4 | | 2° | | 1.01 | 38 | 3 | 12,120 |
| C-CTE 2008-5 | | 2°30′ | | 1.06 | 38 | 3 | 12,120 |
| C-CTE 2008-6 | | 3° | | 1.11 | 38 | 3 | 12,120 |
| C-CTE 2008-10 | | 5° | | 1.32 | 38 | 3 | 14,280 |
| C-CTE 2008-14 | | 7° | | 1.54 | 38 | 3 | 16,440 |
| C-CTE 2008-20 | | 10° | | 1.86 | 38 | 3 | 17,520 |
| C-CTE 2008-24 | | 12° | | 2.08 | 38 | 3 | 18,000 |
| C-CTE 2008-30 | | 15° | | 2.41 | 38 | 3 | 18,600 |
| C-CTE 2010-1 | 1 | 30′ | 4 | 1.07 | 45 | 4 | 9,480 |
| C-CTE 2010-2 | | 1° | | 1.14 | 45 | 4 | 9,480 |
| C-CTE 2010-3 | | 1°30′ | | 1.21 | 45 | 4 | 9,480 |

Next Page ➡

Unit (mm)

| Model Number | Tip Diameter | Half Included Angle | Length of Cut | Dia. at Large End | Overall Length | Shank Diameter | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CTE 2010-4 | 1 | 2° | 4 | 1.28 | 45 | 4 | 9,480 |
| C-CTE 2010-5 | | 2°30′ | | 1.35 | 45 | 4 | 9,480 |
| C-CTE 2010-6 | | 3° | | 1.42 | 45 | 4 | 9,720 |
| C-CTE 2010-8 | | 4° | | 1.56 | 45 | 4 | 11,760 |
| C-CTE 2010-10 | | 5° | | 1.70 | 45 | 4 | 11,760 |
| C-CTE 2010-14 | | 7° | | 1.98 | 45 | 4 | 15,720 |
| C-CTE 2010-20 | | 10° | | 2.41 | 45 | 4 | 16,800 |
| C-CTE 2010-24 | | 12° | | 2.70 | 45 | 4 | 18,000 |
| C-CTE 2010-30 | | 15° | | 3.14 | 50 | 6 | 18,720 |
| C-CTE 2015-1 | 1.5 | 30′ | 5 | 1.59 | 45 | 4 | 9,480 |
| C-CTE 2015-2 | | 1° | | 1.67 | 45 | 4 | 9,480 |
| C-CTE 2015-3 | | 1°30′ | | 1.76 | 45 | 4 | 9,480 |
| C-CTE 2015-4 | | 2° | | 1.85 | 45 | 4 | 9,480 |
| C-CTE 2015-5 | | 2°30′ | | 1.94 | 45 | 4 | 9,480 |
| C-CTE 2015-6 | | 3° | | 2.02 | 45 | 4 | 9,720 |
| C-CTE 2015-8 | | 4° | | 2.20 | 45 | 4 | 11,760 |
| C-CTE 2015-10 | | 5° | | 2.37 | 45 | 4 | 11,760 |
| C-CTE 2015-14 | | 7° | | 2.73 | 45 | 4 | 15,720 |
| C-CTE 2015-20 | | 10° | | 3.26 | 45 | 4 | 16,800 |
| C-CTE 2015-24 | | 12° | | 3.63 | 45 | 4 | 18,000 |
| C-CTE 2015-30 | | 15° | | 4.18 | 50 | 6 | 18,720 |
| C-CTE 2020-1 | 2 | 30′ | 6 | 2.10 | 45 | 4 | 9,480 |
| C-CTE 2020-2 | | 1° | | 2.21 | 45 | 4 | 9,480 |
| C-CTE 2020-3 | | 1°30′ | | 2.31 | 45 | 4 | 9,480 |
| C-CTE 2020-4 | | 2° | | 2.42 | 45 | 4 | 9,480 |
| C-CTE 2020-5 | | 2°30′ | | 2.52 | 45 | 4 | 9,480 |
| C-CTE 2020-6 | | 3° | | 2.63 | 45 | 4 | 9,720 |
| C-CTE 2020-8 | | 4° | | 2.84 | 45 | 4 | 10,080 |
| C-CTE 2020-10 | | 5° | | 3.05 | 45 | 4 | 11,200 |
| C-CTE 2020-14 | | 7° | | 3.47 | 45 | 4 | 15,720 |
| C-CTE 2020-20 | | 10° | | 4.12 | 50 | 6 | 18,720 |
| C-CTE 2020-24 | | 12° | | 4.55 | 50 | 6 | 19,680 |
| C-CTE 2020-30 | | 15° | | 5.22 | 50 | 6 | 20,640 |
| C-CTE 2025-1 | 2.5 | 30′ | 8 | 2.64 | 45 | 4 | 10,800 |
| C-CTE 2025-2 | | 1° | | 2.78 | 45 | 4 | 10,800 |
| C-CTE 2025-3 | | 1°30′ | | 2.92 | 45 | 4 | 10,800 |
| C-CTE 2025-4 | | 2° | | 3.06 | 45 | 4 | 10,800 |
| C-CTE 2025-5 | | 2°30′ | | 3.20 | 45 | 4 | 10,800 |
| C-CTE 2025-6 | | 3° | | 3.34 | 45 | 4 | 10,800 |
| C-CTE 2025-8 | | 4° | | 3.62 | 45 | 4 | 11,100 |
| C-CTE 2025-10 | | 5° | | 3.90 | 45 | 4 | 11,400 |
| C-CTE 2025-14 | | 7° | | 4.45 | 45 | 6 | 13,340 |
| C-CTE 2025-20 | | 10° | | 5.32 | 50 | 6 | 24,150 |
| C-CTE 2025-24 | | 12° | | 5.90 | 50 | 8 | 26,400 |
| C-CTE 2025-30 | | 15° | | 6.79 | 50 | 8 | 27,500 |

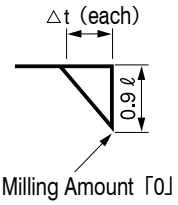
## Milling Conditions for C-CTE（2 Flutes）

| WORK MATERIAL | | CARBON STEELS ALLOY STEELS (～325HB) | | TOOL STEELS PREHARDENED STEELS (30～40HRC) | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | |
|---|---|---|---|---|---|---|---|
| Model Number | Tip Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **2002** | **0.2** | 32,000 | 45 | 25,000 | 30 | 18,000 | 20 |
| **2003** | **0.3** | 30,000 | 50 | 23,000 | 30 | 16,200 | 25 |
| **2004** | **0.4** | 28,000 | 60 | 21,000 | 35 | 14,500 | 25 |
| **2005** | **0.5** | 25,500 | 70 | 19,100 | 40 | 12,700 | 25 |
| **2006** | **0.6** | 21,300 | 70 | 15,900 | 40 | 10,600 | 25 |
| **2008** | **0.8** | 15,900 | 100 | 11,900 | 60 | 8,000 | 40 |
| **2010** | **1** | 12,800 | 150 | 9,600 | 110 | 6,400 | 70 |
| **2015** | **1.5** | 8,500 | 150 | 6,400 | 110 | 4,300 | 70 |
| **2020** | **2** | 6,400 | 150 | 4,800 | 110 | 3,200 | 70 |
| **2025** | **2.5** | 5,100 | 150 | 3,800 | 110 | 2,600 | 70 |

Milling Amount for Side Milling (mm)

$\ell$ = Length of Cut

$\triangle t$ = tan Half Included Taper Angle × 0.9 $\ell$




Note:
・Recommend water soluble or oil coolant.
・Recommend wet coolant for Copper.

Size φ3～φ10

# C-CTE4000

Super MG | UT COAT | 30° | Flatland | ±5′ | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ◎ | | | ○ | | | ○ | | | | | | |

## Features

**Extensive line up of tapered design from 30′ to 7° of half included angle.**
**Refer to page 534 for 2 flute C-CTE.**

Total 46 models　　Unit（mm）

| Model Number | Tip Diameter | Half Included Angle | Length of Cut | Dia. at Large End | Overall Length | Shank Diameter | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CTE 4030-1 | 3 | 30′ | 10 | 3.17 | 50 | 6 | 11,340 |
| C-CTE 4030-2 | | 1° | | 3.35 | 50 | 6 | 11,340 |
| C-CTE 4030-3 | | 1°30′ | | 3.52 | 50 | 6 | 11,340 |
| C-CTE 4030-4 | | 2° | | 3.70 | 50 | 6 | 11,340 |
| C-CTE 4030-5 | | 2°30′ | | 3.87 | 50 | 6 | 11,340 |
| C-CTE 4030-6 | | 3° | | 4.05 | 50 | 6 | 11,340 |
| C-CTE 4030-10 | | 5° | | 4.75 | 50 | 6 | 12,290 |
| C-CTE 4030-14 | | 7° | | 5.46 | 50 | 6 | 13,650 |
| C-CTE 4040-1 | 4 | 30′ | 15 | 4.26 | 50 | 6 | 11,760 |
| C-CTE 4040-2 | | 1° | | 4.52 | 50 | 6 | 11,760 |
| C-CTE 4040-3 | | 1°30′ | | 4.79 | 50 | 6 | 11,760 |
| C-CTE 4040-4 | | 2° | | 5.05 | 50 | 6 | 11,760 |
| C-CTE 4040-5 | | 2°30′ | | 5.31 | 50 | 6 | 11,760 |
| C-CTE 4040-6 | | 3° | | 5.57 | 50 | 6 | 11,760 |
| C-CTE 4040-10 | | 5° | | 6.63 | 50 | 8 | 16,280 |
| C-CTE 4040-14 | | 7° | | 7.68 | 50 | 8 | 18,150 |

Next Page ➡

Unit（mm）

| Model Number | Tip Diameter | Half Included Angle | Length of Cut | Dia. at Large End | Overall Length | Shank Diameter | Price ¥ |
|---|---|---|---|---|---|---|---|
| C-CTE 4050-1 | 5 | 30′ | 20 | 5.35 | 60 | 6 | 13,650 |
| C-CTE 4050-2 | | 1° | | 5.70 | 60 | 6 | 13,650 |
| C-CTE 4050-3 | | 1°30′ | | 6.05 | 60 | 8 | 14,300 |
| C-CTE 4050-4 | | 2° | | 6.40 | 60 | 8 | 14,300 |
| C-CTE 4050-5 | | 2°30′ | | 6.75 | 60 | 8 | 14,300 |
| C-CTE 4050-6 | | 3° | | 7.10 | 60 | 8 | 14,300 |
| C-CTE 4050-10 | | 5° | | 8.50 | 60 | 10 | 21,780 |
| C-CTE 4050-14 | | 7° | | 9.91 | 60 | 10 | 24,200 |
| C-CTE 4060-1 | 6 | 30′ | 20 | 6.35 | 60 | 8 | 14,300 |
| C-CTE 4060-2 | | 1° | | 6.70 | 60 | 8 | 14,300 |
| C-CTE 4060-3 | | 1°30′ | | 7.05 | 60 | 8 | 14,300 |
| C-CTE 4060-4 | | 2° | | 7.40 | 60 | 8 | 14,300 |
| C-CTE 4060-5 | | 2°30′ | | 7.75 | 60 | 8 | 15,840 |
| C-CTE 4060-6 | | 3° | | 8.10 | 60 | 10 | 15,840 |
| C-CTE 4060-10 | | 5° | | 9.50 | 60 | 10 | 23,320 |
| C-CTE 4060-14 | | 7° | | 10.91 | 60 | 12 | 25,960 |
| C-CTE 4080-1 | 8 | 30′ | 25 | 8.44 | 70 | 10 | 22,440 |
| C-CTE 4080-2 | | 1° | | 8.87 | 70 | 10 | 23,100 |
| C-CTE 4080-3 | | 1°30′ | | 9.31 | 70 | 10 | 24,750 |
| C-CTE 4080-4 | | 2° | | 9.75 | 70 | 10 | 26,070 |
| C-CTE 4080-5 | | 2°30′ | | 10.18 | 75 | 12 | 28,600 |
| C-CTE 4080-6 | | 3° | | 10.62 | 75 | 12 | 30,360 |
| C-CTE 4080-10 | | 5° | | 12.37 | 90 | 12 | 52,800 |
| C-CTE 4100-1 | 10 | 30′ | 35 | 10.61 | 90 | 12 | 37,950 |
| C-CTE 4100-2 | | 1° | | 11.22 | 90 | 12 | 40,260 |
| C-CTE 4100-3 | | 1°30′ | | 11.83 | 90 | 12 | 42,900 |
| C-CTE 4100-4 | | 2° | | 12.44 | 90 | 12 | 49,500 |
| C-CTE 4100-5 | | 2°30′ | | 13.05 | 90 | 12 | 53,900 |
| C-CTE 4100-6 | | 3° | | 13.67 | 90 | 12 | 57,750 |
| C-CTE 4100-10 | | 5° | | 16.12 | 90 | 16 | 69,300 |

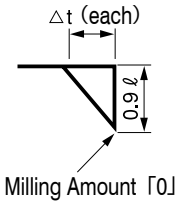
## Milling Conditions for C-CTE（4 Flutes）

| WORK MATERIAL | | CARBON STEELS ALLOY STEELS (～325HB) | | TOOL STEELS PREHARDENED STEELS (30～40HRC) | | PREHARDENED STEELS HARDENED STEELS (40～50HRC) | |
|---|---|---|---|---|---|---|---|
| Model Number | Tip Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **4030** | **3** | 4,200 | 200 | 3,200 | 150 | 2,100 | 90 |
| **4040** | **4** | 3,200 | 200 | 2,400 | 150 | 1,600 | 90 |
| **4050** | **5** | 2,600 | 200 | 1,900 | 150 | 1,300 | 90 |
| **4060** | **6** | 2,100 | 200 | 1,600 | 150 | 1,100 | 90 |
| **4080** | **8** | 1,600 | 200 | 1,200 | 150 | 800 | 90 |
| **4100** | **10** | 1,300 | 200 | 1,000 | 150 | 600 | 90 |

Milling Amount for Side Milling (mm)

$\ell$ = Length of Cut

$\triangle t$ = tan Half Included Taper Angle × 0.9$\ell$




Note:
・Recommend water soluble or oil coolant.
・Recommend wet coolant for Copper.

## Size φ3～φ12

# SV

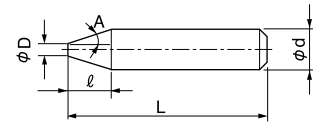
Super MG | 30° | Flatland | Shank Dia 0/-0.005

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | | | | ○ | ○ | ○ | ○ | ○ | | | | | |

## Features

**Spiral type Chamfering cutter.**
**Half included angle 45˚.**
**By applying a spiral peripheral cutting edge, burrs are greatly reduced when compared to a straight cutting edge design.**




Total 6 models

Unit (mm)

| Model Number | Tip Diameter φD | Length of Cut ℓ | Overall Length L | Half Included Angle A | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|
| **SV 2030** | 0.8 | 1.1 | 40 | 45˚ | 3 | 13,000 |
| **SV 2040** | | 1.6 | 45 | | 4 | 14,000 |
| **SV 2060** | 1 | 2.5 | 50 | | 6 | 15,750 |
| **SV 2080** | | 3.5 | 60 | | 8 | 19,250 |
| **SV 2100** | | 4.5 | 70 | | 10 | 27,500 |
| **SV 2120** | | 5.5 | 75 | | 12 | 32,230 |

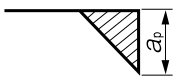
## Milling Conditions for SV

| WORK MATERIAL | | CARBON STEELS S45C / S50C (～225HB) | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | |
|---|---|---|---|---|---|---|---|
| Model Number | Shank Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **2030** | **3** | 2,700～5,300 | 59～86 | 2,100～4,200 | 46～67 | 1,600～3,200 | 35～51 |
| **2040** | **4** | 2,000～4,000 | 48～68 | 1,600～3,200 | 38～54 | 1,200～2,400 | 29～41 |
| **2060** | **6** | 1,300～2,700 | 36～49 | 1,100～2,100 | 31～42 | 800～1,600 | 22～30 |
| **2080** | **8** | 1,000～2,000 | 32～42 | 800～1,600 | 26～34 | 600～1,200 | 22～30 |
| **2100** | **10** | 800～1,600 | 30～37 | 640～1,300 | 23～29 | 600～1,200 | 17～22 |
| **2120** | **12** | 700～1,300 | 28～35 | 530～1,100 | 21～27 | 400～800 | 17～22 |

Milling Amount (mm)

$a_p = 0.1D$

$a_p$ : Axial Depth (mm)




Note:
・The figures listed above are for nominal diameters. Adjust the speed and feed rate according to the correct diameter.
・Recommend slot milling with the tip flutes. Decrease the feed rate 50% from the milling parameters in this case.
・Recommend water soluble or oil coolant.

**Size φ2～φ12**

# UTDF

Super MG | UT COAT | 30° | Flatland | Shank Dia 0/-0.005

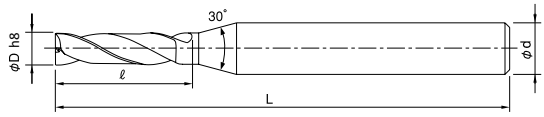
Patented in Japan

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Structural Steels SS400 | Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | | | | ◎ | ◎ | | | | | | | | |

## Features

**Available to a wide variety of applications by the 180° point angle.**
**The helix angle of 30° offers excellent chip evacuation, stable and highly efficient pilot hole drilling.**
**New web-thinning design for improved chip evacuation and sharpness.**
**Double-margin will guide the tool into inner wall and achieve high-straightness drilling to non-planar surface.**
**Size M4 - M12 for drilling pilot holes before tapping.**




| Outside Diameter | Diameter Tolerance(h8) |
|---|---|
| φ D ≦ 3 | 0/-0.014 |
| 3 < φ D ≦ 6 | 0/-0.018 |
| 6 < φ D ≦ 10 | 0/-0.022 |
| 10 < φ D ≦ 12 | 0/-0.027 |

### Feature1 : Helix angle 30°

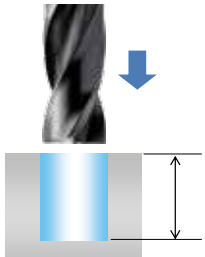
Excellent chip evacuation with 30° helix angle

### Feature2 : Double-margin

**Double-margin**

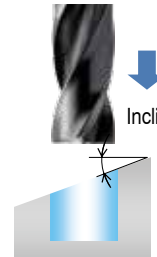
High-straightness drilling

### Feature3 : A wide variety of applications



Hole depth : 2D or below (ℓ/D=4)
1D or below (ℓ/D=2)

Flat surface



Inclined angle θ

Inclined surface

**Designed for drilling on flat, inclined or curved surfaces.**

Total 21 models

Unit（mm）

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| **UTDF 2200-080** | 2 | 8 | 50 | 4 | 6,500 |
| **UTDF 2250-100** | 2.5 | 10 | 50 | 4 | 6,500 |
| **UTDF 2300-120** | 3 | 12 | 60 | 6 | 6,500 |
| **UTDF 2330-132** | 3.3 | 13.2 | 60 | 6 | 7,000 |
| **UTDF 2400-160** | 4 | 16 | 60 | 6 | 7,200 |
| **UTDF 2420-168** | 4.2 | 16.8 | 60 | 6 | 7,500 |
| **UTDF 2500-200** | 5 | 20 | 60 | 6 | 7,800 |
| **UTDF 2510-204** | 5.1 | 20.4 | 60 | 6 | 7,800 |
| **UTDF 2600-240** | 6 | 24 | 60 | 6 | 8,000 |
| **UTDF 2650-130** | 6.5 | 13 | 70 | 8 | 9,700 |
| **UTDF 2680-272** | 6.8 | 27.2 | 70 | 8 | 9,700 |
| **UTDF 2700-280** | 7 | 28 | 80 | 8 | 9,700 |
| **UTDF 2800-320** | 8 | 32 | 80 | 8 | 10,500 |
| **UTDF 2850-340** | 8.5 | 34 | 80 | 10 | 11,500 |
| **UTDF 2860-344** | 8.6 | 34.4 | 80 | 10 | 11,500 |
| **UTDF 2900-360** | 9 | 36 | 80 | 10 | 13,500 |
| **UTDF 2950-190** | 9.5 | 19 | 90 | 10 | 13,500 |
| **UTDF 21000-400** | 10 | 40 | 90 | 10 | 13,500 |
| **UTDF 21030-412** | 10.3 | 41.2 | 90 | 12 | 14,000 |
| **UTDF 21100-220** | 11 | 22 | 100 | 12 | 15,500 |
| **UTDF 21200-480** | 12 | 48 | 100 | 12 | 15,500 |

*Contact our sales for the custom size tool.

## Milling Conditions for UTDF

Flat Surface

| WORK MATERIAL | | | CARBON STEELS STRUCTURAL STEELS GRAY CAST IRON S50C / SS400 / FC250 | | ALLOY STEELS SCM415 | | PREHARDENED STEELS NAK80 | | DUCTILE IRON FCD | | ALUMINUM ALLOYS A5052 / A7075 | | ALUMINUM CAST ADC12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Diameter φD (mm) | Flute Length ℓ (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **2200-080** | **2** | 8 | 15,000 | 900 | 12,900 | 740 | 6,000 | 160 | 12,900 | 660 | 25,200 | 2,070 | 18,900 | 1,340 |
| **2250-100** | **2.5** | 10 | 12,000 | 880 | 10,320 | 730 | 4,800 | 160 | 10,320 | 660 | 20,160 | 2,070 | 15,120 | 1,340 |
| **2300-120** | **3** | 12 | 10,000 | 860 | 8,600 | 710 | 4,000 | 150 | 8,600 | 630 | 16,800 | 1,970 | 12,600 | 1,280 |
| **2330-132** | **3.3** | 13.2 | 9,090 | 860 | 7,820 | 710 | 3,640 | 150 | 7,820 | 630 | 15,280 | 1,970 | 11,460 | 1,280 |
| **2400-160** | **4** | 16 | 7,500 | 830 | 6,450 | 690 | 3,000 | 150 | 6,450 | 610 | 12,600 | 1,900 | 9,450 | 1,230 |
| **2420-168** | **4.2** | 16.8 | 7,150 | 830 | 6,150 | 690 | 2,860 | 150 | 6,150 | 610 | 12,000 | 1,900 | 9,000 | 1,230 |
| **2500-200** | **5** | 20 | 6,000 | 800 | 5,160 | 660 | 2,400 | 140 | 5,160 | 590 | 10,080 | 1,840 | 7,560 | 1,190 |
| **2510-204** | **5.1** | 20.4 | 5,880 | 800 | 5,060 | 660 | 2,350 | 140 | 5,060 | 590 | 9,880 | 1,840 | 7,400 | 1,190 |
| **2600-240** | **6** | 24 | 5,000 | 770 | 4,300 | 640 | 2,000 | 140 | 4,300 | 560 | 8,400 | 1,770 | 6,300 | 1,140 |
| **2650-130** | **6.5** | 13 | 4,620 | 770 | 3,970 | 640 | 1,850 | 140 | 3,970 | 560 | 7,750 | 1,770 | 5,820 | 1,140 |
| **2680-272** | **6.8** | 27.2 | 4,420 | 770 | 3,800 | 640 | 1,770 | 140 | 3,800 | 560 | 7,420 | 1,770 | 5,560 | 1,140 |
| **2700-280** | **7** | 28 | 4,290 | 760 | 3,680 | 630 | 1,710 | 140 | 3,680 | 560 | 7,200 | 1,770 | 5,400 | 1,140 |
| **2800-320** | **8** | 32 | 3,750 | 730 | 3,230 | 600 | 1,500 | 130 | 3,230 | 540 | 6,300 | 1,670 | 4,730 | 1,080 |
| **2850-340** | **8.5** | 34 | 3,530 | 730 | 3,040 | 600 | 1,420 | 130 | 3,040 | 540 | 5,930 | 1,670 | 4,450 | 1,080 |
| **2860-344** | **8.6** | 34.4 | 3,490 | 720 | 3,000 | 600 | 1,400 | 130 | 3,000 | 540 | 5,860 | 1,670 | 4,400 | 1,080 |
| **2900-360** | **9** | 36 | 3,330 | 720 | 2,870 | 590 | 1,330 | 120 | 2,870 | 530 | 5,600 | 1,670 | 4,200 | 1,080 |
| **2950-190** | **9.5** | 19 | 3,160 | 700 | 2,720 | 580 | 1,260 | 120 | 2,720 | 520 | 5,300 | 1,620 | 3,980 | 1,050 |
| **21000-400** | **10** | 40 | 3,000 | 690 | 2,580 | 570 | 1,200 | 120 | 2,580 | 510 | 5,040 | 1,580 | 3,780 | 1,020 |
| **21030-412** | **10.3** | 41.2 | 2,920 | 690 | 2,510 | 570 | 1,170 | 120 | 2,510 | 510 | 4,900 | 1,580 | 3,670 | 1,020 |
| **21100-220** | **11** | 22 | 2,730 | 670 | 2,350 | 550 | 1,090 | 110 | 2,350 | 500 | 4,580 | 1,540 | 3,440 | 1,000 |
| **21200-480** | **12** | 48 | 2,500 | 650 | 2,150 | 540 | 1,000 | 110 | 2,150 | 480 | 4,200 | 1,490 | 3,150 | 960 |

## Milling Conditions for UTDF

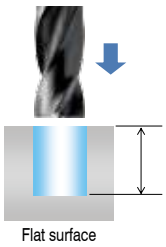
Inclined Surface ( $\theta \leqq 30^{\circ}$ )

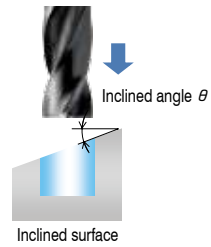
| WORK MATERIAL | | | CARBON STEELS STRUCTURAL STEELS GRAY CAST IRON S50C / SS400 / FC250 | | ALLOY STEELS SCM415 | | PREHARDENED STEELS NAK80 | | DUCTILE IRON FCD | | ALUMINUM ALLOYS A5052 / A7075 | | ALUMINUM CAST ADC12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Diameter φD (mm) | Flute Length ℓ (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **2200-080** | **2** | 8 | 15,000 | 270 | 12,900 | 220 | 6,000 | 48 | 12,900 | 190 | 25,200 | 620 | 18,900 | 400 |
| **2250-100** | **2.5** | 10 | 12,000 | 260 | 10,320 | 220 | 4,800 | 48 | 10,320 | 190 | 20,160 | 620 | 15,120 | 400 |
| **2300-120** | **3** | 12 | 10,000 | 250 | 8,600 | 210 | 4,000 | 45 | 8,600 | 180 | 16,800 | 590 | 12,600 | 380 |
| **2330-132** | **3.3** | 13.2 | 9,090 | 250 | 7,820 | 210 | 3,640 | 45 | 7,820 | 180 | 15,280 | 590 | 11,460 | 380 |
| **2400-160** | **4** | 16 | 7,500 | 240 | 6,450 | 200 | 3,000 | 45 | 6,450 | 180 | 12,600 | 570 | 9,450 | 360 |
| **2420-168** | **4.2** | 16.8 | 7,150 | 240 | 6,150 | 200 | 2,860 | 45 | 6,150 | 180 | 12,000 | 570 | 9,000 | 360 |
| **2500-200** | **5** | 20 | 6,000 | 240 | 5,160 | 190 | 2,400 | 42 | 5,160 | 170 | 10,080 | 550 | 7,560 | 350 |
| **2510-204** | **5.1** | 20.4 | 5,880 | 230 | 5,060 | 190 | 2,350 | 42 | 5,060 | 170 | 9,880 | 550 | 7,400 | 350 |
| **2600-240** | **6** | 24 | 5,000 | 230 | 4,300 | 190 | 2,000 | 42 | 4,300 | 160 | 8,400 | 530 | 6,300 | 340 |
| **2650-130** | **6.5** | 13 | 4,620 | 230 | 3,970 | 190 | 1,850 | 42 | 3,970 | 160 | 7,750 | 530 | 5,820 | 340 |
| **2680-272** | **6.8** | 27.2 | 4,420 | 230 | 3,800 | 190 | 1,770 | 42 | 3,800 | 160 | 7,420 | 530 | 5,560 | 340 |
| **2700-280** | **7** | 28 | 4,290 | 230 | 3,680 | 190 | 1,710 | 42 | 3,680 | 160 | 7,200 | 530 | 5,400 | 340 |
| **2800-320** | **8** | 32 | 3,750 | 210 | 3,230 | 180 | 1,500 | 39 | 3,230 | 160 | 6,300 | 500 | 4,730 | 320 |
| **2850-340** | **8.5** | 34 | 3,530 | 210 | 3,040 | 180 | 1,420 | 39 | 3,040 | 160 | 5,930 | 500 | 4,450 | 320 |
| **2860-344** | **8.6** | 34.4 | 3,490 | 210 | 3,000 | 180 | 1,400 | 39 | 3,000 | 160 | 5,860 | 500 | 4,400 | 320 |
| **2900-360** | **9** | 36 | 3,330 | 210 | 2,870 | 180 | 1,330 | 38 | 2,870 | 160 | 5,600 | 500 | 4,200 | 320 |
| **2950-190** | **9.5** | 19 | 3,160 | 210 | 2,720 | 170 | 1,260 | 36 | 2,720 | 150 | 5,300 | 490 | 3,980 | 310 |
| **21000-400** | **10** | 40 | 3,000 | 200 | 2,580 | 170 | 1,200 | 36 | 2,580 | 150 | 5,040 | 470 | 3,780 | 300 |
| **21030-412** | **10.3** | 41.2 | 2,920 | 200 | 2,510 | 170 | 1,170 | 36 | 2,510 | 150 | 4,900 | 470 | 3,670 | 300 |
| **21100-220** | **11** | 22 | 2,730 | 200 | 2,350 | 160 | 1,090 | 34 | 2,350 | 140 | 4,580 | 460 | 3,440 | 290 |
| **21200-480** | **12** | 48 | 2,500 | 190 | 2,150 | 160 | 1,000 | 33 | 2,150 | 140 | 4,200 | 440 | 3,150 | 280 |

## Milling Conditions for UTDF

Inclined Surface ($\theta > 30°$)

| WORK MATERIAL | | | CARBON STEELS STRUCTURAL STEELS GRAY CAST IRON S50C / SS400 / FC250 | | ALLOY STEELS SCM415 | | PREHARDENED STEELS NAK80 | | DUCTILE IRON FCD | | ALUMINUM ALLOYS A5052 / A7075 | | ALUMINUM CAST ADC12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Diameter φD (mm) | Flute Length ℓ (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **2200-080** | **2** | 8 | 10,500 | 90 | 9,030 | 74 | 4,200 | 16 | 9,030 | 66 | 17,640 | 200 | 13,230 | 130 |
| **2250-100** | **2.5** | 10 | 8,400 | 90 | 7,220 | 74 | 3,360 | 16 | 7,220 | 66 | 14,110 | 200 | 10,580 | 130 |
| **2300-120** | **3** | 12 | 7,000 | 86 | 6,020 | 71 | 2,800 | 15 | 6,020 | 63 | 11,760 | 190 | 8,820 | 120 |
| **2330-132** | **3.3** | 13.2 | 6,370 | 86 | 5,480 | 71 | 2,550 | 15 | 5,480 | 63 | 10,700 | 190 | 8,030 | 120 |
| **2400-160** | **4** | 16 | 5,250 | 83 | 4,520 | 69 | 2,100 | 15 | 4,520 | 61 | 8,820 | 190 | 6,620 | 120 |
| **2420-168** | **4.2** | 16.8 | 5,010 | 83 | 4,310 | 69 | 2,010 | 15 | 4,310 | 61 | 8,400 | 190 | 6,300 | 120 |
| **2500-200** | **5** | 20 | 4,200 | 80 | 3,620 | 66 | 1,680 | 14 | 3,620 | 59 | 7,060 | 180 | 5,300 | 110 |
| **2510-204** | **5.1** | 20.4 | 4,120 | 80 | 3,540 | 66 | 1,650 | 14 | 3,540 | 59 | 6,920 | 180 | 5,190 | 110 |
| **2600-240** | **6** | 24 | 3,500 | 77 | 3,010 | 64 | 1,400 | 14 | 3,010 | 56 | 5,880 | 170 | 4,410 | 110 |
| **2650-130** | **6.5** | 13 | 3,230 | 77 | 2,780 | 64 | 1,290 | 14 | 2,780 | 56 | 5,430 | 170 | 4,070 | 110 |
| **2680-272** | **6.8** | 27.2 | 3,100 | 77 | 2,660 | 64 | 1,240 | 14 | 2,660 | 56 | 5,200 | 170 | 3,900 | 110 |
| **2700-280** | **7** | 28 | 3,000 | 77 | 2,580 | 64 | 1,200 | 14 | 2,580 | 56 | 5,040 | 170 | 3,780 | 110 |
| **2800-320** | **8** | 32 | 2,630 | 73 | 2,270 | 60 | 1,050 | 13 | 2,270 | 54 | 4,410 | 160 | 3,320 | 100 |
| **2850-340** | **8.5** | 34 | 2,480 | 73 | 2,130 | 60 | 1,000 | 13 | 2,130 | 54 | 4,160 | 160 | 3,120 | 100 |
| **2860-344** | **8.6** | 34.4 | 2,440 | 73 | 2,100 | 60 | 980 | 13 | 2,100 | 54 | 4,100 | 160 | 3,080 | 100 |
| **2900-360** | **9** | 36 | 2,330 | 73 | 2,010 | 60 | 930 | 13 | 2,010 | 54 | 3,920 | 160 | 2,940 | 100 |
| **2950-190** | **9.5** | 19 | 2,210 | 71 | 1,900 | 58 | 880 | 12 | 1,900 | 53 | 3,710 | 150 | 2,790 | 100 |
| **21000-400** | **10** | 40 | 2,100 | 69 | 1,810 | 57 | 840 | 12 | 1,810 | 51 | 3,530 | 150 | 2,650 | 100 |
| **21030-412** | **10.3** | 41.2 | 2,050 | 69 | 1,760 | 57 | 820 | 12 | 1,760 | 51 | 3,430 | 150 | 2,570 | 100 |
| **21100-220** | **11** | 22 | 1,910 | 67 | 1,640 | 55 | 760 | 11 | 1,640 | 49 | 3,210 | 140 | 2,400 | 90 |
| **21200-480** | **12** | 48 | 1,750 | 65 | 1,510 | 54 | 700 | 11 | 1,510 | 48 | 2,940 | 140 | 2,210 | 90 |



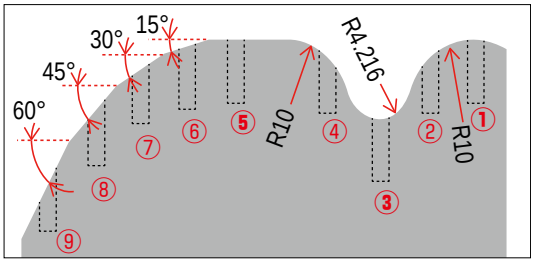




Note:
- These milling parameters are for reference only.
- Adjust the parameters in accordance with the machine rigidity, workpiece clamping condition and shape.
- Recommend water soluble or oil coolant.
- Step milling is recommended in case of clogging.

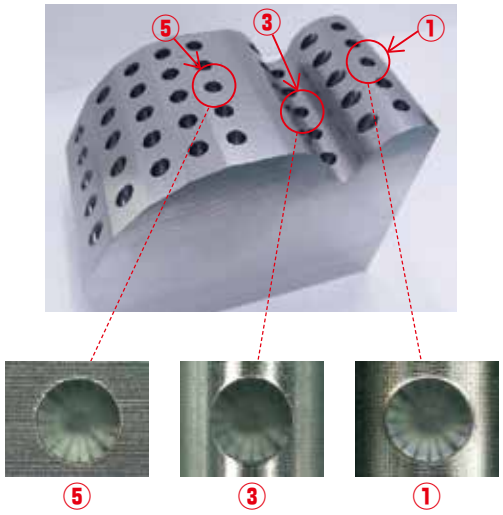
## UTDF Inclined Surface Drilling Example
## ϕ3.5 × Flute Length 14 mm(Prototype)

SS400

Work Shape




Coolant : Water Soluble（Nozzle）
Work Size : 40 × 75 × 60 mm




Each hole after drilling

**Excellent drilling performance with less burrs.**

| Drilling spot | Surface | Spindle Speed (min$^{-1}$) | Feed Rate (min/min) | Drilling Depth (The Deepest spot) (mm) |
|---|---|---|---|---|
| 1 | 凸 Curved surface (Top) | 7,000 | 450 | 7 |
| 2 | Curved surface (45°) | | 270 | |
| 3 | 凹 Curved surface (Top) | | 450 | |
| 4 | Curved surface (45°) | | 270 | |
| 5 | Flat Surface | | 450 | |
| 6 | Inclined Surface (15°) | | 320 | |
| 7 | Inclined Surface (30°) | | 320 | |
| 8 | Inclined Surface (45°) | | 270 | |
| 9 | Inclined Surface (60°) | | 225 | |

*Contact our sales for the custom size tool.

UTDF Inclined Surface Drilling Video

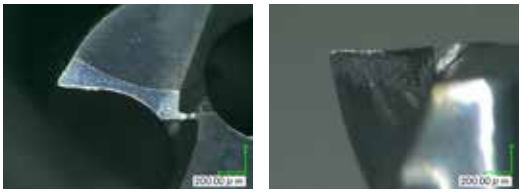
## Tool After Drilling ϕ 2 × Flute Length 8 mm

A5052

| Surface | Spindle Speed | Feed Rate | Drilling Depth | Number of Holes | Coolant |
|---|---|---|---|---|---|
| Flat Surface | 23,100 min$^{-1}$ | 830 mm/min | 4 mm | 100 holes | Water Soluble（Nozzle） |

Comparison of Tip Damage after 100 hits

**UTDF**



**More tool-life left without adhesion after drilling 100 holes.**

**Competitor**

**Chip adhesion**

**Size φ0.3～φ2**

# UTDSX

Super MG | MICRO COAT | 30° | X Thinning | Shank Dia 0/-0.005

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRUCTUAL STEELS SS400 | Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | Contact sales when drilling over 45HRC. | | | ○ | ◎ | | ○ | | | ○ | ○ | | |

Total 35 models

Unit（mm）

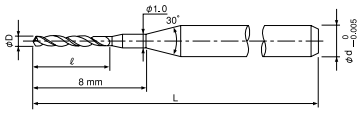
| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| **UTDSX 2030-015** | 0.3 | 1.5 | 38 | 3 | 3,470 |
| **UTDSX 2035-018** | 0.35 | 1.8 | 38 | 3 | 3,860 |
| **UTDSX 2040-020** | 0.4 | 2 | 38 | 3 | 3,470 |
| **UTDSX 2045-023** | 0.45 | 2.3 | 38 | 3 | 3,860 |
| **UTDSX 2050-025** | 0.5 | 2.5 | 38 | 3 | 3,860 |
| **UTDSX 2055-028** | 0.55 | 2.8 | 38 | 3 | 3,070 |
| **UTDSX 2060-030** | 0.6 | 3 | 38 | 3 | 2,670 |
| **UTDSX 2065-033** | 0.65 | 3.3 | 38 | 3 | 3,070 |
| **UTDSX 2070-035** | 0.7 | 3.5 | 38 | 3 | 2,670 |
| **UTDSX 2075-038** | 0.75 | 3.8 | 38 | 3 | 3,070 |
| **UTDSX 2080-040** | 0.8 | 4 | 38 | 3 | 2,670 |
| **UTDSX 2085-043** | 0.85 | 4.3 | 38 | 3 | 3,070 |
| **UTDSX 2090-045** | 0.9 | 4.5 | 38 | 3 | 2,670 |
| **UTDSX 2095-048** | 0.95 | 4.8 | 38 | 3 | 3,070 |
| **UTDSX 2100-050** | 1 | 5 | 38 | 3 | 2,480 |
| **UTDSX 2105-053** | 1.05 | 5.3 | 38 | 3 | 2,480 |
| **UTDSX 2110-055** | 1.1 | 5.5 | 38 | 3 | 2,480 |
| **UTDSX 2115-058** | 1.15 | 5.8 | 38 | 3 | 2,480 |
| **UTDSX 2120-060** | 1.2 | 6 | 38 | 3 | 2,480 |
| **UTDSX 2125-063** | 1.25 | 6.3 | 38 | 3 | 2,480 |
| **UTDSX 2130-065** | 1.3 | 6.5 | 38 | 3 | 2,480 |
| **UTDSX 2135-068** | 1.35 | 6.8 | 38 | 3 | 2,480 |
| **UTDSX 2140-070** | 1.4 | 7 | 38 | 3 | 2,480 |
| **UTDSX 2145-073** | 1.45 | 7.3 | 38 | 3 | 2,480 |
| **UTDSX 2150-075** | 1.5 | 7.5 | 38 | 3 | 2,480 |
| **UTDSX 2155-078** | 1.55 | 7.8 | 38 | 3 | 2,480 |
| **UTDSX 2160-080** | 1.6 | 8 | 38 | 3 | 2,480 |
| **UTDSX 2165-083** | 1.65 | 8.3 | 38 | 3 | 2,670 |
| **UTDSX 2170-085** | 1.7 | 8.5 | 38 | 3 | 2,670 |
| **UTDSX 2175-088** | 1.75 | 8.8 | 38 | 3 | 2,670 |
| **UTDSX 2180-090** | 1.8 | 9 | 38 | 3 | 2,670 |
| **UTDSX 2185-093** | 1.85 | 9.3 | 38 | 3 | 2,670 |
| **UTDSX 2190-095** | 1.9 | 9.5 | 38 | 3 | 2,670 |
| **UTDSX 2195-098** | 1.95 | 9.8 | 38 | 3 | 2,670 |
| **UTDSX 2200-100** | 2 | 10 | 38 | 3 | 2,670 |

## Features

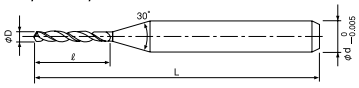
**A highly efficient and economic drill for both mass and prototype production of parts.**
**UT MICRO COAT offers excellent performance for cutting a broad range of materials.**
**The new drill design and X thinning geometry offers stable drilling performance with increased tool life.**
**The 130˚ point angle ensures reduced burring of the drilled hole.**
**The drill is perfect for high quality drilling applications and for pilot drilling/pre-drilling higher aspect ratio holes.**

Diameter Tolerance: 0/-0.01 mm
Point Angle: 130˚

■φ0.3～φ0.65



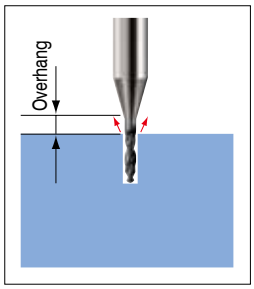

■φ0.7～φ2.0




## Milling Conditions for UTDSX

| WORK MATERIAL | STRUCTUAL STEELS SS400 | | CARBON STEELS S50C | | ALLOY STEELS SCM / SUS | | ALUMINUM ALLOYS A5052 / ADC12 | |
|---|---|---|---|---|---|---|---|---|
| Velocity | *Vc*=20～35 m/min | | *Vc*=20～35 m/min | | *Vc*=15～20 m/min | | *Vc*=20～60 m/min | |
| Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| 0.3 | 20,000 | 100 | 20,000 | 100 | 16,000 | 80 | 20,000 | 200 |
| 0.4 | 17,400 | 130 | 17,400 | 180 | 12,000 | 90 | 20,000 | 440 |
| 0.5 | 15,900 | 150 | 15,900 | 250 | 9,500 | 100 | 20,000 | 680 |
| 0.6 | 14,100 | 170 | 14,100 | 300 | 8,000 | 110 | 20,000 | 920 |
| 0.7 | 12,800 | 180 | 12,800 | 340 | 6,700 | 110 | 20,000 | 1,160 |
| 0.8 | 11,900 | 200 | 11,900 | 380 | 6,300 | 120 | 20,000 | 1,400 |
| 0.9 | 10,500 | 200 | 10,500 | 390 | 6,000 | 130 | 17,500 | 1,430 |
| 1 | 9,500 | 200 | 9,500 | 400 | 6,000 | 150 | 16,000 | 1,500 |
| 1.5 | 7,300 | 220 | 7,300 | 500 | 4,500 | 180 | 13,000 | 1,960 |
| 2 | 5,600 | 230 | 5,600 | 560 | 3,000 | 160 | 9,500 | 2,030 |
| Step Amount | 0.3D | | 0.5D | | 0.3D | | 1.0D | |

Note:
・Recommend shallower drilling than flute length (under φ1:1D, φ1 and over: 0.5D).
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.



**Size φ0.1～φ3**

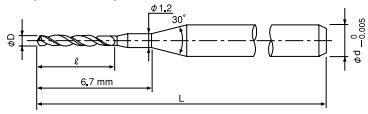
# C-UMD

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

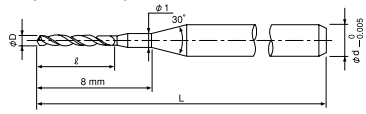
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ○ | Contact sales when drilling over 45HRC. | | | ○ | ◎ | | ○ | | | ○ | ○ | | |

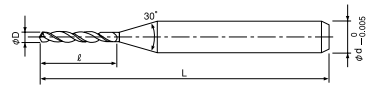
■φ 0.1 ～φ 0.25




■φ 0.26 ～φ 0.65




■φ 0.66 ～φ 3




**Actual tool geometries for some specifications and tolerances may differ from above drawings. φ3 is Straight type.**

**Diameter Tolerance** : φD ≦ φ3 : $\phi D\ ^{0}_{-0.01}$

**Point Angle** : 150°

Total 225 models

Unit（mm）

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| C-UMD 2010-012 | 0.1 | 1.2 | 38 | 3 | 5,500 |
| C-UMD 2011-012 | 0.11 | 1.2 | 38 | 3 | 6,050 |
| C-UMD 2012-014 | 0.12 | 1.4 | 38 | 3 | 6,050 |
| C-UMD 2013-014 | 0.13 | 1.4 | 38 | 3 | 6,050 |
| C-UMD 2014-014 | 0.14 | 1.4 | 38 | 3 | 6,050 |
| C-UMD 2015-020 | 0.15 | 2 | 38 | 3 | 5,060 |
| C-UMD 2016-020 | 0.16 | 2 | 38 | 3 | 5,390 |
| C-UMD 2017-020 | 0.17 | 2 | 38 | 3 | 5,390 |
| C-UMD 2018-020 | 0.18 | 2 | 38 | 3 | 5,390 |
| C-UMD 2019-020 | 0.19 | 2 | 38 | 3 | 5,390 |
| C-UMD 2020-025 | 0.2 | 2.5 | 38 | 3 | 4,400 |
| C-UMD 2021-025 | 0.21 | 2.5 | 38 | 3 | 4,950 |
| C-UMD 2022-025 | 0.22 | 2.5 | 38 | 3 | 4,950 |
| C-UMD 2023-025 | 0.23 | 2.5 | 38 | 3 | 4,950 |
| C-UMD 2024-025 | 0.24 | 2.5 | 38 | 3 | 4,950 |
| C-UMD 2025-030 | 0.25 | 3 | 38 | 3 | 4,950 |
| C-UMD 2026-030 | 0.26 | 3 | 38 | 3 | 4,730 |
| C-UMD 2027-030 | 0.27 | 3 | 38 | 3 | 4,730 |
| C-UMD 2028-030 | 0.28 | 3 | 38 | 3 | 4,730 |
| C-UMD 2029-030 | 0.29 | 3 | 38 | 3 | 4,730 |
| C-UMD 2030-050 | 0.3 | 5 | 38 | 3 | 3,850 |
| C-UMD 2031-050 | 0.31 | 5 | 38 | 3 | 4,730 |
| C-UMD 2032-050 | 0.32 | 5 | 38 | 3 | 4,730 |
| C-UMD 2033-050 | 0.33 | 5 | 38 | 3 | 4,730 |

Unit（mm）

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| C-UMD 2034-050 | 0.34 | 5 | 38 | 3 | 4,730 |
| C-UMD 2035-060 | 0.35 | 6 | 38 | 3 | 4,290 |
| C-UMD 2036-060 | 0.36 | 6 | 38 | 3 | 4,730 |
| C-UMD 2037-060 | 0.37 | 6 | 38 | 3 | 4,730 |
| C-UMD 2038-060 | 0.38 | 6 | 38 | 3 | 4,730 |
| C-UMD 2039-060 | 0.39 | 6 | 38 | 3 | 4,730 |
| C-UMD 2040-070 | 0.4 | 7 | 38 | 3 | 3,850 |
| C-UMD 2041-070 | 0.41 | 7 | 38 | 3 | 4,730 |
| C-UMD 2042-070 | 0.42 | 7 | 38 | 3 | 4,730 |
| C-UMD 2043-070 | 0.43 | 7 | 38 | 3 | 4,730 |
| C-UMD 2044-070 | 0.44 | 7 | 38 | 3 | 4,730 |
| C-UMD 2045-070 | 0.45 | 7 | 38 | 3 | 4,290 |
| C-UMD 2046-070 | 0.46 | 7 | 38 | 3 | 4,730 |
| C-UMD 2047-070 | 0.47 | 7 | 38 | 3 | 4,730 |
| C-UMD 2048-070 | 0.48 | 7 | 38 | 3 | 4,730 |
| C-UMD 2049-070 | 0.49 | 7 | 38 | 3 | 4,730 |
| C-UMD 2050-070 | 0.5 | 7 | 38 | 3 | 4,290 |
| C-UMD 2051-070 | 0.51 | 7 | 38 | 3 | 4,290 |
| C-UMD 2052-070 | 0.52 | 7 | 38 | 3 | 4,290 |
| C-UMD 2053-070 | 0.53 | 7 | 38 | 3 | 4,290 |
| C-UMD 2054-070 | 0.54 | 7 | 38 | 3 | 4,290 |
| C-UMD 2055-070 | 0.55 | 7 | 38 | 3 | 3,410 |
| C-UMD 2056-070 | 0.56 | 7 | 38 | 3 | 4,290 |
| C-UMD 2057-070 | 0.57 | 7 | 38 | 3 | 4,290 |

Next Page ➡

Unit (mm)

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| C-UMD 2058-070 | 0.58 | 7 | 38 | 3 | 4,290 |
| C-UMD 2059-070 | 0.59 | 7 | 38 | 3 | 4,290 |
| C-UMD 2060-070 | 0.6 | 7 | 38 | 3 | 2,970 |
| C-UMD 2061-070 | 0.61 | 7 | 38 | 3 | 4,290 |
| C-UMD 2062-070 | 0.62 | 7 | 38 | 3 | 4,290 |
| C-UMD 2063-070 | 0.63 | 7 | 38 | 3 | 4,290 |
| C-UMD 2064-070 | 0.64 | 7 | 38 | 3 | 4,290 |
| C-UMD 2065-070 | 0.65 | 7 | 38 | 3 | 3,410 |
| C-UMD 2066-070 | 0.66 | 7 | 38 | 3 | 4,290 |
| C-UMD 2067-070 | 0.67 | 7 | 38 | 3 | 4,290 |
| C-UMD 2068-070 | 0.68 | 7 | 38 | 3 | 4,290 |
| C-UMD 2069-070 | 0.69 | 7 | 38 | 3 | 4,290 |
| C-UMD 2070-080 | 0.7 | 8 | 38 | 3 | 2,970 |
| C-UMD 2071-080 | 0.71 | 8 | 38 | 3 | 4,290 |
| C-UMD 2072-080 | 0.72 | 8 | 38 | 3 | 4,290 |
| C-UMD 2073-080 | 0.73 | 8 | 38 | 3 | 4,290 |
| C-UMD 2074-080 | 0.74 | 8 | 38 | 3 | 4,290 |
| C-UMD 2075-080 | 0.75 | 8 | 38 | 3 | 3,410 |
| C-UMD 2076-080 | 0.76 | 8 | 38 | 3 | 4,290 |
| C-UMD 2077-080 | 0.77 | 8 | 38 | 3 | 4,290 |
| C-UMD 2078-080 | 0.78 | 8 | 38 | 3 | 4,290 |
| C-UMD 2079-080 | 0.79 | 8 | 38 | 3 | 4,290 |
| C-UMD 2080-100 | 0.8 | 10 | 38 | 3 | 2,970 |
| C-UMD 2081-100 | 0.81 | 10 | 38 | 3 | 4,290 |
| C-UMD 2082-100 | 0.82 | 10 | 38 | 3 | 4,290 |
| C-UMD 2083-100 | 0.83 | 10 | 38 | 3 | 4,290 |
| C-UMD 2084-100 | 0.84 | 10 | 38 | 3 | 4,290 |
| C-UMD 2085-100 | 0.85 | 10 | 38 | 3 | 3,410 |
| C-UMD 2086-100 | 0.86 | 10 | 38 | 3 | 4,290 |
| C-UMD 2087-100 | 0.87 | 10 | 38 | 3 | 4,290 |
| C-UMD 2088-100 | 0.88 | 10 | 38 | 3 | 4,290 |
| C-UMD 2089-100 | 0.89 | 10 | 38 | 3 | 4,290 |
| C-UMD 2090-100 | 0.9 | 10 | 38 | 3 | 2,970 |
| C-UMD 2091-100 | 0.91 | 10 | 38 | 3 | 4,290 |
| C-UMD 2092-100 | 0.92 | 10 | 38 | 3 | 4,290 |
| C-UMD 2093-100 | 0.93 | 10 | 38 | 3 | 4,290 |
| C-UMD 2094-100 | 0.94 | 10 | 38 | 3 | 4,290 |
| C-UMD 2095-100 | 0.95 | 10 | 38 | 3 | 3,410 |
| C-UMD 2096-100 | 0.96 | 10 | 38 | 3 | 4,290 |
| C-UMD 2097-100 | 0.97 | 10 | 38 | 3 | 4,290 |
| C-UMD 2098-100 | 0.98 | 10 | 38 | 3 | 4,290 |
| C-UMD 2099-100 | 0.99 | 10 | 38 | 3 | 4,290 |
| C-UMD 2100-100 | 1 | 10 | 38 | 3 | 2,750 |
| C-UMD 2101-100 | 1.01 | 10 | 38 | 3 | 3,410 |
| C-UMD 2102-100 | 1.02 | 10 | 38 | 3 | 3,410 |
| C-UMD 2103-100 | 1.03 | 10 | 38 | 3 | 3,410 |

Unit (mm)

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| C-UMD 2104-100 | 1.04 | 10 | 38 | 3 | 3,410 |
| C-UMD 2105-100 | 1.05 | 10 | 38 | 3 | 2,750 |
| C-UMD 2106-100 | 1.06 | 10 | 38 | 3 | 3,410 |
| C-UMD 2107-100 | 1.07 | 10 | 38 | 3 | 3,410 |
| C-UMD 2108-100 | 1.08 | 10 | 38 | 3 | 3,410 |
| C-UMD 2109-100 | 1.09 | 10 | 38 | 3 | 3,410 |
| C-UMD 2110-100 | 1.1 | 10 | 38 | 3 | 2,750 |
| C-UMD 2111-100 | 1.11 | 10 | 38 | 3 | 3,410 |
| C-UMD 2112-100 | 1.12 | 10 | 38 | 3 | 3,410 |
| C-UMD 2113-100 | 1.13 | 10 | 38 | 3 | 3,410 |
| C-UMD 2114-100 | 1.14 | 10 | 38 | 3 | 3,410 |
| C-UMD 2115-100 | 1.15 | 10 | 38 | 3 | 2,750 |
| C-UMD 2116-100 | 1.16 | 10 | 38 | 3 | 3,410 |
| C-UMD 2117-100 | 1.17 | 10 | 38 | 3 | 3,410 |
| C-UMD 2118-100 | 1.18 | 10 | 38 | 3 | 3,410 |
| C-UMD 2119-100 | 1.19 | 10 | 38 | 3 | 3,410 |
| C-UMD 2120-100 | 1.2 | 10 | 38 | 3 | 2,750 |
| C-UMD 2121-100 | 1.21 | 10 | 38 | 3 | 3,410 |
| C-UMD 2122-100 | 1.22 | 10 | 38 | 3 | 3,410 |
| C-UMD 2123-100 | 1.23 | 10 | 38 | 3 | 3,410 |
| C-UMD 2124-100 | 1.24 | 10 | 38 | 3 | 3,410 |
| C-UMD 2125-100 | 1.25 | 10 | 38 | 3 | 2,750 |
| C-UMD 2126-100 | 1.26 | 10 | 38 | 3 | 3,410 |
| C-UMD 2127-100 | 1.27 | 10 | 38 | 3 | 3,410 |
| C-UMD 2128-100 | 1.28 | 10 | 38 | 3 | 3,410 |
| C-UMD 2129-100 | 1.29 | 10 | 38 | 3 | 3,410 |
| C-UMD 2130-100 | 1.3 | 10 | 38 | 3 | 2,750 |
| C-UMD 2131-100 | 1.31 | 10 | 38 | 3 | 3,410 |
| C-UMD 2132-100 | 1.32 | 10 | 38 | 3 | 3,410 |
| C-UMD 2133-100 | 1.33 | 10 | 38 | 3 | 3,410 |
| C-UMD 2134-100 | 1.34 | 10 | 38 | 3 | 3,410 |
| C-UMD 2135-100 | 1.35 | 10 | 38 | 3 | 2,750 |
| C-UMD 2136-100 | 1.36 | 10 | 38 | 3 | 3,410 |
| C-UMD 2137-100 | 1.37 | 10 | 38 | 3 | 3,410 |
| C-UMD 2138-100 | 1.38 | 10 | 38 | 3 | 3,410 |
| C-UMD 2139-100 | 1.39 | 10 | 38 | 3 | 3,410 |
| C-UMD 2140-100 | 1.4 | 10 | 38 | 3 | 2,750 |
| C-UMD 2141-100 | 1.41 | 10 | 38 | 3 | 3,410 |
| C-UMD 2142-100 | 1.42 | 10 | 38 | 3 | 3,410 |
| C-UMD 2143-100 | 1.43 | 10 | 38 | 3 | 3,410 |
| C-UMD 2144-100 | 1.44 | 10 | 38 | 3 | 3,410 |
| C-UMD 2145-100 | 1.45 | 10 | 38 | 3 | 2,750 |
| C-UMD 2146-100 | 1.46 | 10 | 38 | 3 | 3,410 |
| C-UMD 2147-100 | 1.47 | 10 | 38 | 3 | 3,410 |
| C-UMD 2148-100 | 1.48 | 10 | 38 | 3 | 3,410 |
| C-UMD 2149-100 | 1.49 | 10 | 38 | 3 | 3,410 |

Next Page ➡

Unit (mm)

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| C-UMD 2150-100 | 1.5 | 10 | 38 | 3 | 2,750 |
| C-UMD 2151-100 | 1.51 | 10 | 38 | 3 | 3,410 |
| C-UMD 2152-100 | 1.52 | 10 | 38 | 3 | 3,410 |
| C-UMD 2153-100 | 1.53 | 10 | 38 | 3 | 3,410 |
| C-UMD 2154-100 | 1.54 | 10 | 38 | 3 | 3,410 |
| C-UMD 2155-100 | 1.55 | 10 | 38 | 3 | 2,750 |
| C-UMD 2156-100 | 1.56 | 10 | 38 | 3 | 3,410 |
| C-UMD 2157-100 | 1.57 | 10 | 38 | 3 | 3,410 |
| C-UMD 2158-100 | 1.58 | 10 | 38 | 3 | 3,410 |
| C-UMD 2159-100 | 1.59 | 10 | 38 | 3 | 3,410 |
| C-UMD 2160-120 | 1.6 | 12 | 38 | 3 | 2,750 |
| C-UMD 2161-120 | 1.61 | 12 | 38 | 3 | 3,630 |
| C-UMD 2162-120 | 1.62 | 12 | 38 | 3 | 3,630 |
| C-UMD 2163-120 | 1.63 | 12 | 38 | 3 | 3,630 |
| C-UMD 2164-120 | 1.64 | 12 | 38 | 3 | 3,630 |
| C-UMD 2165-120 | 1.65 | 12 | 38 | 3 | 2,970 |
| C-UMD 2166-120 | 1.66 | 12 | 38 | 3 | 3,630 |
| C-UMD 2167-120 | 1.67 | 12 | 38 | 3 | 3,630 |
| C-UMD 2168-120 | 1.68 | 12 | 38 | 3 | 3,630 |
| C-UMD 2169-120 | 1.69 | 12 | 38 | 3 | 3,630 |
| C-UMD 2170-120 | 1.7 | 12 | 38 | 3 | 2,970 |
| C-UMD 2171-120 | 1.71 | 12 | 38 | 3 | 3,630 |
| C-UMD 2172-120 | 1.72 | 12 | 38 | 3 | 3,630 |
| C-UMD 2173-120 | 1.73 | 12 | 38 | 3 | 3,630 |
| C-UMD 2174-120 | 1.74 | 12 | 38 | 3 | 3,630 |
| C-UMD 2175-120 | 1.75 | 12 | 38 | 3 | 2,970 |
| C-UMD 2176-120 | 1.76 | 12 | 38 | 3 | 3,630 |
| C-UMD 2177-120 | 1.77 | 12 | 38 | 3 | 3,630 |
| C-UMD 2178-120 | 1.78 | 12 | 38 | 3 | 3,630 |
| C-UMD 2179-120 | 1.79 | 12 | 38 | 3 | 3,630 |
| C-UMD 2180-120 | 1.8 | 12 | 38 | 3 | 2,970 |
| C-UMD 2181-120 | 1.81 | 12 | 38 | 3 | 3,630 |
| C-UMD 2182-120 | 1.82 | 12 | 38 | 3 | 3,630 |
| C-UMD 2183-120 | 1.83 | 12 | 38 | 3 | 3,630 |
| C-UMD 2184-120 | 1.84 | 12 | 38 | 3 | 3,630 |
| C-UMD 2185-120 | 1.85 | 12 | 38 | 3 | 2,970 |
| C-UMD 2186-120 | 1.86 | 12 | 38 | 3 | 3,630 |
| C-UMD 2187-120 | 1.87 | 12 | 38 | 3 | 3,630 |
| C-UMD 2188-120 | 1.88 | 12 | 38 | 3 | 3,630 |
| C-UMD 2189-120 | 1.89 | 12 | 38 | 3 | 3,630 |
| C-UMD 2190-120 | 1.9 | 12 | 38 | 3 | 2,970 |
| C-UMD 2191-120 | 1.91 | 12 | 38 | 3 | 3,630 |
| C-UMD 2192-120 | 1.92 | 12 | 38 | 3 | 3,630 |

Unit (mm)

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| C-UMD 2193-120 | 1.93 | 12 | 38 | 3 | 3,630 |
| C-UMD 2194-120 | 1.94 | 12 | 38 | 3 | 3,630 |
| C-UMD 2195-120 | 1.95 | 12 | 38 | 3 | 2,970 |
| C-UMD 2196-120 | 1.96 | 12 | 38 | 3 | 3,630 |
| C-UMD 2197-120 | 1.97 | 12 | 38 | 3 | 3,630 |
| C-UMD 2198-120 | 1.98 | 12 | 38 | 3 | 3,630 |
| C-UMD 2199-120 | 1.99 | 12 | 38 | 3 | 3,630 |
| C-UMD 2200-120 | 2 | 12 | 38 | 3 | 2,970 |
| C-UMD 2205-120 | 2.05 | 12 | 38 | 3 | 3,850 |
| C-UMD 2210-120 | 2.1 | 12 | 38 | 3 | 3,190 |
| C-UMD 2212-120 | 2.12 | 12 | 38 | 3 | 3,190 |
| C-UMD 2213-120 | 2.13 | 12 | 38 | 3 | 3,190 |
| C-UMD 2214-120 | 2.14 | 12 | 38 | 3 | 3,190 |
| C-UMD 2215-120 | 2.15 | 12 | 38 | 3 | 3,850 |
| C-UMD 2220-120 | 2.2 | 12 | 38 | 3 | 3,190 |
| C-UMD 2225-120 | 2.25 | 12 | 38 | 3 | 3,850 |
| C-UMD 2229-120 | 2.29 | 12 | 38 | 3 | 3,190 |
| C-UMD 2230-120 | 2.3 | 12 | 38 | 3 | 3,190 |
| C-UMD 2231-120 | 2.31 | 12 | 38 | 3 | 3,190 |
| C-UMD 2232-120 | 2.32 | 12 | 38 | 3 | 3,190 |
| C-UMD 2235-120 | 2.35 | 12 | 38 | 3 | 3,850 |
| C-UMD 2239-120 | 2.39 | 12 | 38 | 3 | 3,190 |
| C-UMD 2240-120 | 2.4 | 12 | 38 | 3 | 3,190 |
| C-UMD 2241-120 | 2.41 | 12 | 38 | 3 | 3,190 |
| C-UMD 2242-120 | 2.42 | 12 | 38 | 3 | 3,190 |
| C-UMD 2245-120 | 2.45 | 12 | 38 | 3 | 3,850 |
| C-UMD 2250-120 | 2.5 | 12 | 38 | 3 | 3,190 |
| C-UMD 2255-120 | 2.55 | 12 | 38 | 3 | 3,850 |
| C-UMD 2256-120 | 2.56 | 12 | 38 | 3 | 3,190 |
| C-UMD 2257-120 | 2.57 | 12 | 38 | 3 | 3,190 |
| C-UMD 2260-120 | 2.6 | 12 | 38 | 3 | 3,190 |
| C-UMD 2265-120 | 2.65 | 12 | 38 | 3 | 3,850 |
| C-UMD 2270-120 | 2.7 | 12 | 38 | 3 | 3,190 |
| C-UMD 2275-120 | 2.75 | 12 | 38 | 3 | 3,850 |
| C-UMD 2277-120 | 2.77 | 12 | 38 | 3 | 3,190 |
| C-UMD 2278-120 | 2.78 | 12 | 38 | 3 | 3,190 |
| C-UMD 2279-120 | 2.79 | 12 | 38 | 3 | 3,190 |
| C-UMD 2280-120 | 2.8 | 12 | 38 | 3 | 3,190 |
| C-UMD 2285-120 | 2.85 | 12 | 38 | 3 | 3,850 |
| C-UMD 2290-120 | 2.9 | 12 | 38 | 3 | 3,190 |
| C-UMD 2295-120 | 2.95 | 12 | 38 | 3 | 3,850 |
| C-UMD 2300-120 | 3 | 12 | 38 | 3 | 3,190 |

## Milling Conditions for C-UMD

| WORK MATERIAL | CARBON STEELS S45C / S50C (～225HB) | | ALLOY STEELS SK / SCM / SUS (225～325HB) | | PREHARDENED STEELS HARDENED STEELS NAK / SKD (30～45HRC) | | ALUMINUM ALLOYS A5052 | |
|---|---|---|---|---|---|---|---|---|
| Velocity | *Vc*=25～40 m/min | | *Vc*=15～25 m/min | | *Vc*=10～15 m/min | | *Vc*=20～60 m/min | |
| Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **0.3** | 20,000 | 40 | 15,900 | 30 | 10,600 | 10 | 20,000 | 400 |
| **0.4** | 17,400 | 50 | 11,800 | 40 | 8,000 | 20 | 19,900 | 690 |
| **0.5** | 15,900 | 80 | 9,500 | 50 | 6,400 | 30 | 20,000 | 1,000 |
| **0.6** | 14,100 | 80 | 7,900 | 40 | 5,300 | 20 | 19,900 | 1,050 |
| **0.7** | 12,800 | 90 | 6,800 | 50 | 4,500 | 20 | 19,900 | 1,120 |
| **0.8** | 11,900 | 100 | 6,000 | 50 | 4,000 | 20 | 19,900 | 1,190 |
| **0.9** | 10,500 | 100 | 6,200 | 50 | 3,500 | 20 | 17,600 | 1,220 |
| **1** | 9,500 | 100 | 6,400 | 60 | 3,200 | 20 | 15,900 | 1,270 |
| **2** | 5,600 | 170 | 3,200 | 100 | 1,600 | 20 | 9,500 | 950 |
| **3** | 3,700 | 150 | 2,700 | 110 | 1,600 | 20 | 6,400 | 640 |

Note:
・Recommend step amount 0.1D-0.2D. Recommend 0.2D-0.5D for Aluminum Alloys.
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.

## Drilling Example 1 SUS304

### Comments

● Tip Damage:

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

● Hole Position:

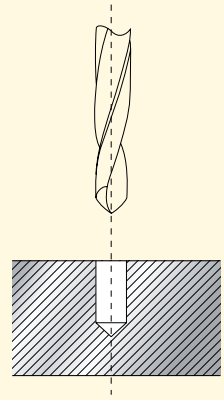
The solid carbide drill has minimal deflection when compared to a High Speed steel model, through the entire drilling cycle.

### Drilling Condition

| | |
|---|---|
| Tool: | $\phi$ 0.6 × Flute Length 7mm |
| Work Material: | SUS304 (1.4301) |
| Spindle Speed: | 8,000 $min^{-1}$ |
| Velocity: | 15 m/min |
| Z Feed Rate: | 50 mm/min |
| Chip Load: | 0.00625 mm/rev |
| Peck Amount: | 0.12 mm/time |
| Hole Depth: | 2.4 mm |
| Number of Holes: | 500 holes |
| Drilling Time: | 25 min/100 holes |
| Overhang Length: | 10 mm |
| Coolant: | Water Soluble (Nozzle) |

### Process Form

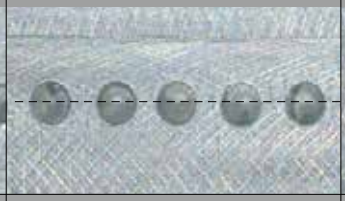
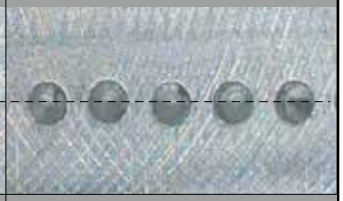
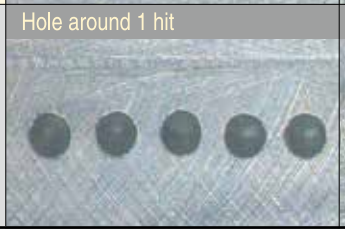
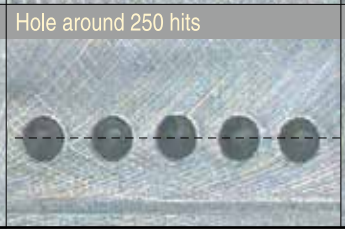
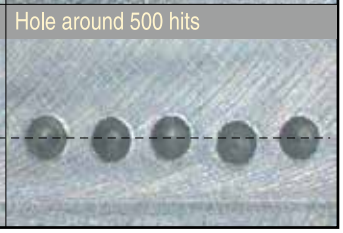
* Blind Hole Step Process



### Comparison of Tip Damage

| | Before use | After 250 hits | After 500 hits |
|---|---|---|---|
| UT C-UMD2060-070 $\phi$0.6 Flute Length 7 mm Ti-Composite Membrane | | | |
| Company A High Speed Steel Drill $\phi$0.6 Flute Length 7 mm TiN | | | |

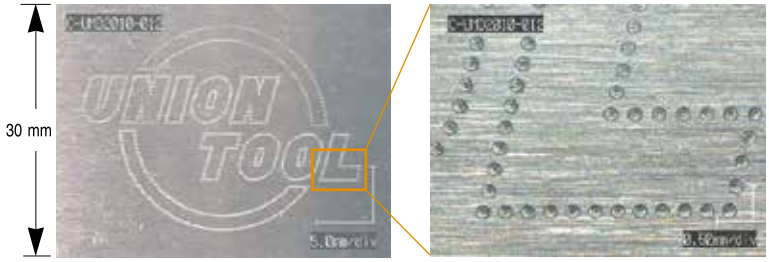
## Comparison of Hole Position

| | Hole around 1 hit | Hole around 250 hits | Hole around 500 hits |
|---|---|---|---|
| UT<br>C-UMD 2060-070<br>$\phi$0.6<br>Flute Length 7 mm<br>Ti-Composite<br>Membrane | |  |  |
| Company A<br>High Speed<br>Steel Drill<br>$\phi$0.6<br>Flute Length 7 mm<br>TiN |  |  |  |

## Drilling Example 2

**SUS304**

$\phi$0.1 Drilling (about 800 holes)




| | Spindle Speed (min$^{-1}$) | Feed Rate (mm/min) | Peck Amount (mm/time) | Hole Depth (mm) | Drilling Time | Coolant | Note |
|---|---|---|---|---|---|---|---|
| Acrylic $\phi$0.1 | | | | | | | |
| C-UMD $\phi$ 0.1 | 20,000 | 20 | 0.02 | 1.00 | 1 h 30 min | Air Blow | Direct + Drilling |
| SUS304 (1.4301) $\phi$0.1 | | | | | | | |
| Center Drill+Chamfering C-UMD $\phi$ 0.2 | 10,000 | 2 | 0.01 | 0.05 | 2 h 50 min | Water Soluble | |
| Drilling C-UMD $\phi$ 0.1 | 12,000 | 4 | 0.02 | 0.20 | 3 h 27 min | Water Soluble | |
| Aluminum (A5052) $\phi$0.2 | | | | | | | |
| C-UMD $\phi$ 0.2 | 16,000 | 80 | 0.04 | 1.50 | 2 h 50 min | Water Soluble | Using back-up board |
| NAK55 (AISI P21) $\phi$0.3 | | | | | | | |
| C-UMD $\phi$ 0.3 | 15,000 | 15 | 0.06 | 1.50 | 3 h 35 min | Water Soluble | Using Center Drill |
| SUS304 (1.4301) $\phi$0.3 | | | | | | | |
| C-UMD $\phi$ 0.3 | 16,000 | 30 | 0.06 | 1.50 | 2 h 24 min | Water Soluble | Using Center Drill |

## Size φ0.3～φ3

# UTDLX

Super MG | MICRO COAT | 30° | X Thinning | Shank Dia 0/-0.005

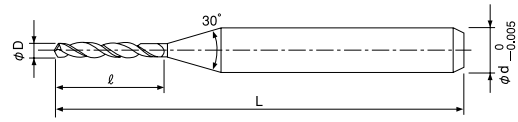
Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRUCTUAL STEELS SS400 | Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | Contact sales when drilling over 45HRC. | | | ○ | ◎ | | ○ | | | ○ | ○ | | |

## Features

**A highly efficient and economic drill for both mass and prototype production of parts.**
**UT MICRO COAT offers excellent performance for cutting a broad range of materials.**
**The new drill design and geometry offers stable drilling performance with increased tool life.**
**The 130˚ point angle ensures reduced burring of the drilled hole.**
**With an aspect ratio of 15:1, the drill is ideal for deep hole drilling, that requires high accuracy.**

**Diameter Tolerance: 0/-0.01 mm**
**Point Angle: 130˚**




Total 55 models　　Unit（mm）

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| **UTDLX 2030-045** | 0.3 | 4.5 | 38 | 3 | 4,600 |
| **UTDLX 2035-053** | 0.35 | 5.3 | 38 | 3 | 5,130 |
| **UTDLX 2040-060** | 0.4 | 6 | 38 | 3 | 4,600 |
| **UTDLX 2045-068** | 0.45 | 6.8 | 38 | 3 | 5,130 |
| **UTDLX 2050-075** | 0.5 | 7.5 | 38 | 3 | 4,600 |
| **UTDLX 2055-083** | 0.55 | 8.3 | 38 | 3 | 5,130 |
| **UTDLX 2060-090** | 0.6 | 9 | 45 | 3 | 4,600 |
| **UTDLX 2065-098** | 0.65 | 9.8 | 45 | 3 | 5,290 |
| **UTDLX 2070-105** | 0.7 | 10.5 | 45 | 3 | 4,600 |
| **UTDLX 2075-113** | 0.75 | 11.3 | 45 | 3 | 5,290 |
| **UTDLX 2080-120** | 0.8 | 12 | 45 | 3 | 4,600 |
| **UTDLX 2085-128** | 0.85 | 12.8 | 45 | 3 | 5,290 |

Next Page ➡

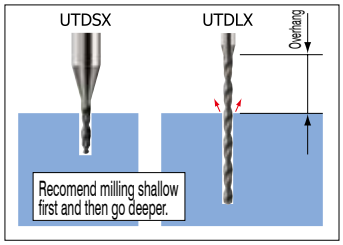
Unit（mm）

| Model Number | Diameter φD | Flute Length ℓ | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|
| UTDLX 2090-135 | 0.9 | 13.5 | 45 | 3 | 4,600 |
| UTDLX 2095-143 | 0.95 | 14.3 | 45 | 3 | 5,290 |
| UTDLX 2100-150 | 1 | 15 | 50 | 3 | 4,600 |
| UTDLX 2105-158 | 1.05 | 15.8 | 50 | 3 | 4,600 |
| UTDLX 2110-165 | 1.1 | 16.5 | 50 | 3 | 4,600 |
| UTDLX 2115-173 | 1.15 | 17.3 | 50 | 3 | 4,600 |
| UTDLX 2120-180 | 1.2 | 18 | 50 | 3 | 4,600 |
| UTDLX 2125-188 | 1.25 | 18.8 | 50 | 3 | 4,600 |
| UTDLX 2130-195 | 1.3 | 19.5 | 50 | 3 | 4,600 |
| UTDLX 2135-203 | 1.35 | 20.3 | 60 | 3 | 4,600 |
| UTDLX 2140-210 | 1.4 | 21 | 60 | 3 | 4,600 |
| UTDLX 2145-218 | 1.45 | 21.8 | 60 | 3 | 4,600 |
| UTDLX 2150-225 | 1.5 | 22.5 | 60 | 3 | 4,600 |
| UTDLX 2155-233 | 1.55 | 23.3 | 60 | 3 | 4,600 |
| UTDLX 2160-240 | 1.6 | 24 | 60 | 3 | 4,600 |
| UTDLX 2165-248 | 1.65 | 24.8 | 60 | 3 | 4,970 |
| UTDLX 2170-255 | 1.7 | 25.5 | 60 | 3 | 4,970 |
| UTDLX 2175-263 | 1.75 | 26.3 | 60 | 3 | 4,970 |
| UTDLX 2180-270 | 1.8 | 27 | 60 | 3 | 4,970 |
| UTDLX 2185-278 | 1.85 | 27.8 | 60 | 3 | 4,970 |
| UTDLX 2190-285 | 1.9 | 28.5 | 60 | 3 | 4,970 |
| UTDLX 2195-293 | 1.95 | 29.3 | 60 | 3 | 4,970 |
| UTDLX 2200-300 | 2 | 30 | 60 | 3 | 4,970 |
| UTDLX 2205-308 | 2.05 | 30.8 | 80 | 3 | 6,640 |
| UTDLX 2210-315 | 2.1 | 31.5 | 80 | 3 | 5,500 |
| UTDLX 2215-323 | 2.15 | 32.3 | 80 | 3 | 6,640 |
| UTDLX 2220-330 | 2.2 | 33 | 80 | 3 | 5,500 |
| UTDLX 2225-338 | 2.25 | 33.8 | 80 | 3 | 6,640 |
| UTDLX 2230-345 | 2.3 | 34.5 | 80 | 3 | 5,500 |
| UTDLX 2235-353 | 2.35 | 35.3 | 80 | 3 | 6,640 |
| UTDLX 2240-360 | 2.4 | 36 | 80 | 3 | 5,500 |
| UTDLX 2245-368 | 2.45 | 36.8 | 80 | 3 | 6,640 |
| UTDLX 2250-375 | 2.5 | 37.5 | 80 | 3 | 5,500 |
| UTDLX 2255-383 | 2.55 | 38.3 | 80 | 3 | 6,640 |
| UTDLX 2260-390 | 2.6 | 39 | 80 | 3 | 5,500 |
| UTDLX 2265-398 | 2.65 | 39.8 | 80 | 3 | 6,640 |
| UTDLX 2270-405 | 2.7 | 40.5 | 80 | 3 | 5,500 |
| UTDLX 2275-413 | 2.75 | 41.3 | 80 | 3 | 6,640 |
| UTDLX 2280-420 | 2.8 | 42 | 80 | 3 | 5,500 |
| UTDLX 2285-428 | 2.85 | 42.8 | 80 | 3 | 6,640 |
| UTDLX 2290-435 | 2.9 | 43.5 | 80 | 3 | 5,500 |
| UTDLX 2295-443 | 2.95 | 44.3 | 80 | 3 | 6,640 |
| UTDLX 2300-450 | 3 | 45 | 80 | 3 | 5,500 |

## Milling Conditions for UTDLX

| WORK MATERIAL | STRUCTUAL STEELS SS400 | | CARBON STEELS S50C | | ALLOY STEELS SCM / SUS | | ALUMINUM ALLOYS A5052 | |
|---|---|---|---|---|---|---|---|---|
| Velocity | *Vc*=20~40 m/min | | *Vc*=20~40 m/min | | *Vc*=15~40 m/min | | *Vc*=25~60 m/min | |
| Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) |
| **0.3** | 20,000 | 50 | 20,000 | 50 | 16,000 | 40 | 20,000 | 650 |
| **0.35** | 19,000 | 60 | 19,000 | 60 | 13,600 | 50 | 20,000 | 700 |
| **0.4** | 18,000 | 80 | 18,000 | 80 | 11,900 | 50 | 20,000 | 800 |
| **0.45** | 17,000 | 100 | 17,000 | 100 | 10,600 | 60 | 20,000 | 850 |
| **0.5** | 16,000 | 120 | 16,000 | 120 | 9,500 | 60 | 20,000 | 920 |
| **0.55** | 15,000 | 140 | 15,000 | 140 | 9,000 | 70 | 20,000 | 1,050 |
| **0.6** | 14,100 | 140 | 14,100 | 140 | 7,900 | 70 | 19,900 | 1,150 |
| **0.7** | 12,800 | 140 | 12,800 | 140 | 6,800 | 70 | 19,900 | 1,230 |
| **0.8** | 11,900 | 140 | 11,900 | 140 | 6,000 | 70 | 19,900 | 1,310 |
| **0.9** | 10,500 | 140 | 10,500 | 140 | 6,200 | 70 | 17,600 | 1,350 |
| **1** | 9,500 | 150 | 9,500 | 150 | 6,400 | 70 | 15,900 | 1,400 |
| **1.5** | 7,200 | 150 | 7,200 | 150 | 5,500 | 70 | 12,000 | 1,470 |
| **2** | 5,600 | 150 | 5,600 | 150 | 5,000 | 70 | 9,500 | 1,590 |
| **2.5** | 4,500 | 150 | 4,500 | 150 | 4,400 | 70 | 7,600 | 1,640 |
| **3** | 4,000 | 150 | 4,000 | 150 | 3,800 | 70 | 6,400 | 1,700 |
| Peck Amount | 0.5D | | 0.3D | | 0.1D | | 0.3D | |

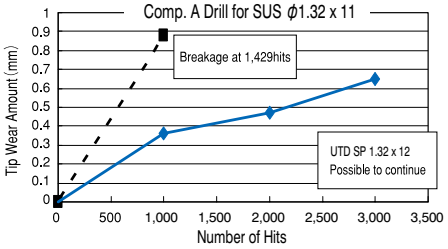
Note:
・Apply pre-drilling more than 3D depth before deep drilling. Recommend UTDSX for pre-drilling.
・Recommend shallower drilling than flute length (under $\phi$1:1D, $\phi$1 and over: 0.5D).
・Recommend water soluble or oil coolant.
・Recommend oil coolant for Titanium Alloys and Heat Resistant Alloys.



# SUS420J2 (Raw Material) Comparison of UTD (Carbide) and HSS Drill Bit

UTD can drill more than 2X holes compared to an HSS model

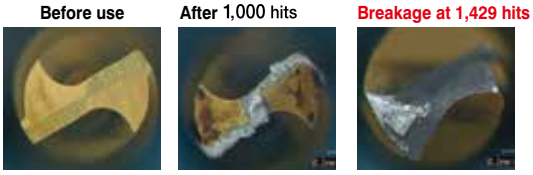
| | |
|---|---|
| Tool Size | $\phi$1.32 × 12 UTD proto type |
| Spindle Speed | 5,000 min$^{-1}$ (*Vc*: 21 m/min) |
| Feed Rate | 200 mm/min (f: 0.04 mm/rev.) |
| Peck Amount | 1.3 mm |
| Depth | 7 mm blind hole |




Flank wear comparison with HSS

**UTD prototype**

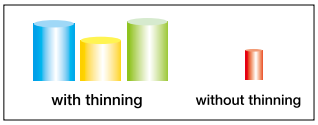
**HSS Drill (Company A: $\phi$3 shank diameter with TiN coating for SUS)**

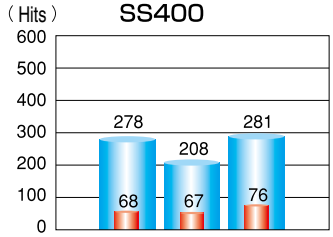



# Drilling test with various materials (Comparison of with / without thinning)

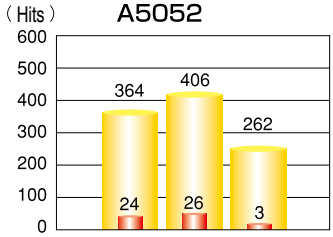
Smooth chip evacuation using the X-thinning design, offers greater resistance to breakage and more accurate drilling

Drill Size : $\phi$1.0 x 15
Tool : UTDLX 2100-150 (with thinning)
Test Tool: $\phi$1.0 x 15 (without thinning)

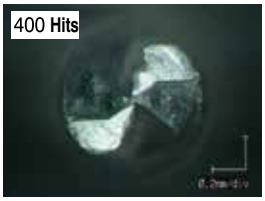


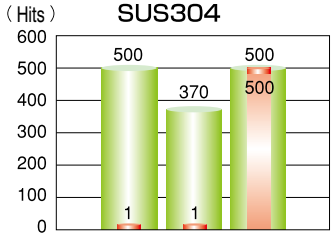




| | |
|---|---|
| Spindle Speed | 9,500 min$^{-1}$ (*Vc*: 30 m/min) |
| Feed Rate | 400 mm/min (f: 0.042 mm/rev.) |
| Peck Amount | 0.2 mm |
| Depth | 14 mm blind hole |

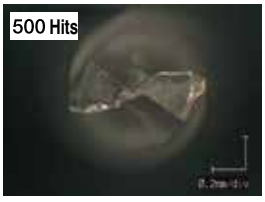



| | |
|---|---|
| Spindle Speed | 15,900 min$^{-1}$ (*Vc*: 50 m/min) |
| Feed Rate | 1,500 mm/min (f: 0.094 mm/rev.) |
| Peck Amount | 0.7 mm |
| Depth | 14 mm blind hole |




| | |
|---|---|
| Spindle Speed | 6,400 min$^{-1}$ (*Vc*: 20 m/min) |
| Feed Rate | 150 mm/min (f: 0.023 mm/rev.) |
| Peck Amount | 0.2 mm |
| Depth | 14 mm blind hole |



# UNIMAX EURO Series

**★ What is EURO Series?**
**The EURO series was designed for the European market and has proved very succesful with a wide range of users. It is also popular with European machine OEM's, CAM system companies and toolholder makers.**

**Introducing EURO Series**

| | Features | Coating | Flute Shape | Outside Diameter | Page |
|---|---|---|---|---|---|
| **Radius / Long Neck Radius for Aluminum and Plastics** **CPRS25NSP** | | | | | |
| **2 Flutes** | ·Recommend for milling Aluminum Alloys and Plastics<br>·All models adopt a corner radius of R0.1 in order to prevent chipping | NON-COAT | Positive Rake Design | φ2 ~φ12 | 564 |
| **Long Neck Radius for Aluminum and Plastics** **CPRS30N** | | | | | |
| **2 Flutes** | ·Recommend for milling Aluminum Alloys and Plastics<br>·Designed for finishing applications | NON-COAT | Positive Rake Design | φ4 ~φ10 | 566 |
| **Long Neck Radius** **CRS40HSP** | | | | | |
| **3 Flutes** | ·Helix angle 40˚<br>·Broad application range from SUS up to Hardened Steels (60HRC) | HARDMAX | Positive Rake Design | φ2 ~φ12 | 568 |
| **Long Neck Radius** **CRS20HSP** | | | | | |
| **4 Flutes** | ·Recommend for milling Hardened Steels and Cast Iron<br>·Helix angle 20˚ | HARDMAX | Negative Rake Design | φ2 ~φ12 | 570 |

Size φ2～φ12

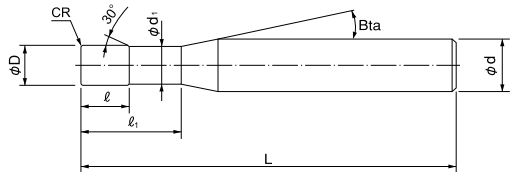
# CPRS25NSP

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ◎ | | ○ | ◎ | | | | | |

## Features

**Non-coated Radius and Long Neck Radius for Aluminum Alloys and Plastics.**
**All models adopt a corner radius of R0.1 in order to prevent chipping.**




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

Total 10 models

Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Lenght ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| CPRS25NSP 2020-010-06 | 2 | R0.1 | 6 | 3 | 1.92 | 16° | 38 | 3 | 7,300 |
| CPRS25NSP 2030-010-08 | 3 | R0.1 | 8 | 4 | 2.93 | — | 38 | 3 | 7,300 |
| CPRS25NSP 2040-010-12 | 4 | R0.1 | 12 | 5 | 3.83 | — | 50 | 4 | 8,800 |
| CPRS25NSP 2050-010-14 | 5 | R0.1 | 14 | 8 | 4.83 | 16° | 50 | 6 | 14,200 |
| CPRS25NSP 2060-010 | 6 | R0.1 | No Undercut | 13 | — | — | 50 | 6 | 11,200 |
| CPRS25NSP 2060-010-18 | | | 18 | 8 | 5.73 | | 65 | 6 | 12,900 |
| CPRS25NSP 2080-010 | 8 | R0.1 | No Undercut | 13 | — | — | 50 | 8 | 16,200 |
| CPRS25NSP 2080-010-22 | | | 22 | 10 | 7.82 | | 80 | 8 | 17,800 |
| CPRS25NSP 2100-010-28 | 10 | R0.1 | 28 | 14 | 9.82 | — | 80 | 10 | 23,000 |
| CPRS25NSP 2120-010-35 | 12 | R0.1 | 35 | 16 | 11.82 | — | 90 | 12 | 29,000 |

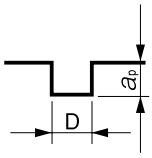
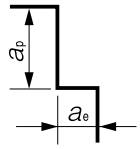
# Milling Conditions for CPRS25NSP（2 Flutes）

## ◆ Under cut type

| WORK MATERIAL | | PLASTICS | | | ALUMINUM ALLOYS | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) |
| **2020-010-06** | **2** | 12,800 | 510 | 765 | 23,900 | 480 | 720 |
| **2030-010-08** | **3** | 12,800 | 640 | 960 | 16,000 | 580 | 870 |
| **2040-010-12** | **4** | 12,000 | 600 | 900 | 12,000 | 615 | 920 |
| **2050-010-14** | **5** | 9,600 | 480 | 720 | 9,600 | 640 | 960 |
| **2060-010-18** | **6** | 8,000 | 400 | 600 | 8,000 | 690 | 1,040 |
| **2080-010-22** | **8** | 6,000 | 300 | 450 | 6,000 | 735 | 1,100 |
| **2100-010-28** | **10** | 4,800 | 240 | 360 | 4,800 | 825 | 1,240 |
| **2120-010-35** | **12** | 4,000 | 200 | 300 | 4,000 | 850 | 1,280 |

## ◆ Straight type

| WORK MATERIAL | | PLASTICS | | | ALUMINUM ALLOYS | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) |
| **2060-010** | **6** | 8,000 | 400 | 600 | 8,000 | 690 | 1,040 |
| **2080-010** | **8** | 6,000 | 300 | 450 | 6,000 | 735 | 1,100 |

| | | | |
|---|---|---|---|
| Slotting Milling Amount (mm)   | Roughing | $a_p$ = 0.5D | D ≦ 2 $a_p$ = 0.2D<br>D ≧ 3 $a_p$ = 0.5D |
| | Finishing | $a_p$ = 0.03D | $a_p$ = 0.05D |
| Side Milling Milling Amount (mm)   | Roughing | $a_p$ = 1.0D<br>$a_e$ = 0.2D | $a_p$ = 1.0D<br>$a_e$ = 0.2D |
| | Finishing | $a_p$ = 0.6D<br>$a_e$ = 0.04D | $a_p$ = 0.8D<br>$a_e$ = 0.05D |
| Note | | Recommend air blow. | Recommend water soluble or oil coolant. |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Size φ4～φ10

# CPRS30N

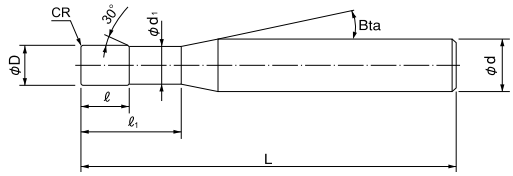
Super MG | 30° | R | R ±0.02

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| | | | | | | | ◎ | | ○ | ◎ | | | | | |

## Features

**Non coated Long Neck Radius for Aluminum Alloys and Plastics.**
**Designed for finishing applications.**



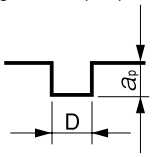
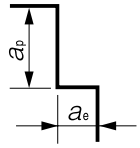

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 7 models　　Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Lenght ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| CPRS30N 2040-030-10 | 4 | R0.3 | 10 | 5 | 3.63 | 16° | 50 | 6 | 8,800 |
| CPRS30N 2060-025-20 | 6 | R0.25 | 20 | 8 | 5.43 | — | 60 | 6 | 14,000 |
| CPRS30N 2060-050-20 | | R0.5 | 20 | | | | 60 | 6 | 14,000 |
| CPRS30N 2080-030-30 | 8 | R0.3 | 30 | 10 | 7.82 | — | 80 | 8 | 16,200 |
| CPRS30N 2080-060-30 | | R0.6 | 30 | | | | 80 | 8 | 16,200 |
| CPRS30N 2100-030-36 | 10 | R0.3 | 36 | 12 | 9.82 | — | 80 | 10 | 21,000 |
| CPRS30N 2100-080-36 | | R0.8 | 36 | | | | 80 | 10 | 21,000 |

## Milling Conditions for CPRS30N（2 Flutes）

| WORK MATERIAL | | PLASTICS | | | ALUMINUM ALLOYS | | |
|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) |
| **2040** | **4** | 12,000 | 600 | 900 | 12,000 | 615 | 920 |
| **2060** | **6** | 8,000 | 400 | 600 | 8,000 | 690 | 1,040 |
| **2080** | **8** | 6,000 | 300 | 450 | 6,000 | 735 | 1,100 |
| **2100** | **10** | 4,800 | 240 | 360 | 4,800 | 825 | 1,240 |

| | | | |
|---|---|---|---|
| Slotting<br>Milling Amount (mm)<br>  | Roughing | $a_p$ = 0.5D | D ≦ 2 $a_p$ = 0.2D<br>D ≧ 3 $a_p$ = 0.5D |
| | Finishing | $a_p$ = 0.03D | $a_p$ = 0.05D |
| Side Milling<br>Milling Amount (mm)<br>  | Roughing | $a_p$ = 1.0D<br>$a_e$ = 0.2D | $a_p$ = 1.0D<br>$a_e$ = 0.2D |
| | Finishing | $a_p$ = 0.6D<br>$a_e$ = 0.04D | $a_p$ = 0.8D<br>$a_e$ = 0.05D |
| Note | | Recommend air blow. | Recommend water soluble or oil coolant. |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Size φ2～φ12

# CRS40HSP

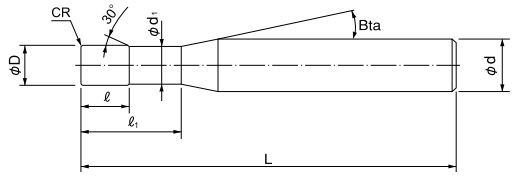
Super MG | HARD MAX | 40° | R | R ±0.02

Material Applications (☆ Highly Recommended ◎ Recommended ○ Suggested)

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ◎ | ◎ | ◎ | ○ | ○ | | ◎ | | ○ | | ○ | | | | | |

## Features

**Highly Efficient Long Neck Radius with short flute length.**
**Helix angle 40°.**
**Broad application range from SUS up to Hardened Steels (60HRC).**




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

Total 25 models

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Lenght ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| CRS40HSP 3020-020-06 | 2 | R0.2 | 6 | 3 | 1.93 | 16° | 38 | 3 | 11,500 |
| CRS40HSP 3020-020-10 | | | 10 | | | | 60 | 3 | 12,000 |
| CRS40HSP 3025-020-06 | 2.5 | R0.2 | 6 | 4 | 2.43 | 16° | 38 | 3 | 11,500 |
| CRS40HSP 3030-010-07 | 3 | R0.1 | 7 | 4 | 2.84 | — | 38 | 3 | 11,500 |
| CRS40HSP 3030-020-07 | | R0.2 | | | | | 38 | 3 | 11,500 |
| CRS40HSP 3030-020-14 | | | 14 | | | | 60 | 3 | 12,000 |
| CRS40HSP 3035-020-09 | 3.5 | R0.2 | 9 | 5 | 3.24 | 16° | 50 | 6 | 12,800 |
| CRS40HSP 3040-020-09 | 4 | R0.2 | 9 | 5 | 3.74 | 16° | 50 | 6 | 12,800 |
| CRS40HSP 3040-020-18 | | | 18 | | | | 65 | 6 | 13,200 |
| CRS40HSP 3040-030-09 | | R0.3 | 9 | | | | 50 | 6 | 12,800 |
| CRS40HSP 3040-050-09 | | R0.5 | | | | | 50 | 6 | 12,800 |
| CRS40HSP 3050-020-11 | 5 | R0.2 | 11 | 6 | 4.64 | 16° | 50 | 6 | 13,200 |
| CRS40HSP 3050-020-22 | | | 22 | | | | 65 | 6 | 13,800 |
| CRS40HSP 3060-020-14 | 6 | R0.2 | 14 | 7 | 5.64 | — | 60 | 6 | 14,600 |
| CRS40HSP 3060-030-14 | | R0.3 | | | | | 60 | 6 | 14,600 |
| CRS40HSP 3060-030-26 | | | 26 | | | | 80 | 6 | 15,200 |
| CRS40HSP 3060-050-14 | | R0.5 | 14 | | | | 60 | 6 | 14,600 |

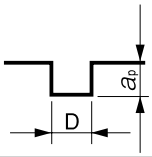
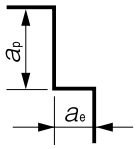
Next Page ➡

Unit (mm)

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Lenght ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| **CRS40HSP 3080-020-18** | 8 | R0.2 | 18 | 9 | 7.82 | — | 60 | 8 | 18,400 |
| **CRS40HSP 3080-050-18** | | R0.5 | | | | | 60 | 8 | 18,400 |
| **CRS40HSP 3080-050-36** | | | 36 | | | | 90 | 8 | 19,200 |
| **CRS40HSP 3100-020-25** | 10 | R0.2 | 25 | 12 | 9.82 | — | 70 | 10 | 24,000 |
| **CRS40HSP 3100-050-25** | | R0.5 | | | | | 70 | 10 | 24,000 |
| **CRS40HSP 3100-050-45** | | | 45 | | | | 100 | 10 | 26,000 |
| **CRS40HSP 3120-050-30** | 12 | R0.5 | 30 | 15 | 11.82 | — | 75 | 12 | 30,400 |
| **CRS40HSP 3120-050-54** | | | 54 | | | | 120 | 12 | 32,000 |

## Milling Conditions for CRS40HSP (3 Flutes)

| WORK MATERIAL | | CARBON STEELS / CAST IRON | | | PREHARDENED STEELS (30~48 HRC) | | | ALLOY STEELS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) |
| **3020** | **2** | 22,000 | 610 | 810 | 14,500 | 380 | 500 | 12,000 | 310 | 410 |
| **3025** | **2.5** | 19,000 | 640 | 860 | 12,100 | 410 | 550 | 10,100 | 340 | 460 |
| **3030** | **3** | 17,000 | 680 | 900 | 10,500 | 440 | 590 | 8,800 | 380 | 500 |
| **3035** | **3.5** | 15,500 | 980 | 1,300 | 9,600 | 610 | 810 | 8,000 | 490 | 650 |
| **3040** | **4** | 14,500 | 1,220 | 1,620 | 8,800 | 750 | 990 | 7,500 | 610 | 810 |
| **3050** | **5** | 12,000 | 1,290 | 1,710 | 7,200 | 780 | 1,040 | 6,000 | 650 | 860 |
| **3060** | **6** | 10,500 | 1,420 | 1,890 | 6,500 | 810 | 1,080 | 5,500 | 710 | 950 |
| **3080** | **8** | 8,000 | 1,520 | 2,030 | 4,800 | 810 | 1,080 | 4,000 | 750 | 990 |
| **3100** | **10** | 6,500 | 1,320 | 1,760 | 3,800 | 650 | 860 | 3,200 | 650 | 860 |
| **3120** | **12** | 5,500 | 1,120 | 1,490 | 3,200 | 540 | 720 | 2,500 | 510 | 680 |

| | | | | |
|---|---|---|---|---|
| Slotting Milling Amount (mm)   | Roughing | $a_p$ = 0.095D | $a_p$ = 0.045D | $a_p$ = 0.04D |
| | Finishing | $a_p$ = 0.03D | $a_p$ = 0.02D | $a_p$ = 0.01D |
| Side Milling Milling Amount (mm)   | Roughing | $a_p$ = 1.0D<br>$a_e$ = 0.045D | $a_p$ = 0.8D<br>$a_e$ = 0.035D | $a_p$ = 0.8D<br>$a_e$ = 0.02D |
| | Finishing | $a_p$ = 0.85D<br>$a_e$ = 0.03D | $a_p$ = 0.65D<br>$a_e$ = 0.02D | $a_p$ = 0.55D<br>$a_e$ = 0.01D |
| Note | | Recommend air blow. | Recommend air blow. | Recommend air blow. |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

Size φ2～φ12

# CRS20HSP

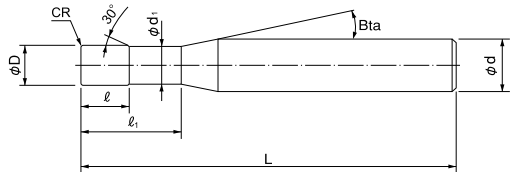
Super MG | HARD MAX | 20° | R | R ±0.02

Material Applications（☆ Highly Recommended ◎ Recommended ○ Suggested）

| Work Material | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon Steels S45C S55C | Alloy Steels SK / SCM SUS | Prehardened Steels NAK HPM | Hardened Steels ～55HRC | Hardened Steels ～60HRC | Hardened Steels ～70HRC | Cast Iron | Aluminum Alloys | Graphite | Copper | Plastics | Glass Filled Plastics | Titanium Alloys | Heat Resistant Alloys | Cemented Carbide | Hard Brittle (Non-Metallic) Materials |
| ○ | | ○ | ◎ | ◎ | | ◎ | | | | | | | | | |

## Features

**4 flute Long Neck Radius with high rigidity for hard materials.**
**Helix angle 20°.**



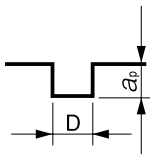
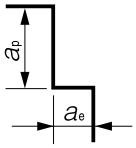

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

Total 9 models　　Unit（mm）

| Model Number | Outside Diameter φD | Corner Radius CR | Effective Lenght ℓ1 | Length of Cut ℓ | Neck Diameter φd1 | Shank Taper Angle Bta | Overall Length L | Shank Diameter φd | Price ¥ |
|---|---|---|---|---|---|---|---|---|---|
| CRS20HSP 4020-020-05 | 2 | R0.2 | 5 | 2.5 | 1.93 | 16° | 50 | 6 | 8,700 |
| CRS20HSP 4025-025-06 | 2.5 | R0.25 | 6 | 3 | 2.43 | 16° | 50 | 6 | 9,500 |
| CRS20HSP 4030-030-07 | 3 | R0.3 | 7 | 4 | 2.84 | 16° | 50 | 6 | 7,800 |
| CRS20HSP 4040-040-09 | 4 | R0.4 | 9 | 5 | 3.74 | 16° | 50 | 6 | 11,600 |
| CRS20HSP 4050-050-12 | 5 | R0.5 | 12 | 6 | 4.64 | 16° | 50 | 6 | 16,800 |
| CRS20HSP 4060-060-14 | 6 | R0.6 | 14 | 7 | 5.64 | — | 55 | 6 | 16,800 |
| CRS20HSP 4080-080-18 | 8 | R0.8 | 18 | 10 | 7.82 | — | 60 | 8 | 18,400 |
| CRS20HSP 4100-100-25 | 10 | R1 | 25 | 12 | 9.82 | — | 70 | 10 | 24,000 |
| CRS20HSP 4120-120-30 | 12 | R1.2 | 30 | 15 | 11.82 | — | 75 | 12 | 29,000 |

## Milling Conditions for CRS20HSP（4 Flutes）

| WORK MATERIAL | | CARBON STEELS / CAST IRON | | | PREHARDENED STEELS (30～48 HRC) | | | HARDENED STEELS (48～56 HRC) | | | HARDENED STEELS (56～60 HRC) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | Outside Diameter (mm) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) | Spindle Speed ($min^{-1}$) | Feed Rate (Slotting) (mm/min) | Feed Rate (Side milling) (mm/min) |
| **4020-020-05** | **2** | 22,000 | 810 | 1,080 | 14,400 | 510 | 680 | 9,600 | 210 | 280 | 4,800 | 90 | 120 |
| **4025-025-06** | **2.5** | 19,000 | 860 | 1,140 | 12,100 | 550 | 730 | 7,700 | 250 | 340 | 4,100 | 130 | 180 |
| **4030-030-07** | **3** | 17,000 | 900 | 1,200 | 10,600 | 600 | 800 | 6,400 | 255 | 340 | 3,600 | 105 | 140 |
| **4040-040-09** | **4** | 14,400 | 1,620 | 2,160 | 8,800 | 990 | 1,320 | 5,400 | 330 | 440 | 2,800 | 145 | 195 |
| **4050-050-12** | **5** | 12,000 | 1,710 | 2,280 | 7,200 | 1,050 | 1,400 | 4,400 | 360 | 480 | 2,400 | 140 | 190 |
| **4060-060-14** | **6** | 10,600 | 1,890 | 2,520 | 6,400 | 1,080 | 1,440 | 4,000 | 450 | 600 | 2,000 | 135 | 185 |
| **4080-080-18** | **8** | 8,000 | 2,040 | 2,720 | 4,800 | 1,080 | 1,440 | 3,200 | 540 | 720 | 1,600 | 130 | 175 |
| **4100-100-25** | **10** | 6,400 | 1,770 | 2,360 | 3,800 | 870 | 1,160 | 2,600 | 450 | 600 | 1,300 | 120 | 165 |
| **4120-120-30** | **12** | 5,400 | 1,500 | 2,000 | 3,200 | 720 | 960 | 2,200 | 420 | 560 | 1,060 | 105 | 140 |

| | | | | | |
|---|---|---|---|---|---|
| Slotting Milling Amount (mm)   | Roughing | $a_p$ = 0.095D | $a_p$ = 0.045D | $a_p$ = 0.045D | $a_p$ = 0.025D |
| | Finishing | $a_p$ = 0.03D | $a_p$ = 0.02D | $a_p$ = 0.02D | $a_p$ = 0.01D |
| Side Milling Milling Amount (mm)   | Roughing | $a_p$ = 1.0D<br>$a_e$ = 0.045D | $a_p$ = 0.8D<br>$a_e$ = 0.035D | $a_p$ = 0.8D<br>$a_e$ = 0.032D | $a_p$ = 0.75D<br>$a_e$ = 0.025D |
| | Finishing | $a_p$ = 0.85D<br>$a_e$ = 0.035D | $a_p$ = 0.65D<br>$a_e$ = 0.02D | $a_p$ = 0.65D<br>$a_e$ = 0.02D | $a_p$ = 0.45D<br>$a_e$ = 0.01D |
| Note | | Recommend air blow. | Recommend air blow. | Recommend air blow. | Recommend air blow. |

$a_p$ : Axial Depth (mm)
$a_e$ : Radial Depth (mm)
D : Outside Diameter (mm)

# OPTECH-MES/MES-D50

## Non-contact dynamic run out measurement of the tool with Micro Eyes !

**Features**

- **Diameter & Run-out detection improves the milling quality and stability.**
  Allowing the process to operate at the optimum condition by controlling the Machine spindle & tool setting.
- **Prevents problems with tool life by detecting the tool tip.**
  Detects tool damage & wear on micro tools.
- **Price cut from the conventional product.**
  Priced below the current OPTECH-Me/EDR-D20 measuring device.

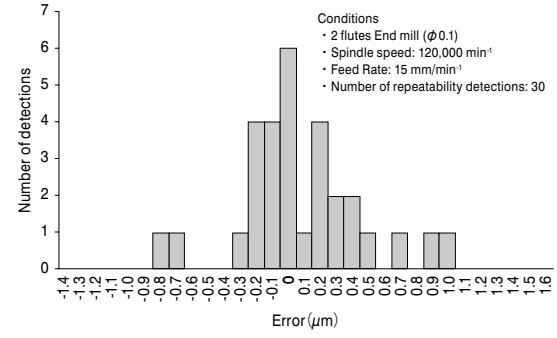
## Measuring example

### ■ End mill Measuring Accuracy (Diameter)

| Spindle speed ($min^{-1}$) | End mill size（mm） | | | | | |
|---|---|---|---|---|---|---|
| | $\phi$0.2 | $\phi$0.5 | $\phi$0.9 | $\phi$2.0 | $\phi$2.5 | $\phi$3.0 |
| 0 | -1 | 0 | 0 | 1 | 1 | 0 |
| 30,000 | -1 | 0 | -1 | 0 | -1 | -1 |
| 60,000 | -1 | -1 | -2 | – | – | – |
| 120,000 | -1 | – | – | – | – | – |

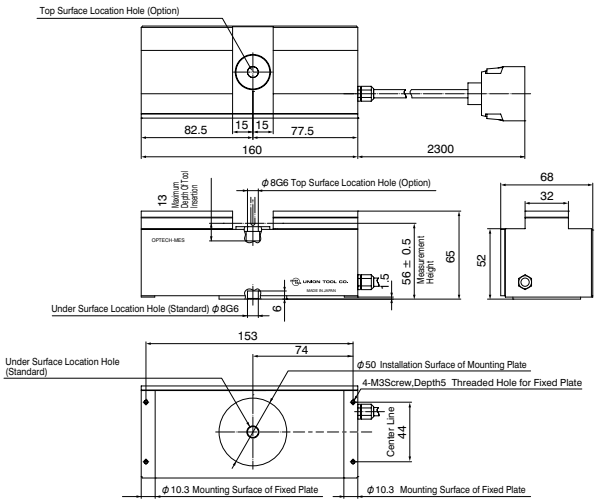
Unit（$\mu$m）

### ■ Tool tip detection repeatability

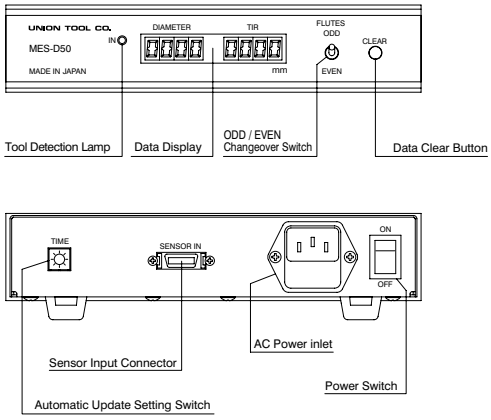


## Dimensions Plan (mm)

### ■ OPTECH-MES (sensor)




### ■ MES-D50 (display)




### ■ Optech Series OPTECH-MES/MES-D50

| Items | Specification | |
|---|---|---|
| Measuring Items | · Tool Diameter, Dynamic run-out (Even number of flutes)<br>· Diameter including dynamic run-out (Odd number of flutes)<br>· Spindle run-out by pin gauge<br>· Tool Tip Detection | |
| Measuring Range | ϕ0.05 ~ϕ3.0 (mm) | |
| Range of Runout Measurement | 0 ~ 0.099 (mm) | |
| Resolution | 1 (μm) | |
| Measuring Accuracy※1 | Diameter | 2 (μm) (ϕ0.05 ~ϕ1.5 (mm)) |
| | | 4 (μm) (ϕ1.5 ~ϕ3.0 (mm)) |
| | Run-out | within 2 (μm) |
| | Tool Tip Detection※2 (Repeatability) | 3 (μm) (Diameter below ϕ0.2 (mm), Square End mills, Radius End mills) |
| | | 2 (μm) (Diameter below ϕ3.0 (mm), Ball End mills, Drills) |
| Measuring Spindle Rotation | · within 120,000 (min$^{-1}$) (ϕ0.05 ~ ϕ0.1 (mm) or below)<br>· within 60,000 (min$^{-1}$) (ϕ0.1 ~ ϕ1.0 (mm) or below)<br>· within 30,000 (min$^{-1}$) (ϕ1.0 ~ ϕ3.0 (mm) or below) | |
| Tool Tip Measurement Position※3 | 56 mm ± 0.5 mm from bottom surface of the detector | |
| Measuring Point Range | within ± 0.02 (mm) ※4 | |
| Dimensions/Mass | · Sensor : W160 × D68 × H65 (mm) 0.7 (kg)<br>· Display : W200 × D200 × H42 (mm) 1.6 (kg) | |
| Display | · Diameter, Run-out display (Diameter, TIR), 4 digits each<br>· Tool tip detection indicator (IN) Lamp ON | |
| Functions | · Odd/even cutters switch (ODD/EVEN)<br>· Data refresh interval (TIME)<br>· No/Yes: Approximately 0.5s, 1.0s, 1.5s, 2.0s<br>· Clear (CLR) | |
| Power Source | AC100 ~ 240 (V) 50/60 Hz | |
| Cable Length | 2.3 (m) | |
| Price | ¥440,000 | |

※1 Quantization errors are not included.
※2 Lamp lights when the tool is detected. Check the scale on milling machine for the actual value.
※3 Absolute position is different on individual tool. Adjust/Assemble the position within 56 ± 0.5mm.
※4 Set the tool position within ± 0.02 mm (XY direction) from the center of gauge hole.

# 1 Calculation of Milling Conditions

Proper tool selection, machine condition, feed and speeds are essential for successful milling. The optimum machining conditions are calculated using the formulas below.



## Formulas for calculation of end milling conditions

1. Velocity : $V_C$ (m/min)

$$V_C = \frac{\pi \times D \times n}{1000}$$

$\pi$ = 3.14 (Circular Constant)
D = Outside Diameter (mm)
$n$ = Spindle Speed ($min^{-1}$)

2. Spindle Speed : $n$ ($min^{-1}$)

$$n = \frac{1000 \times V_C}{\pi \times D}$$

$V_C$ = Velocity (m/min)
$\pi$ = 3.14 (Circular Constant)
D = Outside Diameter (mm)

3. Feed Rate : $V_f$ (mm/min)

$$V_f = n \times z \times f_z$$

$n$ = Spindle Speed ($min^{-1}$)
$z$ = Number of flutes
$f_z$ = Feed per tooth (mm/t)

4. Feed per tooth : $f_z$ (mm/t)

$$f_z = \frac{V_f}{n \times z}$$

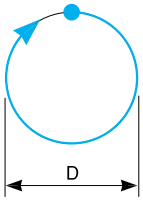
$V_f$ = Feed Rate (mm/min)
$n$ = Spindle Speed ($min^{-1}$)
$z$ = Number of flutes

## Explanation of terms used in parameters

**1**. Velocity $V_C$ [Unit: m/min] :
The milling distance of an optional point on the circumference per unit (1 minute)

Related Value
- Diameter $\phi$ D [mm] : Twice the distance from the center of a circle (radius)
- $\pi$ : Circular constant = 3.14 (Unit : Nil)
- Spindle Speed $n$ [$min^{-1}$] : Revolutions per minute
  [$min^{-1}$] = [rpm ; revolutions per minute]

● Length of Circumference = Diameter × pi : $\pi D$ [mm]
● Velocity $V_c$: Milling length per minute = Length of circumference × Spindle rotation speed



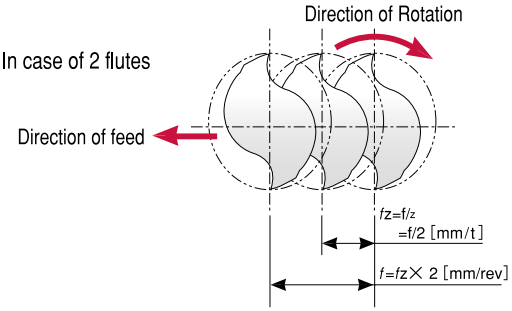

$$V_c = \pi \times D\,[mm] \times n\,[min^{-1}] \rightarrow V_c = \frac{\pi \times D\,[mm] \times n\,[min^{-1}]}{1000}\,[m/min]$$

Unit Conversion : 1 mm = 1/1000 m therefore....
D [mm] = D/1000 [m]

## 2. Feed per tooth $f_z$ [Unit:mm/t]

Related Value
- Feed Rate $V_f$ [mm/min] : Amount of feed per minute
- Spindle Speed n [$min^{-1}$] : Revolutions per minute
  [$min^{-1}$] = [rpm ; revolutions per minute]
- Number of Flutes $z$ : Number of flutes

● The amount of feed per rotation is described below. (rev = revolution)




$$f = \frac{V_f\,[mm/min]}{n\,[rev/min]} = \frac{V_f}{n}\,[\frac{mm}{min}] \times [\frac{min}{rev}]$$
$$= \frac{V_f}{n}\,[mm/rev]$$
※[$min^{-1}$] = [rev/min]

● The amount of feed per flute is calculated using the feed rate divided by the number of flutes.

$$f_z = \frac{f\,[mm/rev]}{z} = \frac{V_f}{n \times z}\,[mm/t]$$

# 2 Using the Parameter Chart

## example 1

<How to calculate spindle speed and feed rate >

For example: C-CES2080 NAK55 (39HRC) high speed milling

(1) Determine the velocity $V_C$ based on the type of work material or its hardness.
Parameter chart on page 165 shows Vc=200 m/min.

(2) We know the Outside diameter, we can set spindle speed ($n$) and feed rate ($V_f$).
NAK55 is in the Prehardened Steel column. Velocity $V_C$ is 200 m/min.
From the table, the Outside diameter (D) is 8.0 mm, then
$n$ = 7900 $min^{-1}$ and $V_f$ = 405 mm/min.

(3) Set the Z-axis cutting depth to approximately half of the outside diameter.

## example 2

<How to calculate feed rate >

●Case 1. You want to work on S50C with a C-CES2030 End Mill,
but the milling machine has 3,500 $min^{-1}$ maximum Spindle capability only.
What is the feed rate with the conditions given?

Based on a feed per tooth 0.0135 mm/t
$V_f$ : = ($n$ x $Z$ x $f_z$) = (3,500 x 2 x 0.0135) = 94.5
$n$ : Spindle speed
$Z$ : Number of flutes
$f_z$ : Feed per tooth
$n$ = 3,500 $min^{-1}$, $V_f$ : = 94.5 mm/min.

<How to calculate the spindle speed>

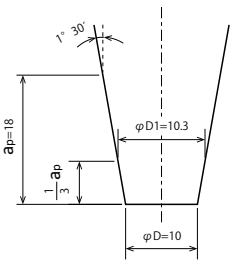
●Case 2. You want to work on NAK80 with a C-CES2100 End Mill
at velocity 22 m/min. What is the spindle speed for this application?

$$n = \frac{1000\,V_C}{\pi D} = \frac{1000 \times 22}{3.14 \times 10} = 700\ min^{-1}$$

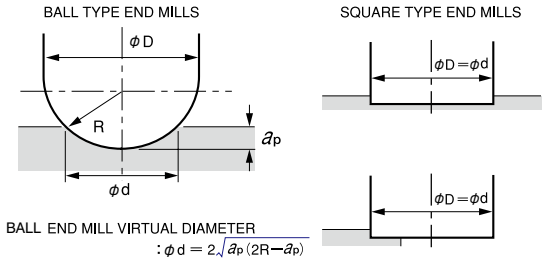
●Case 3. Calculating the spindle speed when side milling using C-CTE 4100-3
Work material: Carbon Steel
Velocity : 40 m/min.
Outside Diameter D is calculated about 1/3 to 1/2 of cutting depth from bottom.
For example:If the blade length is 35 mm, cutting depth is 18 mm.
Outside Diameter D1=(1/3 x Axial Depth $a_p$ x tan (half included angle)) x 2 + tip diameter
=(1/3 x 18 x tan 1.5°) x 2 + $\phi$10 ≒10.3

Spindle speed: $n = \frac{1000\,V_C}{\pi D} = \frac{1000 \times 40}{3.14 \times 10.3}$

$= 1{,}237\ min^{-1}$



## Diagram of End Mill Virtual Diameter




BALL END MILL VIRTUAL DIAMETER

$: \phi d = 2\sqrt{a_p(2R-a_p)}$

Square type diameter equals to the virtual diameter. Ball type virtual diameter will vary depending on the contact point with work material and milling depth. The velocity of Ball End Mill can be calculated by using the virtual diameter.

Velocity of virtual diameter (V) can be calculated by the following formula.

$V_C$ **(m/min)** $= \pi \times \phi$ **d (mm)** $\times$ **n (min$^{-1}$) / 1000**

Ex.) With virtual diameter $\phi$1 mm and spindle speed 30,000 (min$^{-1}$),

$V_C$(m/min) is ; $V_C$(m/min) $= 3.14 \times \phi 1$ (mm) $\times$ 30,000 (min$^{-1}$) /1000

$= 94.2$ m/min

Virtual Diameter of Ball End Mill (mm)　　$a_p$ : Axial Depth (mm)

(Unit : mm)

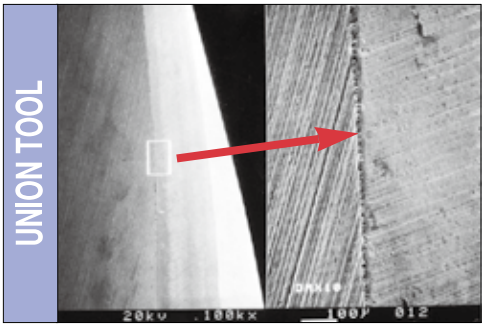
| R \ $a_p$ | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.1 | 0.15 | 0.2 | 0.25 | 0.3 | 0.4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R0.1 | 0.087 | 0.120 | 0.143 | 0.160 | 0.173 | 0.200 | – | – | – | – | – |
| R0.15 | 0.108 | 0.150 | 0.180 | 0.204 | 0.224 | 0.283 | 0.300 | – | – | – | – |
| R0.2 | 0.125 | 0.174 | 0.211 | 0.240 | 0.265 | 0.346 | 0.387 | 0.400 | – | – | – |
| R0.25 | 0.140 | 0.196 | 0.237 | 0.271 | 0.300 | 0.400 | 0.458 | 0.490 | 0.500 | – | – |
| R0.3 | 0.154 | 0.215 | 0.262 | 0.299 | 0.332 | 0.447 | 0.520 | 0.566 | 0.592 | 0.600 | – |
| R0.4 | 0.178 | 0.250 | 0.304 | 0.349 | 0.387 | 0.529 | 0.624 | 0.693 | 0.742 | 0.775 | 0.800 |
| R0.5 | 0.199 | 0.280 | 0.341 | 0.392 | 0.436 | 0.600 | 0.714 | 0.800 | 0.866 | 0.917 | 0.980 |
| R0.6 | 0.218 | 0.307 | 0.375 | 0.431 | 0.480 | 0.663 | 0.794 | 0.894 | 0.975 | 1.039 | 1.131 |
| R0.7 | 0.236 | 0.332 | 0.405 | 0.466 | 0.520 | 0.721 | 0.866 | 0.980 | 1.072 | 1.149 | 1.265 |
| R0.8 | 0.252 | 0.356 | 0.434 | 0.500 | 0.557 | 0.775 | 0.933 | 1.058 | 1.162 | 1.249 | 1.386 |
| R0.9 | 0.268 | 0.377 | 0.461 | 0.531 | 0.592 | 0.825 | 0.995 | 1.131 | 1.245 | 1.342 | 1.497 |
| R1 | 0.282 | 0.398 | 0.486 | 0.560 | 0.624 | 0.872 | 1.054 | 1.200 | 1.323 | 1.428 | 1.600 |
| R1.5 | 0.346 | 0.488 | 0.597 | 0.688 | 0.768 | 1.077 | 1.308 | 1.497 | 1.658 | 1.800 | 2.040 |
| R2 | 0.399 | 0.564 | 0.690 | 0.796 | 0.889 | 1.249 | 1.520 | 1.744 | 1.936 | 2.107 | 2.400 |
| R2.5 | 0.447 | 0.631 | 0.772 | 0.891 | 0.995 | 1.400 | 1.706 | 1.960 | 2.179 | 2.375 | 2.713 |
| R3 | 0.489 | 0.692 | 0.846 | 0.977 | 1.091 | 1.536 | 1.873 | 2.154 | 2.398 | 2.615 | 2.993 |
| R4 | 0.565 | 0.799 | 0.978 | 1.129 | 1.261 | 1.778 | 2.170 | 2.498 | 2.784 | 3.040 | 3.487 |
| R5 | 0.632 | 0.894 | 1.094 | 1.262 | 1.411 | 1.990 | 2.431 | 2.800 | 3.122 | 3.412 | 3.919 |
| R6 | 0.693 | 0.979 | 1.198 | 1.383 | 1.546 | 2.182 | 2.666 | 3.072 | 3.428 | 3.747 | 4.308 |

| R \ $a_p$ | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1 | 1.5 | 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| R0.5 | 1.000 | – | – | – | – | – | – | – | – | – |
| R0.6 | 1.183 | 1.200 | – | – | – | – | – | – | – | – |
| R0.7 | 1.342 | 1.386 | 1.400 | – | – | – | – | – | – | – |
| R0.8 | 1.483 | 1.549 | 1.587 | 1.600 | – | – | – | – | – | – |
| R0.9 | 1.612 | 1.697 | 1.755 | 1.789 | 1.800 | – | – | – | – | – |
| R1 | 1.732 | 1.833 | 1.908 | 1.960 | 1.990 | 2.000 | – | – | – | – |
| R1.5 | 2.236 | 2.400 | 2.538 | 2.653 | 2.750 | 2.828 | 3.000 | – | – | – |
| R2 | 2.646 | 2.857 | 3.040 | 3.200 | 3.341 | 3.464 | 3.873 | 4.000 | – | – |
| R2.5 | 3.000 | 3.250 | 3.470 | 3.666 | 3.842 | 4.000 | 4.583 | 4.899 | 5.000 | – |
| R3 | 3.317 | 3.600 | 3.852 | 4.079 | 4.285 | 4.472 | 5.196 | 5.657 | 5.916 | 6.000 |
| R4 | 3.873 | 4.214 | 4.521 | 4.800 | 5.056 | 5.292 | 6.245 | 6.928 | 7.416 | 7.746 |
| R5 | 4.359 | 4.750 | 5.103 | 5.426 | 5.724 | 6.000 | 7.141 | 8.000 | 8.660 | 9.165 |
| R6 | 4.796 | 5.231 | 5.625 | 5.987 | 6.321 | 6.633 | 7.937 | 8.944 | 9.747 | 10.392 |

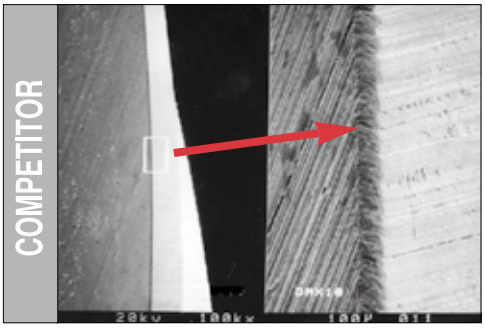
# 3 Features of UNIMAX End Mill

Owing to the in-house specialized fluting machine and improved grinding wheel,
UNIMAX End Mill has realized continuous sharp cutting edge.
This feature enables to get the fine surface roughness and the microscopic finishing.
Ball End Mills have a high precision finish with minimized error of radius accuracy.

## UNIMAX SHARP CUTTING EDGE



## COMPETITOR'S CUTTING EDGE



● COMPETITOR'S CUTTING EDGE

The cutting edge have been honing to prevent chipping.
This makes microscopic milling in the final finishing difficult and causes the cutting edge to diverge from the targeted work finishing surface.

# CSEB / CSELB

Features of CSEB / CSELB Series for Broad Applications from Copper / Raw Materials to 55HRC

◆Optimized Cutting Edge Geometry

Offering durability when roughing, and excellent surface quality for finishing.

◆UTCOAT

Better wear resistance with improved hardness, durability, lubricity and coating adhesion.

◆Broad Application Range

From Copper/Raw Materials up to 55HRC.

## Tool Shape

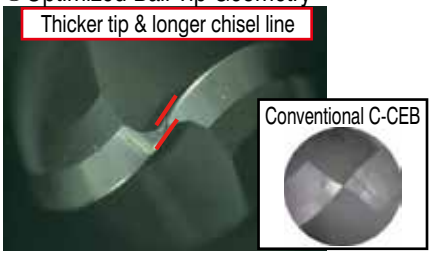
①Helical Ball Shape

Reduce cutting resistance & tool damage!

②Minute Relief Face

Minimal chipping & wearing!

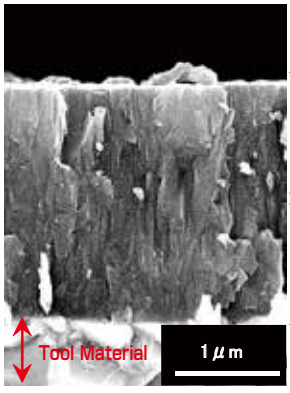
③Optimized Ball Tip Geometry




Ball tip improves finishing performance!

## UTCOAT

◆UTCOAT Cross Section




**Very Hard Coating with Low Friction Properties**

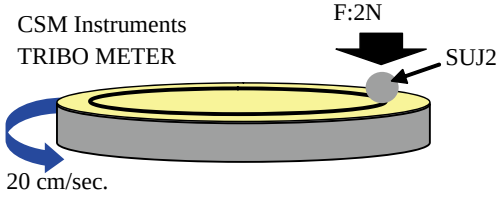
Ultra hard coating >>> Outstanding wear resistance!

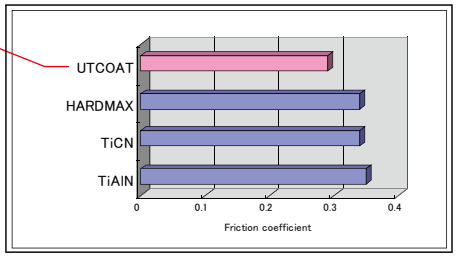
**High Durability and Adhesion**

Fiberous look (high durable) layer offers dramatic performance in resisting chipping during the roughing process. Strong adhesion properties ensure the coating adheres to the carbide.

◆Coating Friction Coefficient Comparison

UTCOAT has smooth surface!
Ideal for sticky materials!



# HSB / HSLB

Features of HSB / HSLB Series for Hard Materials over 40HRC

◆Variable Rake Angle Design

Rake angle transition from ball tip to peripheral cutting edge.

◆HARDMAX Coating

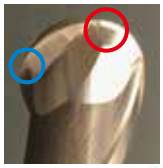
HARDMAX coat offers heat resistance, durability and lubricity at a high level.

◆Recommended for Hard Materials

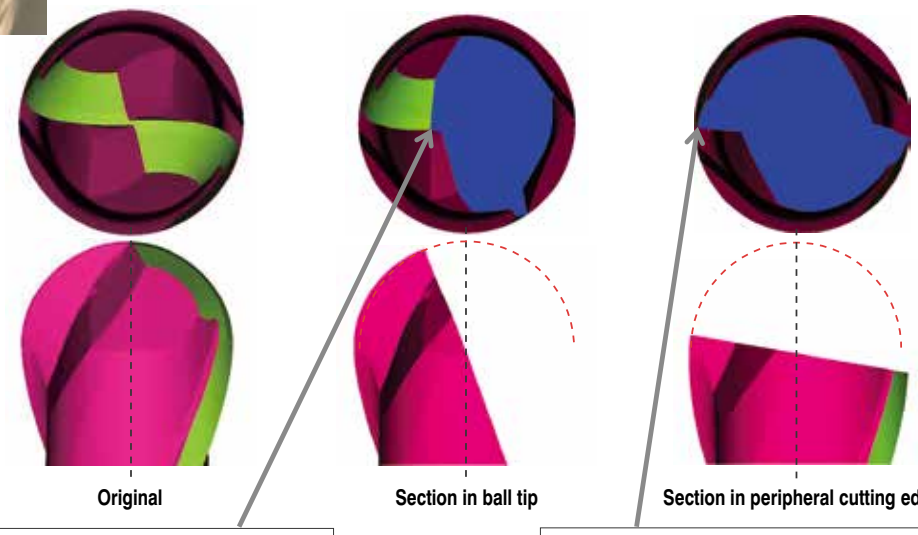
Amazing efficiency with long life and excellent surface finishing on hard materials over 40HRC.

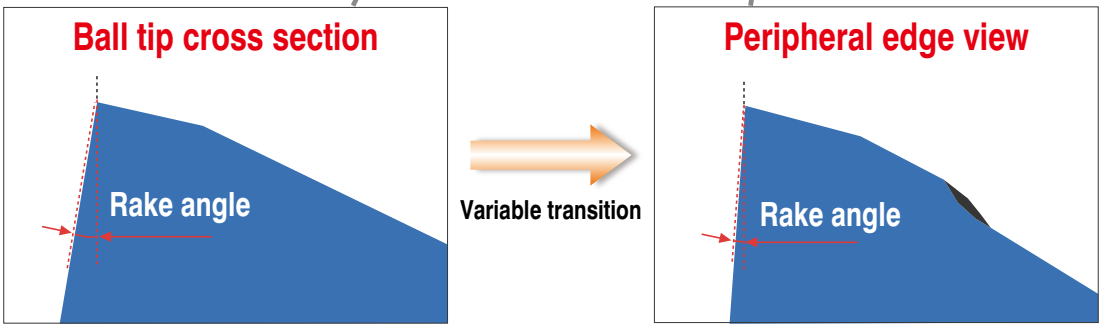
◆Suitable for Various Coolant

Every coolant offers stable milling.



## Variable Rake Angle




**Ball tip point: Super negative**

**Thicker cutting edge improves chipping resistance!**

**Peripheral cutting edge: Slightly negative**

**Small cutting resistance >> Great surface finish!**

# HGB / HGLB

Features of HGB / HGLB for Hardened Steels

◆Adopted new coating "HMGCOAT"

Newly developed "HMGCOAT" (HARDMAX GREAT COAT)

High hardness coating offers higher wear resistance compared to HARDMAX.

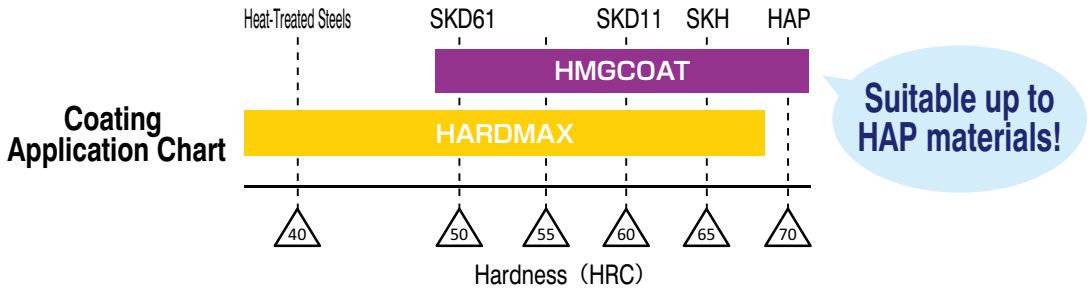
◆New Carbide Materials with excellent wear resistance

◆New design with improved breakage resistance

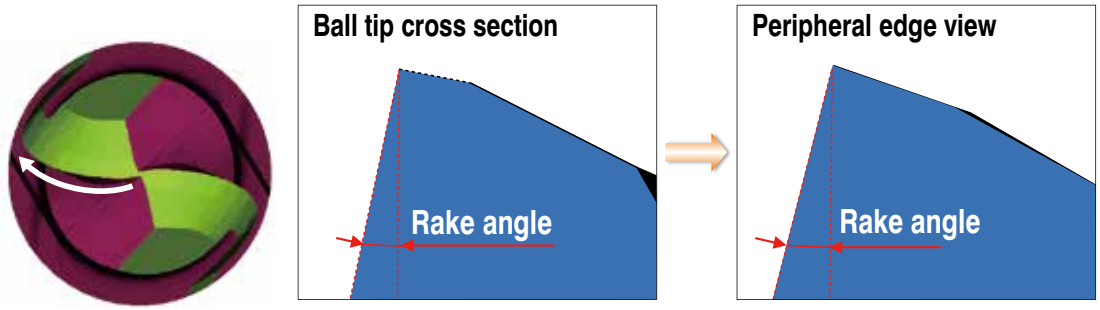
The rake and relief angles optimized for milling hard materials improve breakage resistance.

◆High Precision Diameter Tolerance / Radius Accuracy / Shank Diameter Tolerance

## Newly developed HMGCOAT




## New Design for Hard Materials




**The negative rake angle of the ball gives a gradual angle variation towards the peripheral side.**
**This improves the strength of the entire cutting edge, and tightens the twist of the ball.**

# HGB / HGLB Milling Example

## Spur Gear
## HGB / HGLB R0.5・R1・R1.5

HAP72（68HRC）

Work Size : 60 x 60 x 30 mm
Milled Size : φ 50.4 x Depth 11 mm
Coolant : Air Blow（Through Spindle）

HGB / HGLB
Spur Gear
Milling Video

| No. | Milling Process | Tool | Spindle Speed ($min^{-1}$) | Feed Rate (mm/min) | $a_p$ Axial Depth (mm) | $a_e$ Radial Depth (mm) | Allowance (mm) | Cycle Time (h:m) |
|---|---|---|---|---|---|---|---|---|
| 1 | Roughing | HGB 2030-0450 (R1.5 x Length of Cut 4.5) | 8,280 | 1,140 | 0.12 | 0.55 | 0.02 | 1:41 |
| 2 | Roughing | HGLB 2020-060 (R1 x Effective Length 6) | 12,250 | 1,800 | 0.06 | 0.3 | 0.02 | 0:06 |
| 3 | Semi-finishing | | 12,250 | 1,800 | 0.06 | 0.05 | 0.01 | 0:53 |
| 4 | Finishing | | 12,250 | 900 | 0.00015 (Cusp Height) | — | 0 | 0:09 |
| 5 | Finishing | HMERS 4030-01-0750 (φ3 x CR0.1 x Length of Cut 7.5) | 8,600 | 465 / 1,500 | 0.5 | 1 | 0 | 0:02 |
| 6 | Finishing | | 8,600 | 465 / 1,500 | 0.0002 (Cusp Height) | 1 | 0 | 0:01 |
| 7 | Finishing | HGLB 2010-060 (R0.5 x Effective Length 6) | 20,000 | 800 | 0.00015 (Cusp Height) | — | 0 | 0:55 |
| 8 | Finishing | | 20,000 | 800 | 0.01 | 0.04 | 0 | 0:51 |

Total 4:38

# UDC Series

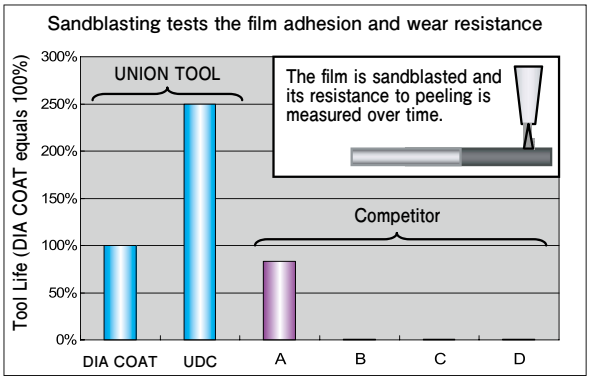
## Features of UDC Series for Cemented Carbide

◆Revolutional Diamond Coating for milling Cemented Carbide

Outstanding hardness, durability and high adhesion coating offers stable and long life milling on Cemented Carbide.

◆Optimum Cutting Geometry

UDC series literally "cuts" the Cemented Carbide and offers highly efficient precise milling.



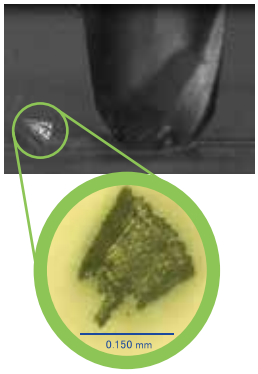

**Coating Patented in Japan**

UNION TOOL's Diamond film made with a hot filament CVD method improve hardness and durability, with outstanding adhesion to the cutting tool. Using fine particle composition control, the UDC coating has dramatically improved hardness and durability.

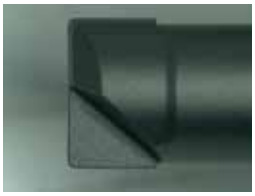
## Direct Milling on Cemented Carbide!

### ◆Ball Series

During a deep cut into the Carbide, UDC tools create a "fan-shaped" chip, just like cutting steels!

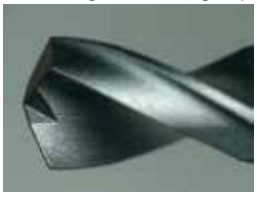



### ◆Radius Series



### ◆Drill and Thread Mill Series

The thinning design improves biting and straight performance, offering highly efficient drilling.



Improved hit counts and hole quality.

# Choose by purposes

UDC
ULTRA DIAMOND COAT

| | For highly efficient roughing and semi-finishing | For better surface finish | For cost saving purposes |
|---|---|---|---|
| Ball | New! UDCBH | UDCBF<br>UDCLBF | UDCB<br>UDCLB |
| Radius | | UDCLRSF | UDCLRS |

The long-awaited 3rd generation UDC!

## UDCBH Patent pending

The best match for roughing and semi-finishing of Cemented Carbide.

## What makes UDCBH different

**High-level Treatment!!** Unbelievable milling performance

**High Speed!!** Mill at surprisingly high feed rate

**High Material Removal Volume!!** Highly improved material removal volume

## Attain both high efficiency and long tool life!

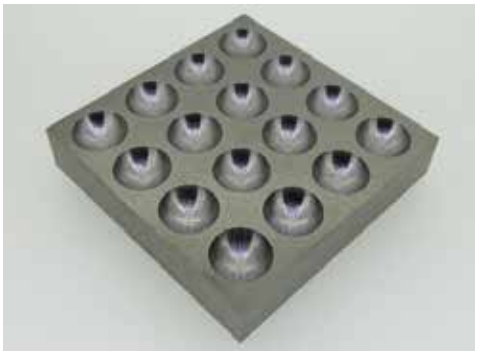
The key points

New generation edge treatment minimize damage × Improved diamond coating to enhance wear resistance

New!

**Cemented Carbide Lens shaped milling Comparison of efficiency and material removal volume with UDCBH / UDCBF R1 × Length of Cut 1.4** — **VM-40 (90 HRA)**

# New! UDCBH



**7.5 times the efficiency**

**Over 4 times the material removal volume**

Work Size : 50 x 50 x 10 mm

Pocket Size : Top $\phi$10 x Depth 3.5 mm

Material Removal Volume : 160 mm³ / Pocket

Coolant : Air Blow

UDCBH shows maximum tool performance under high-speed conditions.
Tool life may shorten when used at the same feed rate as before.

UDCBH Milling example

| Tool | New! UDCBH | UDCBF |
|---|---|---|
| Milling Conditions | | |
| Spindle Speed | 30,000 min⁻¹ | 20,000 min⁻¹ |
| Feed Rate | 1,500 mm/min | 200 mm/min |
| Axial Depth $a_p$ | 0.1 mm | |
| Radial Depth $a_e$ | 0.3 mm | |
| Milling Results | | |
| 1 side 16 pockets | 1 Tool Milling time 76 min | 4 Tool Milling time 7 h 28 min |
| Tool after milling 4 pockets | | |
| Tool after milling 16 pockets | | Still functional |

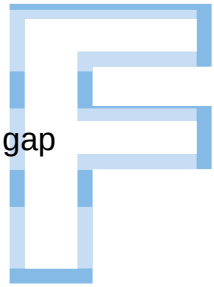
The sharpest cutting edge in the UDC series

# UDC-F series

The best choice for high quality milling surface

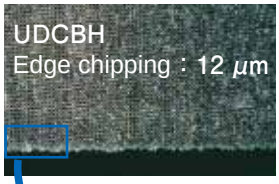
## Features of F series

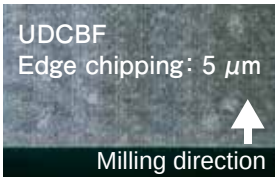
| | |
|---|---|
| ①UDC coating | Optimized coating for F series |
| ②Special treatment for a sharp edge | Minimized edge chipping and level gap |
| ③Chip pocket designed on tool tip | Excellent surface finish |

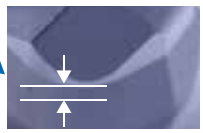


Point!

**Cemented Carbide Flat surface milling Comparison of edge chipping on work piece with UDCBH / UDCBF R0.4 × Length of Cut 0.56** — **VM-40 (90 HRA)**



| Tool | UDCBH | UDCBF |
|---|---|---|
| Spindle Speed | 30,000 $min^{-1}$ | |
| Feed Rate | 750 mm/min | 250 mm/min |
| Axial Depth $a_p$ | 0.02 mm | |
| Radial Depth $a_e$ | 0.02 mm | |
| Coolant | Air Blow | |

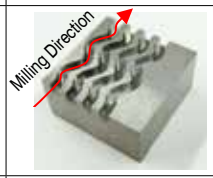
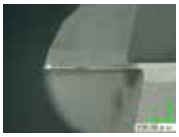
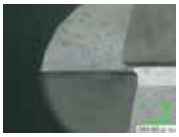
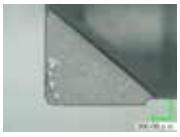
## Improve efficiency and lower costs

by using the right tool based on edge chipping requirements.

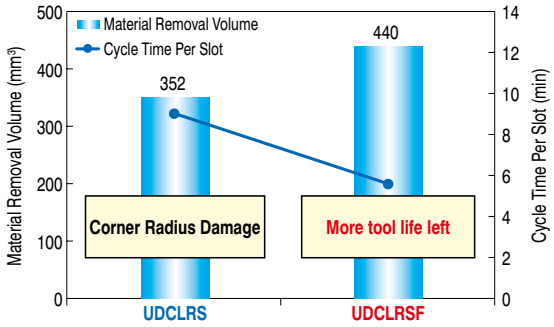
# UDCLRSF / UDCLRS Milling Examples

**Higher efficiency and longer tool life!**

## Cemented Carbide Curve Slotting Milling Example UDCLRSF ϕ2 × CR0.1 × 2 VM-40 (90HRA)

| | UDCLRS | UDCLRSF |
|---|---|---|
| Work Material |   | |
| Relief |  After 4 slots |  After 5 slots |
| Rake Face |  After 4 slots | After 5 slots |

| Tool | UDCLRS 2020-010-020 | UDCLRSF 2020-010-020 |
|---|---|---|
| Work Material | Cemented Carbide VM-40 (90HRA) | |
| Spindle Speed | 20,000 min$^{-1}$ | |
| Feed Rate | 375 mm/min | 190 mm/min |
| Axial Depth $a_p$ | 0.02 mm | 0.06 mm |
| Coolant | Air Blow (Nozzle) | |
| Cycle Time (Per slot) | 9 min 4 second | 5 min 36 second |

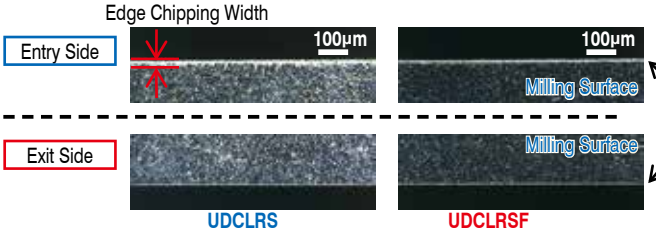


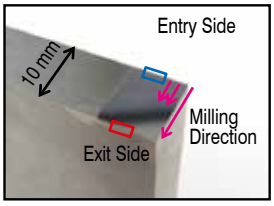

Work Size : 20 mm × 20 mm × 10 mm
Slot Size : Width 2 mm × Depth 1.99 mm

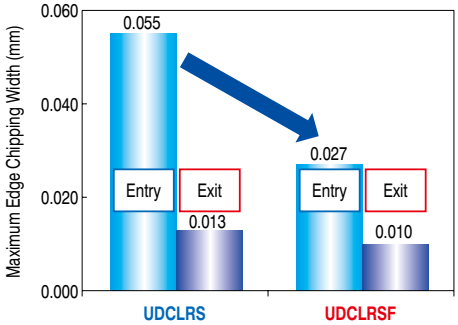
**Minimizing Edge Chipping**

## Cemented Carbide Bottom Surface Milling Example UDCLRSF ϕ2 × CR0.03 × 2 VM-40 (90HRA)

### Edge Chipping Comparison on Work Material




| Tool | UDCLRS 2020-003-020<br>UDCLRSF 2020-003-020 |
|---|---|
| Work Material | Cemented Carbide<br>VM-40 (90HRA) |
| Spindle Speed | 20,000 min$^{-1}$ |
| Feed Rate | 100 mm/min |
| Axial Depth $a_p$ | 0.01 mm |
| Radial Depth $a_e$ | 0.01 mm |
| Coolant | Oil Mist |
| Cycle Time | 137 min |

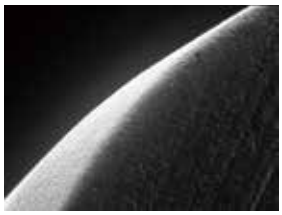
# CBN F series

## Improved sharp edge

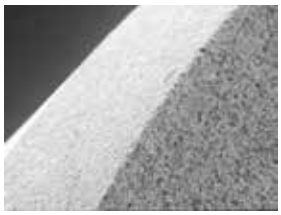
The new cutting edge geometry offers high precision milling and long tool life.

Conventional | **New cutting edge geometry**

**Ball**

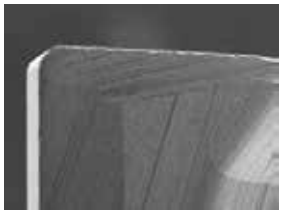


CBN-LB

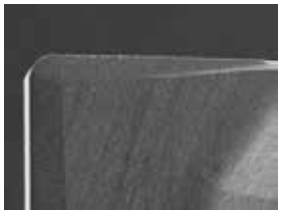


**CBN-LBF**

**Radius**



CBN-LR



**CBN-LRF**

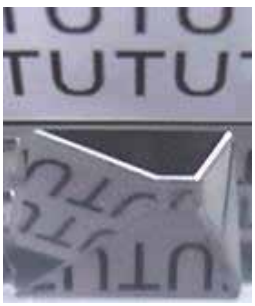
**Dramatically improved wear and chipping resistance!**

**High precision** | **Long tool life** | **Minimized tool damage**

## How to choose CBN Ball

**High efficiency milling/ Long tool life** → **CBN-LBF CBN-LRF**

**Super surface finish** → **CBN-LBSF CBN-RSF**



The surface finish is of such high quality that the letters reflect perfectly in it.

# SPECIAL END MILLS / DRILLS FROM UNION TOOL

## Shape your 'Desire' 'Quickly'.

We manufacture 'Special Tools' over and above our standard items in our catalogue with a **2 weeks manufacturing lead time** to meet customers' request.

## Choices available for standard shapes

### Shape

Square | Ball | Radius | Taper | Taper Ball | + | All Flute | Long Neck | Taper Neck

### Sizes and Options

| | | | | | Options | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Tool Type** | **Shape** | **Min Dia.** | **Max Dia.** | **Number of Flutes** | **Sharp Corner** | **Variable Pitch** | **Variable helix** | **Back Taper** | **Thinning** |
| Solid End Mills | Square | $\phi$0.1 | $\phi$12 | 1~6 | ○ | ○ | ○ | — | — |
| | Ball | R0.03 | R6 | 1~4 | — | ○ | ○ | ○ | — |
| | Radius | $\phi$0.2 X CR0.05 | $\phi$12 X CR4 | 2~6 | — | ○ | ○ | ○ | — |
| CBN Tool | Ball | R0.05 | R1 | 2 | — | — | — | ○ | — |
| | Radius | $\phi$0.1 X CR0.02 | $\phi$2 X CR0.5 | 2 | — | — | — | ○ | — |
| Solid Drills | Drills | $\phi$0.1 | 3 | 2 | — | — | — | — | X Thinning |

*CBN tools have manufacturing lead-times of more than 2 weeks.

*Variable Pitch and helix are available from 3 flutes.

*Please feel free to ask our sales department for other sizes.

### Coatings

Refer to page 6 for the coating selection.

*In case of a repeat order and depending on the requested shape, we may be obliged to exceed two weeks.

# Case studies for non standard shapes

## How can we help you?

**Extend tool life, test trials for new materials, complicated shapes, high precision, improve surface roughness, shorten cycle time,,,**

**We meet your expectations by designing tools according to your requirements!**



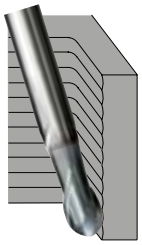
## Case 1 : Barrel End Mills

**<Application>:**
**Highly Efficient Finishing for 5 axis machining**

**What is a barrel end mill?**

**The end mill used mainly in 5-axis machining, having a barrel R at the outer peripheral edge.**

**Standard ball end mills**



Larger $a_p$

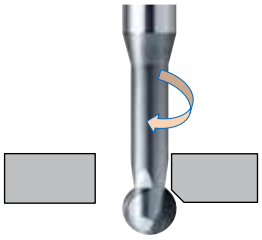
**Barrel end mills**

**Reduces the cycle time significantly for finishing >>> Longer tool life**

**Improves the surface roughness >>> Less polishing process**

## Case 2 : Spherical Ball

**<Application>: Eliminate burring**

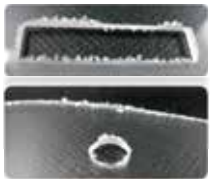


**Helix Design**

# Case studies for non standard shapes

## Case 3 : 1 Flute Square for Aluminum / Plastics

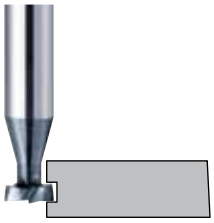
<Application>
Less Burring

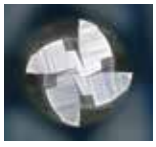


2 Flutes > 1 Flute

## Case 4 : T Slot Cutter

<Application>: Side Slotting





## Case 5 : 12 Flute Radius

<Application>:
Highly Efficient and Longer Tool Life on hardened materials

## Case 6 : Diamond Coated Diamond Cut Router

<Application>: for CFRP / GFRP

## Case 7 : Micro Long Drill (30xD)

<Application>: Deep hole drilling

This is an example of a production application. Please feel free to contact us since numerous shapes are available.

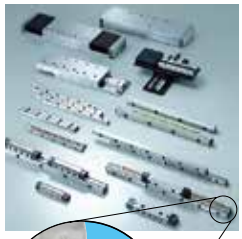
Excellent performance in high speed milling for a wide range of work materials and hardness.
Our extensive product line starts with micro diameters.

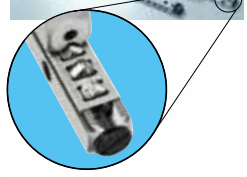
**High performance products developed from PCB drill manufacturing technology.**

# UNIMAX Carbide End Mills

Most of Union Tool's manufacturing equipment is designed and built in-house. We believe that only by having the dedicated fabrications machines designed by engineers who have a thorough knowledge of the products, can we offer uncompromising quality. Since the final process governs the quality of a finished product, all the equipment devoted to final inspection has also been designed in-house. This allows Union Tool to deliver its products with confidence and responsibility.

## Union Tool Products





Liner Motion Products

Heart Rate Sensor

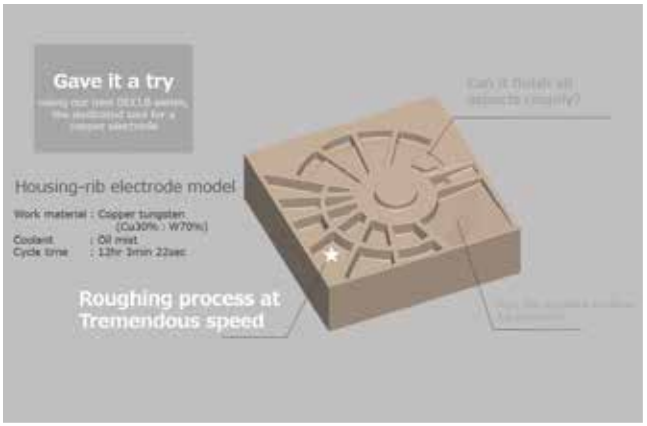
Union Tool's core product is the Printed Circuit Carbide Drill. With a global market share of 30% and a domestic Japanese share of 71%, these ultra precise tools are made at a rate of more than 30 million pieces per month.

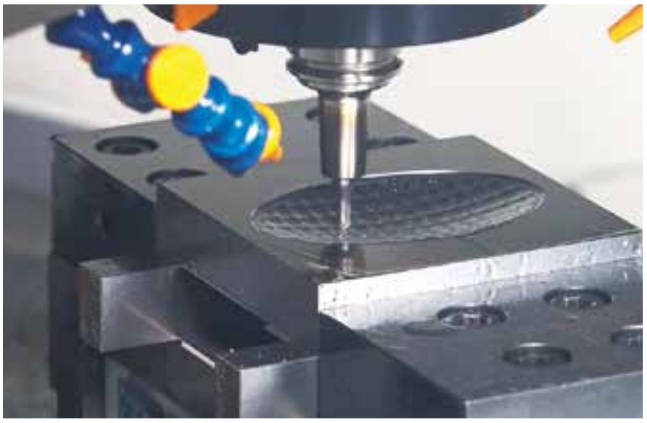
Printed Circuit Board Drills

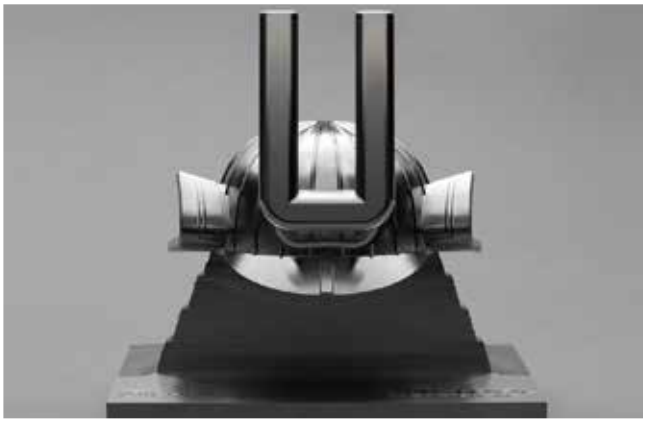
Digital Measurement Equipments

Rolling Die

VEGETABLE OIL INK







# Milling Videos

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2. Catalog revision information

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