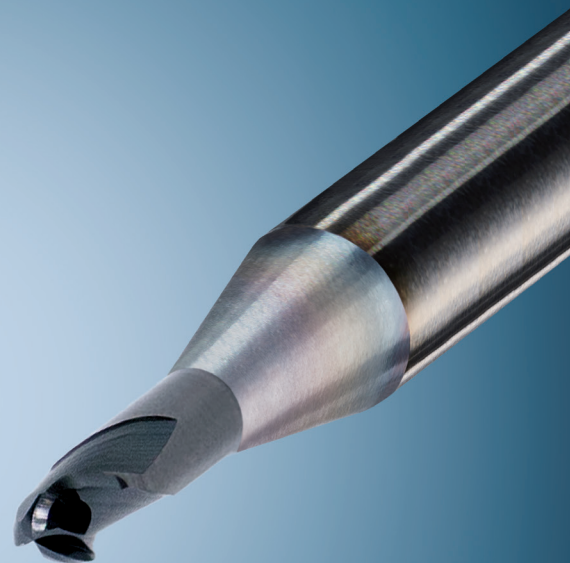
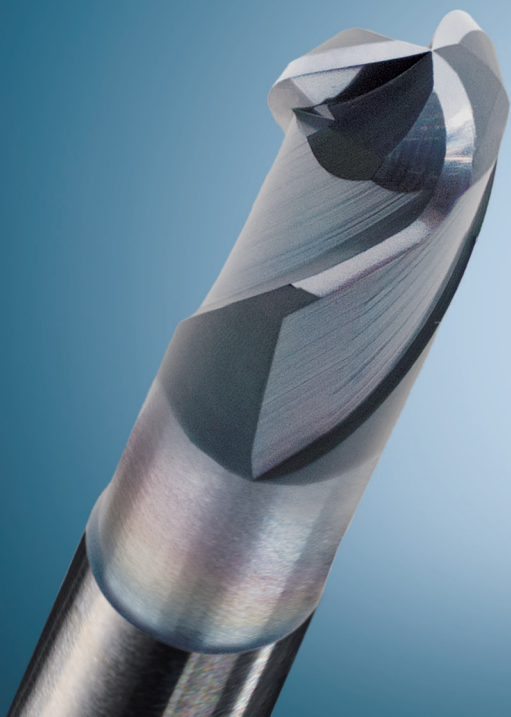
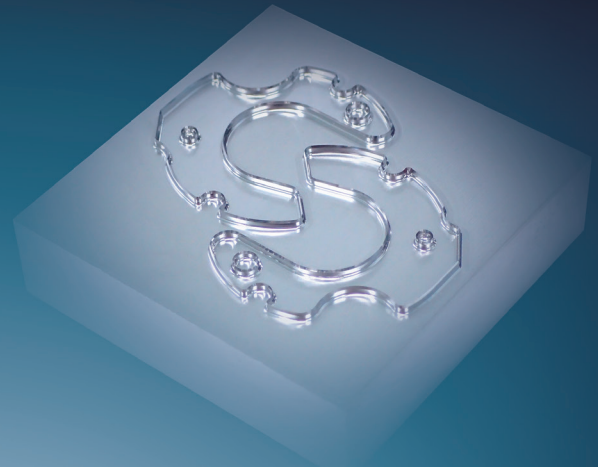
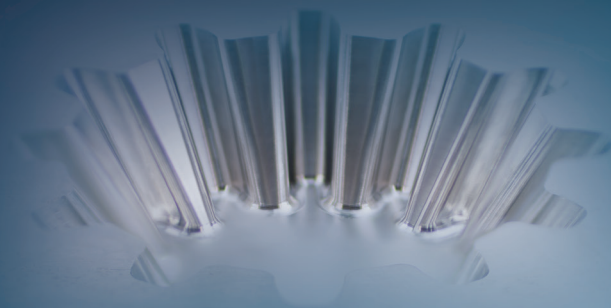


MUGEN COATING PREMIUM Plus High Efficient 3-Flute Small-Diameter Long Neck Ball End Mill for Hardened Steel

MRBSH330 Size Expansion

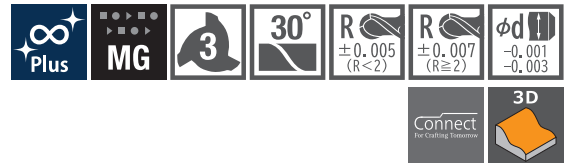
Total 31 sizes



High-efficiency high-precision die machining with improved cutting edge rigidity and chip evacuation

MUGEN COATING PREMIUM Plus
 High Efficient 3-Flute Small-Diameter
 Long Neck Ball End Mill for Hardened Steel

MRBSH330 Lineup Expansion



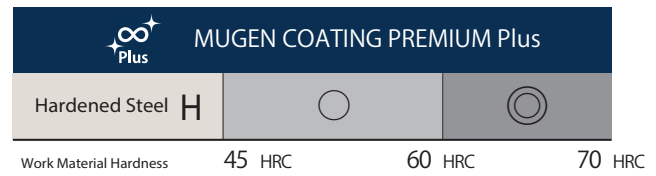
R0.1 ~ R3 Total 31 sizes



Features

| | | |
|---|---|------------------------------------|
| Feature 1 | Long tool life | Coating MUGEN COATING PREMIUM Plus |
|---|---|------------------------------------|

MUGEN COATING PREMIUM Plus is suitable for machining above 60HRC
 Demonstrates same performance with MUGEN COATING PREMIUM even on machining 45 ~ 60HRC



Comparison with other tool brand on roughing process

- Tool size : R1
- Work Material : HAP40 (64HRC)
- Spindle speed : 20,000 min⁻¹
- Feed : 2,400 mm/min

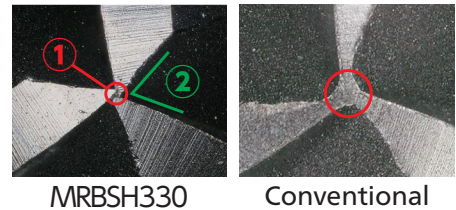
Realize long tool life during high speed machining even comparing with other tool brands

Comparison under the same rate of depth of cut ap 0.23 x ae 0.3 mm

| | Before use | After 60min | After 90min | After 120min |
|---|------------|-------------|-------------|--------------|
| MRBSH330 R1×6 | | | | |
| Other tool brand A 4-flute ball end mill R1 | | | | |
| Other tool brand B 4-flute ball end mill R1 | | | | |

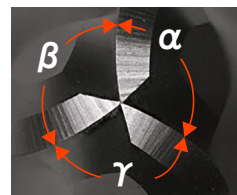
Feature 2 High efficiency Cutting edge shape · Unequal flute spacing · 3-Flute · Chip evacuation

2-1
Optimized center ball shape reduces cutting load to enable high depth of cut



2-2
Optimized chip pocket design realizes smooth chip removal

2-3
Unequal flute prevent chattering



$\alpha \neq \beta \neq \gamma$

2-4
Adopting strong spiral gash for the large diameters to reduce cutting load, break up the chips to improve the chip removal ability and unequal flute prevents chattering ($R \geq 1.5$)



MRBSH330

Conventional

Machining efficiency comparison with conventional product

- Work Material : YXR7 (63HRC)
- Coolant : Oil mist
- Work size : 50 x 50 mm



| Process | MRBSH330 | | Conventional 2-flute ball end mill | |
|------------------------------------|---------------|---------------------|------------------------------------|---------------------|
| | Diamond shape | Circle shape pocket | Diamond shape | Circle shape pocket |
| Tool size | R3 x 20 | R1.5 x 10 | R3 x 20 | R1.5 x 10 |
| Spindle speed (min ⁻¹) | 7,000 | 15,000 | 7,000 | 15,000 |
| Feed (mm/min) | 3,000 | 2,600 | 2,000 | 1,800 |
| Depth of cut (ap x ae mm) | 0.25 x 1 | 0.25 x 0.5 | 0.2 x 1 | 0.15 x 0.3 |
| Machining time | 42min 9sec | 16min 23sec | 73min 11sec | 55min 34sec |

Total machining time reduced by 55%



Introduction of NS Connect

Scanning the barcode on the back of the case to get various information



- Features
- Size and Milling conditions
- Video of machining

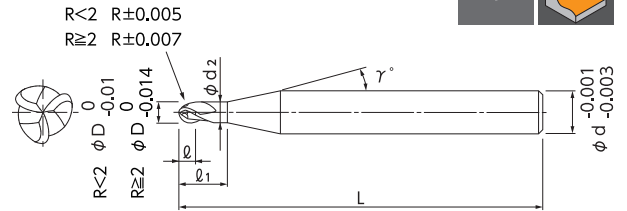


Available to check the information anytime, anywhere before use

MUGEN COATING PREMIUM Plus
High Efficient 3-Flute small-diameter Long Neck Ball End Mill for Hardened Steel

Total 31 sizes

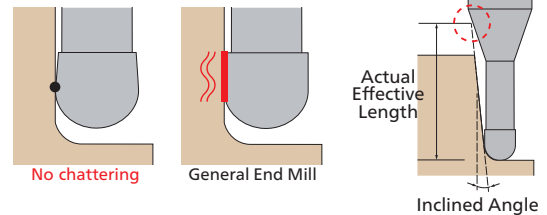
High-efficiency high-precision die machining with improved cutting edge rigidity and chip evacuation



- High-efficiency 3-flute ball end mill optimizes a shape of central edge and enables high depth of cutting.
- Even hardened steel of 45 to 70HRC can be machining with long tool life and high efficiency.
- Shank diameter tolerance, high accuracy type, is - 0.001 ~ - 0.003.

Work Material

| Hardened Steel | |
|----------------|----------|
| 45~60HRC | 60~70HRC |
| ○ | ◎ |



◆ ※Released in Jan, 2023.

Unit [Size : mm]

| Code No. | Corner Radius (R) | Under Neck Length | Length of Cut (ℓ) | Dia. (D) | Neck Dia. (d2) | Neck Taper Angle (γ) | Shank Dia. (d) | Overall Length (L) | Actual effective length depending on inclined angle of workpiece | | | | |
|------------------|-------------------|-------------------|-------------------|----------|----------------|----------------------|----------------|--------------------|--|-------|-------|-------|-------|
| | | | | | | | | | 30° | 1° | 1°30' | 2° | 3° |
| 08-00634-01003 | R0.1 | 0.3 | 0.15 | 0.2 | 0.18 | 12° | 4 | 45 | 0.35 | 0.36 | 0.38 | 0.39 | 0.42 |
| 08-00634-01005 | | 0.5 | 0.15 | 0.2 | 0.18 | 12° | 4 | 45 | 0.56 | 0.58 | 0.61 | 0.63 | 0.69 |
| 08-00634-01505 | R0.15 | 0.5 | 0.2 | 0.3 | 0.28 | 12° | 4 | 45 | 0.56 | 0.58 | 0.60 | 0.62 | 0.67 |
| 08-00634-01506 | | 0.6 | 0.2 | 0.3 | 0.28 | 12° | 4 | 45 | 0.66 | 0.69 | 0.71 | 0.74 | 0.81 |
| 08-00634-01507 | | 0.75 | 0.2 | 0.3 | 0.28 | 12° | 4 | 45 | 0.82 | 0.85 | 0.88 | 0.92 | 1.01 |
| 08-00634-01510 | | 1 | 0.2 | 0.3 | 0.28 | 12° | 4 | 45 | 1.08 | 1.12 | 1.17 | 1.22 | 1.34 |
| 08-00634-02005 | R0.2 | 0.5 | 0.3 | 0.4 | 0.37 | 12° | 4 | 45 | 0.58 | 0.60 | 0.62 | 0.64 | 0.69 |
| 08-00634-02008 | | 0.8 | 0.3 | 0.4 | 0.37 | 12° | 4 | 45 | 0.89 | 0.93 | 0.96 | 1.00 | 1.09 |
| 08-00634-02010 | | 1 | 0.3 | 0.4 | 0.37 | 12° | 4 | 45 | 1.10 | 1.14 | 1.19 | 1.24 | 1.35 |
| 08-00634-02510 | R0.25 | 1 | 0.35 | 0.5 | 0.46 | 12° | 4 | 45 | 1.13 | 1.16 | 1.21 | 1.26 | 1.37 |
| 08-00634-02515 | | 1.5 | 0.35 | 0.5 | 0.46 | 12° | 4 | 45 | 1.65 | 1.71 | 1.78 | 1.85 | 2.03 |
| 08-00634-03010 | R0.3 | 1 | 0.45 | 0.6 | 0.56 | 12° | 4 | 45 | 1.12 | 1.16 | 1.20 | 1.25 | 1.35 |
| 08-00634-03015 | | 1.5 | 0.45 | 0.6 | 0.56 | 12° | 4 | 45 | 1.64 | 1.71 | 1.77 | 1.84 | 2.02 |
| 08-00634-03020 | | 2 | 0.45 | 0.6 | 0.56 | 12° | 4 | 45 | 2.17 | 2.25 | 2.34 | 2.44 | 2.68 |
| 08-00634-05020 | R0.5 | 2 | 0.75 | 1 | 0.95 | 12° | 4 | 45 | 2.18 | 2.26 | 2.34 | 2.43 | 2.65 |
| 08-00634-05025 | | 2.5 | 0.75 | 1 | 0.95 | 12° | 4 | 45 | 2.70 | 2.80 | 2.91 | 3.03 | 3.31 |
| 08-00634-05030 | | 3 | 0.75 | 1 | 0.95 | 12° | 4 | 45 | 3.22 | 3.35 | 3.48 | 3.63 | 3.97 |
| 08-00634-07503 | R0.75 | 3 | 1.1 | 1.5 | 1.45 | 12° | 4 | 45 | 3.21 | 3.33 | 3.45 | 3.58 | 3.89 |
| 08-00634-07504 | | 4 | 1.1 | 1.5 | 1.45 | 12° | 4 | 45 | 4.26 | 4.41 | 4.59 | 4.78 | 5.22 |
| 08-00634-10003 | R1 | 3 | 1.5 | 2 | 1.94 | 12° | 4 | 45 | 3.23 | 3.33 | 3.44 | 3.56 | 3.85 |
| 08-00634-10004 | | 4 | 1.5 | 2 | 1.94 | 12° | 4 | 45 | 4.27 | 4.42 | 4.58 | 4.76 | 5.17 |
| 08-00634-10006 | | 6 | 1.5 | 2 | 1.94 | 12° | 4 | 45 | 6.36 | 6.60 | 6.86 | 7.15 | 7.83 |
| ◆ 08-00634-15006 | R1.5 | 6 | 2.5 | 3 | 2.85 | 12° | 6 | 60 | 6.56 | 6.78 | 7.03 | 7.31 | 7.95 |
| ◆ 08-00634-15008 | | 8 | 2.5 | 3 | 2.85 | 12° | 6 | 60 | 8.64 | 8.96 | 9.31 | 9.70 | 10.60 |
| ◆ 08-00634-15010 | | 10 | 2.5 | 3 | 2.85 | 12° | 6 | 60 | 10.73 | 11.14 | 11.59 | 12.09 | 13.26 |
| ◆ 08-00634-20008 | R2 | 8 | 3 | 4 | 3.8 | 12° | 6 | 65 | 8.74 | 9.05 | 9.38 | 9.74 | 10.60 |
| ◆ 08-00634-20010 | | 10 | 3 | 4 | 3.8 | 12° | 6 | 65 | 10.83 | 11.22 | 11.66 | 12.14 | 13.25 |
| ◆ 08-00634-20012 | | 12 | 3 | 4 | 3.8 | 12° | 6 | 65 | 12.91 | 13.40 | 13.94 | 14.53 | 15.91 |
| ◆ 08-00634-30010 | R3 | 10 | 6 | 6 | 5.7 | - | 6 | 65 | Free | Free | Free | Free | Free |
| ◆ 08-00634-30015 | | 15 | 6 | 6 | 5.7 | - | 6 | 65 | Free | Free | Free | Free | Free |
| ◆ 08-00634-30020 | | 20 | 6 | 6 | 5.7 | - | 6 | 65 | Free | Free | Free | Free | Free |

How to Order When you order, indicate MRBSH330(R)×(ℓ1).

※(γ) is reference value.

Recommended Milling Conditions

| Work Material | | | High Speed Steels/Hardened Steels SKH51·SKD11 (~62HRC) | | | | High Speed Steels SKH55·HAP40 (~66HRC) | | | | High Speed Steels SKH57·HAP72 (~70HRC) | | | |
|------------------|-------------------------|------|---|-------------------|--------|-------------------|---|-------------------|--------|-------------------|---|-------------------|--------|-------------------|
| Corner Radius | Under Neck Length | L/D | Depth of Cut | | Feed | Spindle Speed | Depth of Cut | | Feed | Spindle Speed | Depth of Cut | | Feed | Spindle Speed |
| | | | a _p mm | a _e mm | mm/min | min ⁻¹ | a _p mm | a _e mm | mm/min | min ⁻¹ | a _p mm | a _e mm | mm/min | min ⁻¹ |
| R0.1 | 0.3 | 1.5 | 0.006 | 0.007 | 450 | 40,000 | 0.004 | 0.005 | 300 | 40,000 | 0.004 | 0.005 | 220 | 40,000 |
| | 0.5 | 2.5 | 0.006 | 0.007 | 400 | 40,000 | 0.004 | 0.005 | 250 | 40,000 | 0.004 | 0.005 | 190 | 40,000 |
| R0.15 | 0.5 | 1.7 | 0.01 | 0.01 | 450 | 40,000 | 0.005 | 0.005 | 400 | 40,000 | 0.005 | 0.005 | 300 | 40,000 |
| | 0.6 | 2 | 0.007 | 0.007 | 450 | 40,000 | 0.005 | 0.005 | 350 | 40,000 | 0.005 | 0.005 | 270 | 40,000 |
| | 0.75 | 2.5 | 0.007 | 0.007 | 400 | 40,000 | 0.005 | 0.005 | 350 | 40,000 | 0.005 | 0.005 | 250 | 40,000 |
| R0.2 | 1 | 3.3 | 0.007 | 0.007 | 350 | 40,000 | 0.005 | 0.005 | 300 | 40,000 | 0.005 | 0.005 | 220 | 40,000 |
| | 0.5 | 1.25 | 0.035 | 0.04 | 1,100 | 40,000 | 0.013 | 0.02 | 850 | 40,000 | 0.013 | 0.02 | 650 | 35,000 |
| | 0.8 | 2 | 0.03 | 0.03 | 1,000 | 40,000 | 0.012 | 0.02 | 850 | 40,000 | 0.012 | 0.02 | 600 | 35,000 |
| R0.25 | 1 | 2.5 | 0.03 | 0.03 | 1,000 | 40,000 | 0.012 | 0.02 | 850 | 40,000 | 0.012 | 0.02 | 600 | 35,000 |
| | 1 | 2 | 0.03 | 0.03 | 1,300 | 40,000 | 0.015 | 0.02 | 1,000 | 35,000 | 0.015 | 0.02 | 700 | 30,000 |
| R0.3 | 1.5 | 3 | 0.015 | 0.03 | 1,000 | 40,000 | 0.01 | 0.02 | 800 | 35,000 | 0.01 | 0.02 | 500 | 30,000 |
| | 1 | 1.7 | 0.045 | 0.06 | 1,500 | 40,000 | 0.03 | 0.05 | 1,100 | 30,000 | 0.03 | 0.05 | 800 | 25,000 |
| | 1.5 | 2.5 | 0.045 | 0.06 | 1,500 | 40,000 | 0.03 | 0.05 | 1,100 | 30,000 | 0.03 | 0.05 | 800 | 25,000 |
| R0.5 | 2 | 3.3 | 0.045 | 0.06 | 1,500 | 40,000 | 0.03 | 0.05 | 1,100 | 30,000 | 0.03 | 0.05 | 800 | 25,000 |
| | 2 | 2 | 0.15 | 0.2 | 3,000 | 30,000 | 0.12 | 0.1 | 2,000 | 25,000 | 0.075 | 0.1 | 1,500 | 20,000 |
| | 2.5 | 2.5 | 0.15 | 0.2 | 3,000 | 30,000 | 0.12 | 0.1 | 2,000 | 25,000 | 0.075 | 0.1 | 1,500 | 20,000 |
| R0.75 | 3 | 3 | 0.15 | 0.2 | 3,000 | 30,000 | 0.12 | 0.1 | 2,000 | 25,000 | 0.075 | 0.1 | 1,500 | 20,000 |
| | 3 | 2 | 0.15 | 0.3 | 3,800 | 30,000 | 0.15 | 0.2 | 3,000 | 25,000 | 0.09 | 0.2 | 2,200 | 20,000 |
| R1 | 4 | 2.7 | 0.15 | 0.3 | 3,000 | 25,000 | 0.15 | 0.2 | 2,400 | 22,000 | 0.09 | 0.2 | 1,800 | 18,000 |
| | 3 | 1.5 | 0.3 | 0.5 | 3,800 | 25,000 | 0.22 | 0.3 | 3,000 | 20,000 | 0.15 | 0.3 | 2,200 | 16,000 |
| | 4 | 2 | 0.3 | 0.5 | 3,800 | 25,000 | 0.22 | 0.3 | 3,000 | 20,000 | 0.15 | 0.3 | 2,200 | 16,000 |
| R1.5 | 6 | 3 | 0.3 | 0.3 | 3,000 | 22,000 | 0.22 | 0.3 | 2,400 | 20,000 | 0.15 | 0.3 | 1,800 | 16,000 |
| | 6 | 2 | 0.3 | 0.6 | 3,800 | 18,000 | 0.25 | 0.5 | 3,000 | 15,000 | 0.15 | 0.5 | 2,250 | 12,000 |
| | 8 | 2.7 | 0.3 | 0.6 | 3,800 | 18,000 | 0.25 | 0.5 | 3,000 | 15,000 | 0.15 | 0.5 | 2,250 | 12,000 |
| R2 | 10 | 3.3 | 0.3 | 0.6 | 3,200 | 18,000 | 0.25 | 0.5 | 2,600 | 15,000 | 0.15 | 0.5 | 2,000 | 12,000 |
| | 8 | 2 | 0.3 | 0.8 | 3,800 | 15,000 | 0.25 | 0.6 | 3,000 | 12,000 | 0.18 | 0.6 | 2,250 | 9,500 |
| | 10 | 2.5 | 0.3 | 0.8 | 3,800 | 15,000 | 0.25 | 0.6 | 3,000 | 12,000 | 0.18 | 0.6 | 2,250 | 9,500 |
| R3 | 12 | 3 | 0.3 | 0.8 | 3,800 | 15,000 | 0.25 | 0.6 | 3,000 | 12,000 | 0.18 | 0.6 | 2,250 | 9,500 |
| | 10 | 1.7 | 0.38 | 1.2 | 3,800 | 8,000 | 0.25 | 1 | 3,000 | 7,000 | 0.18 | 1 | 2,250 | 5,500 |
| | 15 | 2.5 | 0.38 | 1.2 | 3,800 | 8,000 | 0.25 | 1 | 3,000 | 7,000 | 0.18 | 1 | 2,250 | 5,500 |
| | 20 | 3.3 | 0.38 | 1.2 | 3,800 | 8,000 | 0.25 | 1 | 3,000 | 7,000 | 0.18 | 1 | 2,250 | 5,500 |

Notes

- ※1 Depth of Cut : a_p = Axial Depth of Cut / a_e = Radial Depth of Cut.
- ※2 Adjust milling condition according to machine rigidity and clamp condition of work material.
- ※3 In case of chattering etc., please adjust cutting conditions if necessary.
- ※4 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly.
- ※5 If machine tool vibration is high during machining, adjust the feed rate as necessary.
- ※6 Attention to a risk of chipping and breakage when insufficient chip flow.
- ※7 Adjust both spindle speed and feed at the same rate.
- ※8 Overhang of end mill should be as short as possible from spindle nose.
- ※9 We recommend using oil mist coolant.

Machining case 1

YXM1 (62HRC) Forging mold

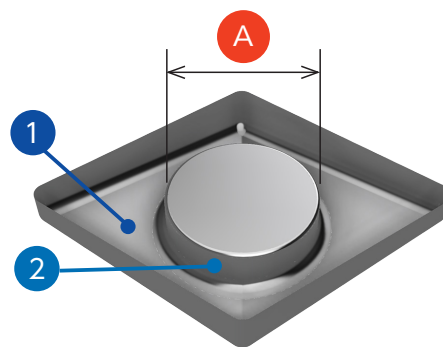
Realize high efficient machining on hardened steels with high depth of cut and high feed rate

Work Material: **YXM1 (62HRC)** as the same as SKH51

Work size: **100 × 100 mm**

Coolant : Oil mist

Total machining time : 3 hr 35 min



Unit [μm]

| Surface roughness | | |
|-------------------|---------------|--------|
| | 1 Inclined 5° | 2 Side |
| Ra | 0.34 | 0.24 |
| Rz | 1.88 | 1.51 |

Unit [mm]

| | Rake | Center | Machining time |
|--|------|--------|----------------|
| MRBSH330 R3 × 15 Roughing + Semi-finishing | | | 2hr 14min |
| MRBSH330 R3 × 15 Finishing | | | 1hr 21min |

| Accuracy | | A |
|-------------------------|--------|---------------|
| Target ϕ 40.000 | Actual | ϕ 40.006 |
| | Error | + 0.006 |

Unit [mm]

| Deflection at cylindrical part |
|--------------------------------|
| Under 0.001 |

| Process | Roughing | Semi-Finishing | Finishing |
|---------------------------------------|---------------------|----------------|---------------------|
| Tool | MRBSH330 R3 × 15 | | MRBSH330 R3 × 15 |
| Spindle speed [min^{-1}] | 7,000 | | 7,000 |
| Feed [mm/min] | 3,000 | 2,100 | 1,500 |
| Depth of cut [mm] $a_p \times a_e$ | 0.25 × 1 | pf 0.2 | pf 0.1 |
| Stock [mm] | 0.05 | 0.03 | 0 |
| Machining time | 1hr 43min | 31min | 1hr 21min |

Machining case 2

HAP40 (64HRC) Two-stage pocket mold

Realize long tool life and high efficiency machining for complex shapes even on hardened steels

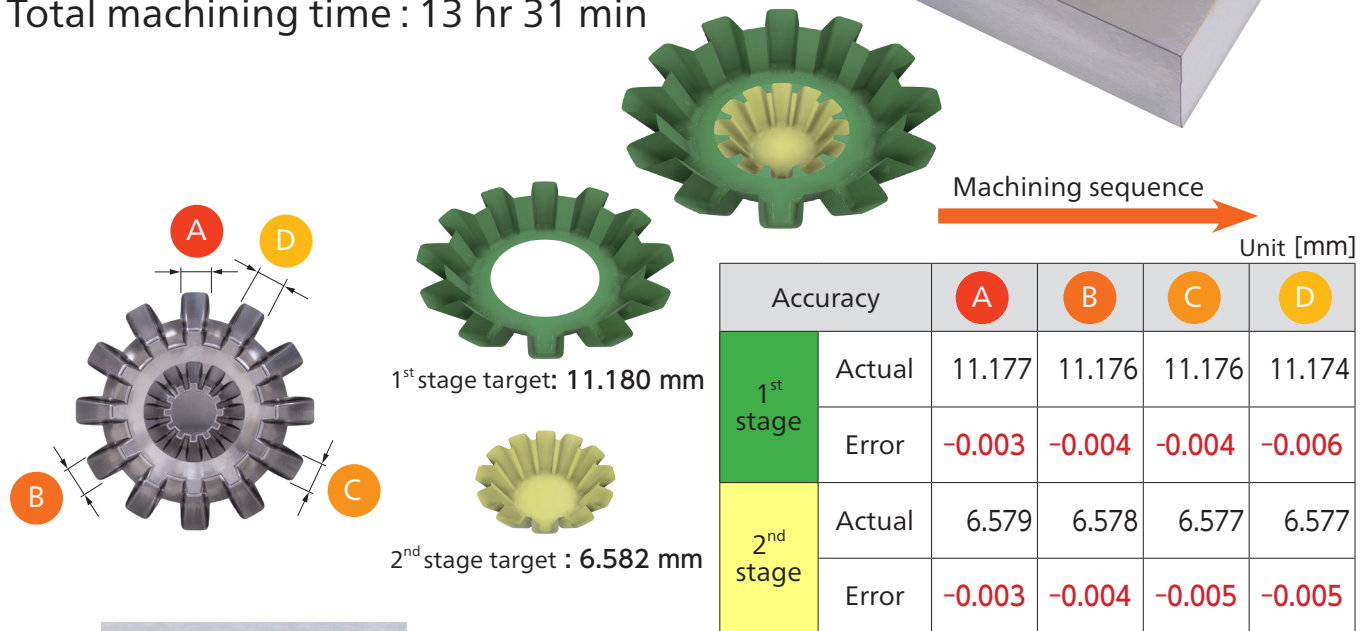
Work Material : **HAP40 (64HRC)**

as the same as SKH40

Work size : **100 × 100 mm**

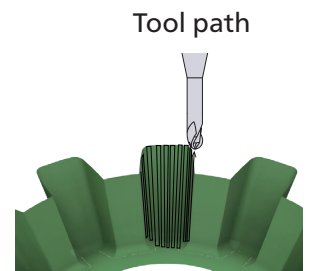
Coolant : Oil mist

Total machining time : 13 hr 31 min



Unit [μm]

| Surface roughness | | | | |
|-------------------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 |
| Ra | 0.053 | 0.067 | 0.065 | 0.070 |



| Machining position | 1 st stage | | 2 nd stage | 1 st stage | | 2 nd stage | | |
|------------------------------------|-----------------------|--------------------|-----------------------|-----------------------|--------------------|-----------------------|-----------------|-----------------|
| | Roughing | Semi-Roughing | Roughing | Semi-Finishing | Finishing | Semi-Roughing | Semi-Finishing | Finishing |
| Tool | MRBSH330 R3 × 20 | MRBSH330 R1.5 × 10 | | MRBSH330 R1.5 × 10 | MRBSH330 R1.5 × 10 | | MRBSH330 R1 × 6 | MRBSH330 R1 × 6 |
| Spindle speed [min ⁻¹] | 7,000 | 15,000 | 15,000 | 10,000 | 10,000 | 15,000 | 13,000 | 13,000 |
| Feed [mm/min] | 2,500 | 2,000 | 2,500 | 1,800 | 1,500 | 1,500 | 1,500 | 1,300 |
| Depth of cut ap × ae [mm] | 0.25 × 1 | 0.15 × 0.1 | 0.2 × 0.8 | 0.05 × 0.05 | 0.035 × 0.035 | 0.15 × 0.1 | 0.04 × 0.04 | 0.03 × 0.03 |
| Stock [mm] | 0.1 | 0.08 | 0.1 | 0.035 | 0 | 0.08 | 0.03 | 0 |
| Machining time | 2hr 5min | 54min | 38min | 2hr 30min | 4hr 4min | 10min | 1hr 23min | 1hr 47min |

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CAUTION

Attention on Safety

- 1) When removing tools from cases, be careful of getting-out of tools and don't touch directly the cutting edges.
- 2) Never touch the cutting edges directly with bare hand.
- 3) Use safety covers and eye protection, as tools may be broken.
- 4) Use holders, etc. that match the tools and nature of the processing operations. The tool should be firmly attached to the holder to prevent shaking.
- 5) The work materials clamp firmly.
- 6) Make sure of dimensions of tools and work pieces before starting operation.
- 7) It is necessary to adjust conditions according to the dimensions of work materials and the machine.
- 8) Select a cutting fluid appropriate to the particular usage. Using a non-water cutting fluid could lead to fires due to sparks generated during processing or heat caused by breakage. Ensure that you take proper fire-prevention measures.
- 9) If abnormal sound, etc. occurs during processing, stop the machine immediately.
- 10) Don't modify tools.

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23'01



MRBSH330_A1_202301_EN_A

Specifications may change without notice for improvement.