

無限コーティングプレミアムPlus  
高硬度鋼高能率加工用  
小径3枚刃ロングネックボールエンドミル

MUGEN COATING PREMIUM Plus

High Efficient 3-Flute Small-Diameter Long Neck Ball End Mill for Hardened Steel

**NEW**

**MRBSH330**

H



# 中心刃形状を最適化し、荒取り加工では高切込みと高送りを実現 また仕上げ加工も可能な高能率3枚刃ボールエンドミル

High efficient 3-flute ball end mill with optimized ball center shape enables high depth of cut and high feed machining and finishing

無限コーティングプレミアムPlus

高硬度鋼高能率加工用小径3枚刃ロングネックボールエンドミル

MUGEN COATING PREMIUM Plus

High Efficient 3-Flute Small-Diameter Long Neck Ball End Mill for Hardened Steel



**MRBSH330** R0.1 ~ R1 全 22 サイズ  
Total 22 sizes



## 特長

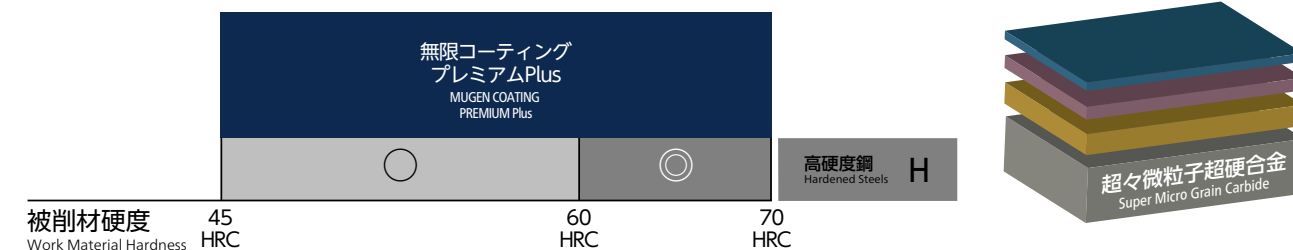
Features

|                     |                                                           |                      |                                                         |
|---------------------|-----------------------------------------------------------|----------------------|---------------------------------------------------------|
| Feature<br><b>1</b> | <b>高硬度鋼加工</b><br>Suitable for machining on hardened steel | <b>被膜</b><br>Coating | <b>無限コーティングプレミアム Plus</b><br>MUGEN COATING PREMIUM Plus |
|---------------------|-----------------------------------------------------------|----------------------|---------------------------------------------------------|

耐酸化性・耐摩耗性の高い無限コーティングプレミアム Plus で 60HRC 以上の被削材に最適な効果を発揮。

45 ~ 60HRC でも無限コーティングプレミアムと同等の性能を発揮します。

MUGEN COATING PREMIUM Plus with high oxidation resistance and abrasion resistance is suitable for machining above 60HRC. Demonstrates same performance with MUGEN COATING PREMIUM even on machining 45 ~ 60HRC.



|                                              |                                                                                             |  |
|----------------------------------------------|---------------------------------------------------------------------------------------------|--|
| <b>耐酸化被膜層</b><br>Oxidation resistant layer   | 切削時の発熱に対し酸化しにくい<br>Prevents oxidation due to heat generated during cutting                  |  |
| <b>硬質被膜層</b><br>Hard coating layer           | 高硬度鋼に対し工具摩耗が進行しにくい<br>Tool wear can be reduced when machining on high hardened steel        |  |
| <b>高密着被膜層</b><br>High adhesion coating layer | 衝撃に対し亀裂を抑え伝播しにくい構造<br>Structure that is difficult to crack and propagate when impact forced |  |

超々微粒子超硬合金  
Super Micro Grain Carbide

|                     |                               |                                                                                |
|---------------------|-------------------------------|--------------------------------------------------------------------------------|
| Feature<br><b>2</b> | <b>高能率</b><br>High efficiency | <b>中心刃形状・不等分割・3 枚刃</b><br>Cutting edge shape · Unequal flute spacing · 3-Flute |
|---------------------|-------------------------------|--------------------------------------------------------------------------------|

### 2-1

中心刃形状を最適化し、切削負荷を低減することで高切込みを可能  
Optimized center ball shape reduces cutting load to enable high depth of cut

### 2-2

切りくずの排出性を損なうことのないチップポケット形状  
Optimized chip pocket design realizes smooth chip removal

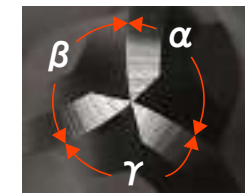
### 2-3

切削負荷を低減するポジティブ切れ刃形状と耐欠損性を重視した素材の採用で高硬度鋼に対し長寿命で高精度な切削加工を実現  
Sharp cutting edge with reduced cutting load and material with fracture resistance realizes long tool life and high precision for hardened steel

|                             |                                  |                                                               |                                  |
|-----------------------------|----------------------------------|---------------------------------------------------------------|----------------------------------|
| <b>MRBSH330</b>             |                                  | <b>一般的な高硬度鋼加工エンドミル</b><br>General end mill for hardened steel |                                  |
| 切れ刃形状<br>Cutting edge shape | ポジティブ刃先<br>Positive cutting edge | 切れ刃形状<br>Cutting edge shape                                   | ネガティブ刃先<br>Negative cutting edge |
|                             |                                  |                                                               |                                  |

### 2-4

不等分割でびびり防止  
Unequal flute prevent chattering



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

## 他社品との荒取り加工比較

Comparison with other tool brand on roughing process

- 被削材：HAP40 (64HRC)  
Work Material
- 回転数：20,000 min<sup>-1</sup>  
Spindle speed
- 送り速度：2,400mm/min  
Feed

4 枚刃の荒取り加工と比較して  
高切込みが可能  
高送りも可能  
切りくず排出性が良好  
Comparing 4-flute with roughing machining process  
High depth of cut  
High feed  
Excellent chip removal

## 切込み量 ap 0.23 × ae 0.3 mm での加工比較を実施

Under the same rate of depth of cut

|                                                                                  | 使用前<br>Before use | 60 分後<br>After 60min | 90 分後<br>After 90min | 120 分後<br>After 120min |
|----------------------------------------------------------------------------------|-------------------|----------------------|----------------------|------------------------|
| <b>MRBSH330</b><br>R1×6                                                          |                   |                      |                      |                        |
| <b>他社品 A</b><br>Other tool brand A<br>4枚刃ボールエンドミル<br>R1<br>4-flute ball end mill |                   |                      |                      |                        |
| <b>他社品 B</b><br>Other tool brand B<br>4枚刃ボールエンドミル<br>R1<br>4-flute ball end mill |                   |                      |                      |                        |

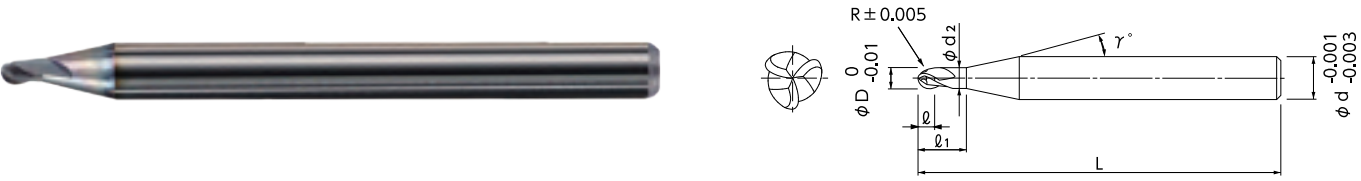
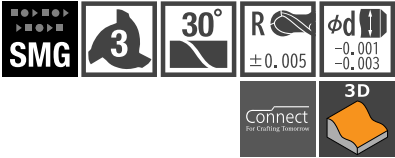
|                |                                         |                                                                                                                                                                     |                                                                                                                   |                                                                                                           |
|----------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>NS TOOL</b> | <b>Connect</b><br>For Crafting Tomorrow | <b>NS Connect のご紹介</b><br>Introduction of NS Connect<br>ケース裏面の二次元コードを読み込むことで様々な情報につながります<br>Scanning the barcode on the back of the case to get various information | <b>工具の特長</b><br>Features<br><b>規格・切削条件</b><br>Size and Milling conditions<br><b>加工動画 など</b><br>Video of machining | <b>いつでも・どこでも</b><br>使用直前に情報を確認<br>できます<br>Available to check the information anytime, anywhere before use |
|----------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|



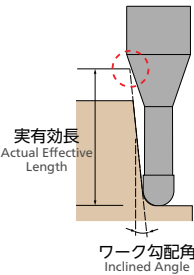
無限コーティングプレミアムPlus 高硬度鋼高能率加工用小径3枚刃ロングネックボールエンドミル  
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全 22 サイズ  
Total 22 sizes

切削条件参考表 Recommended Milling Conditions



- 中心刃形状を最適化し、高切込みを可能とした高能率3枚刃ボールエンドミル。
- 45 ～ 70HRC の高硬度鋼でも、切削性と耐摩耗性を両立し、長寿命・高能率に加工が可能。
- R精度は ±0.005mm (R精度は実外径の1/2を基準とする)。
- シャンク径公差は -0.001mm から -0.003mm の高精度仕様。
- 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.
- R accuracy is ±0.005mm (R accuracy is based on a half value of actual diameter).
- Shank diameter tolerance , high accuracy type, is - 0.001 ～ - 0.003.



| 被削材 Work Material     |            |
|-----------------------|------------|
| H 高硬度鋼 Hardened Steel |            |
| 45 ～ 60HRC            | 60 ～ 70HRC |
| ○                     | ◎          |

| コードNo.<br>Code No. | (R)ボール半径<br>Radius | (L1)首下長<br>Under Neck Length | (L)刃長<br>Length of Cut | (D)外径<br>Dia. | (d2)首下径<br>Neck Dia. | (γ)首角<br>Neck Taper Angle | (d)シャンク径<br>Shank Dia. | (L)全長<br>Overall Length | 標準価格<br>Retail Price | ワーク勾配角に対する実有効長<br>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                      | 10,000               | 0.35                                                                                | 0.36 | 0.38  | 0.39 | 0.42 |
| 08-00634-01005     |                    | 0.5                          | 0.15                   | 0.2           | 0.18                 | 12°                       | 4                      | 45                      | 10,000               | 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                      | 9,900                | 0.56                                                                                | 0.58 | 0.60  | 0.62 | 0.67 |
| 08-00634-01506     |                    | 0.6                          | 0.2                    | 0.3           | 0.28                 | 12°                       | 4                      | 45                      | 9,900                | 0.66                                                                                | 0.69 | 0.71  | 0.74 | 0.81 |
| 08-00634-01507     |                    | 0.75                         | 0.2                    | 0.3           | 0.28                 | 12°                       | 4                      | 45                      | 9,900                | 0.82                                                                                | 0.85 | 0.88  | 0.92 | 1.01 |
| 08-00634-01510     |                    | 1                            | 0.2                    | 0.3           | 0.28                 | 12°                       | 4                      | 45                      | 9,900                | 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                      | 6,800                | 0.58                                                                                | 0.60 | 0.62  | 0.64 | 0.69 |
| 08-00634-02008     |                    | 0.8                          | 0.3                    | 0.4           | 0.37                 | 12°                       | 4                      | 45                      | 6,800                | 0.89                                                                                | 0.93 | 0.96  | 1.00 | 1.09 |
| 08-00634-02010     |                    | 1                            | 0.3                    | 0.4           | 0.37                 | 12°                       | 4                      | 45                      | 6,800                | 1.1                                                                                 | 1.14 | 1.19  | 1.24 | 1.35 |
| 08-00634-02510     | R0.25              | 1                            | 0.35                   | 0.5           | 0.46                 | 12°                       | 4                      | 45                      | 6,800                | 1.13                                                                                | 1.16 | 1.21  | 1.26 | 1.37 |
| 08-00634-02515     |                    | 1.5                          | 0.35                   | 0.5           | 0.46                 | 12°                       | 4                      | 45                      | 6,800                | 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                      | 5,800                | 1.12                                                                                | 1.16 | 1.20  | 1.25 | 1.35 |
| 08-00634-03015     |                    | 1.5                          | 0.45                   | 0.6           | 0.56                 | 12°                       | 4                      | 45                      | 5,800                | 1.64                                                                                | 1.71 | 1.77  | 1.84 | 2.02 |
| 08-00634-03020     |                    | 2                            | 0.45                   | 0.6           | 0.56                 | 12°                       | 4                      | 45                      | 5,800                | 2.17                                                                                | 2.25 | 2.34  | 2.44 | 2.68 |
| 08-00634-05020     | R0.5               | 2                            | 0.75                   | 1             | 0.95                 | 12°                       | 4                      | 45                      | 5,400                | 2.18                                                                                | 2.26 | 2.34  | 2.43 | 2.65 |
| 08-00634-05025     |                    | 2.5                          | 0.75                   | 1             | 0.95                 | 12°                       | 4                      | 45                      | 5,400                | 2.7                                                                                 | 2.80 | 2.91  | 3.03 | 3.31 |
| 08-00634-05030     |                    | 3                            | 0.75                   | 1             | 0.95                 | 12°                       | 4                      | 45                      | 5,400                | 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                      | 6,200                | 3.21                                                                                | 3.33 | 3.45  | 3.58 | 3.89 |
| 08-00634-07504     |                    | 4                            | 1.1                    | 1.5           | 1.45                 | 12°                       | 4                      | 45                      | 6,200                | 4.26                                                                                | 4.41 | 4.59  | 4.78 | 5.22 |
| 08-00634-10003     | R1                 | 3                            | 1.5                    | 2             | 1.94                 | 12°                       | 4                      | 45                      | 4,900                | 3.23                                                                                | 3.33 | 3.44  | 3.56 | 3.85 |
| 08-00634-10004     |                    | 4                            | 1.5                    | 2             | 1.94                 | 12°                       | 4                      | 45                      | 4,900                | 4.27                                                                                | 4.42 | 4.58  | 4.76 | 5.17 |
| 08-00634-10006     |                    | 6                            | 1.5                    | 2             | 1.94                 | 12°                       | 4                      | 45                      | 4,900                | 6.36                                                                                | 6.60 | 6.86  | 7.15 | 7.83 |

オーダー方法  
How to Order

MRBSH330 ボール半径(R)×首下長(L1)を指示してください。  
When you order, indicate MRBSH330(R)×(L1).

※(γ)は参考値です。  
※(γ) is reference value.

| 被削材<br>Work Material |                          |                         | ハイス・高硬度鋼<br>High Speed Steels/Hardened Steels<br>SKH51・SKD11 (～62HRC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |              |                      | ハイス<br>High Speed Steels<br>SKH55・HAP40 (～66HRC) |       |              |                      | ハイス<br>High Speed Steels<br>SKH57・HAP72 (～70HRC) |       |              |                      |
|----------------------|--------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|----------------------|--------------------------------------------------|-------|--------------|----------------------|--------------------------------------------------|-------|--------------|----------------------|
|                      |                          |                         | 切込み量<br>Depth of Cut                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       | 送り速度<br>Feed | 回転数<br>Spindle Speed | 切込み量<br>Depth of Cut                             |       | 送り速度<br>Feed | 回転数<br>Spindle Speed | 切込み量<br>Depth of Cut                             |       | 送り速度<br>Feed | 回転数<br>Spindle Speed |
| Rサイズ<br>Radius       | 首下長<br>Under Neck Length | 外径と<br>首下長の<br>比<br>L/D | ap mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ae mm | mm/min       | min <sup>-1</sup>    | ap mm                                            | ae mm | mm/min       | min <sup>-1</sup>    | ap mm                                            | ae mm | mm/min       | min <sup>-1</sup>    |
|                      |                          |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |              |                      |                                                  |       |              |                      |                                                  |       |              |                      |
| 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               |
|                      | 1                        | 3.3                     | 0.007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0.007 | 350          | 40,000               | 0.005                                            | 0.005 | 300          | 40,000               | 0.005                                            | 0.005 | 220          | 40,000               |
| R0.2                 | 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               |
|                      | 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               |
| R0.25                | 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               |
|                      | 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               |
| R0.3                 | 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               |
|                      | 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               |
| R0.5                 | 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               |
|                      | 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               |
| R0.75                | 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               |
|                      | 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               |
| R1                   | 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               |
|                      | 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               |
| 備 考<br>Notes         |                          |                         | ※1 切込み量のapは軸方向の切込み深さ、aelは半径方向の切込み深さを示します。<br>※2 機械剛性や被削材の保持状態等により切削条件を調整してください。<br>※3 びびり等が発生する場合は、必要に応じて切削条件を調整してください。<br>※4 コーナ部等の切削負荷が高くなる箇所では、特に切削条件の設定やツールパスなどに注意してください。<br>※5 加工中の機械振動が大きい場合は、必要に応じて送り速度を調整してください。<br>※6 切りくず排出が良好でない場合、工具のチッピングや折損の原因になる恐れがありますのでご注意ください。<br>※7 回転数と送り速度は、同じ割合で調整してください。<br>※8 工具突き出し量はできるだけ短くしてください。<br>※9 オイルミストクーラントをお奨めします。<br><br>※1 Depth of Cut : ap = Axial Depth of Cut / ae = Radial Depth of Cut.<br>※2 Adjust milling condition according to machine rigidity and clamp condition of work material.<br>※3 In case of chattering etc., please adjust cutting conditions if necessary.<br>※4 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly.<br>※5 If machine tool vibration is high during machining, adjust the feed rate as necessary.<br>※6 Attention to a risk of chipping and breakage when insufficient chip flow.<br>※7 Adjust both spindle speed and feed at the same rate.<br>※8 Overhang of end mill should be as short as possible form spindle nose.<br>※9 We recommend using oil mist coolant. |       |              |                      |                                                  |       |              |                      |                                                  |       |              |                      |

小径サイズを使用した微細形状への加工でも高能率

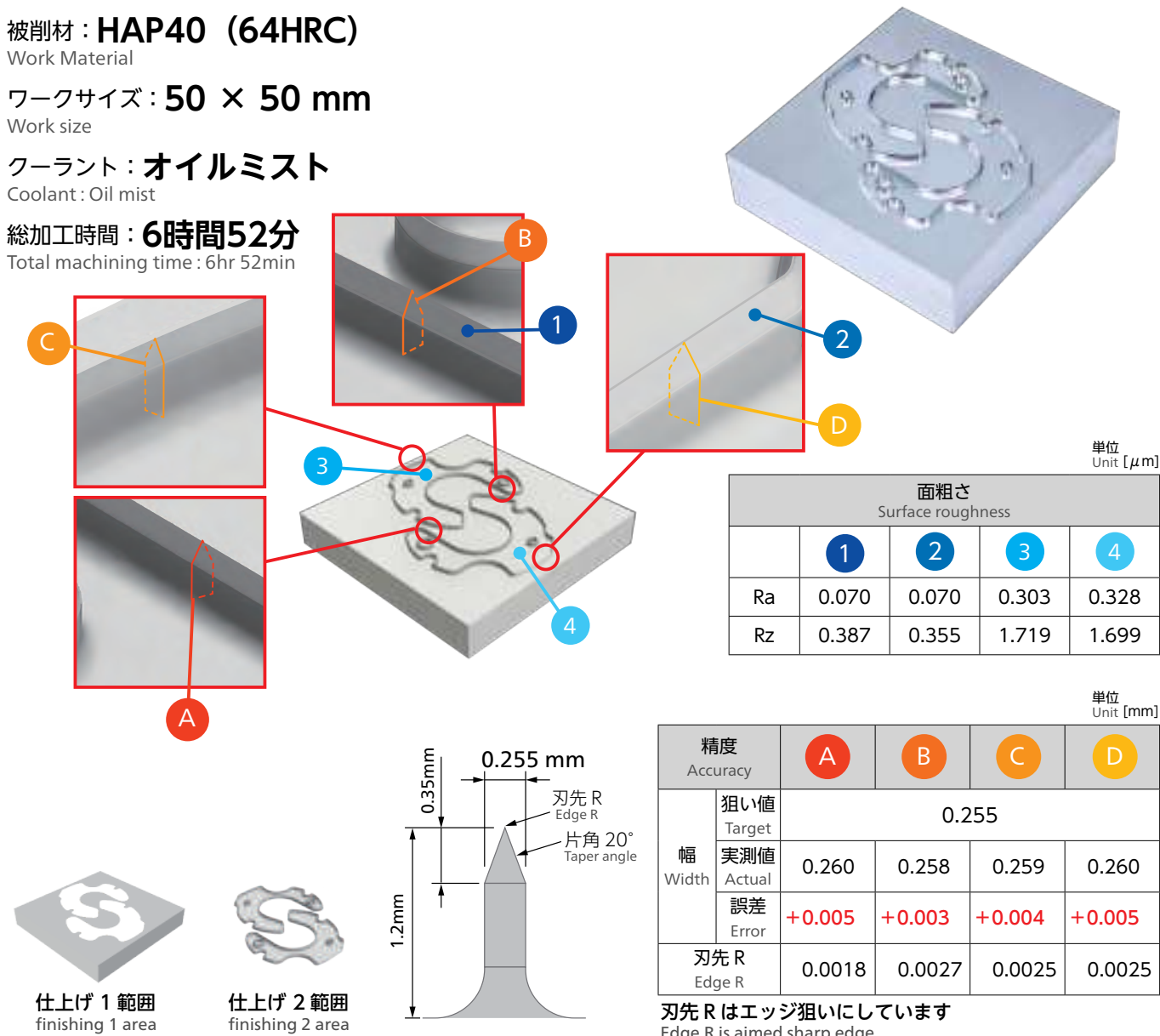
Realize high efficient machining on micro shape machined by small diameter end mill

被削材：HAP40 (64HRC)  
Work Material

ワークサイズ：50 × 50 mm  
Work size

クーラント：オイルミスト  
Coolant : Oil mist

総加工時間：6時間52分  
Total machining time : 6hr 52min



| 面粗さ<br>Surface roughness |       |       |       |       |
|--------------------------|-------|-------|-------|-------|
|                          | 1     | 2     | 3     | 4     |
| Ra                       | 0.070 | 0.070 | 0.303 | 0.328 |
| Rz                       | 0.387 | 0.355 | 1.719 | 1.699 |

| 精度<br>Accuracy |                | A      | B      | C      | D      |
|----------------|----------------|--------|--------|--------|--------|
| 幅<br>Width     | 狙い値<br>Target  | 0.255  |        |        |        |
|                | 実測値<br>Actual  | 0.260  | 0.258  | 0.259  | 0.260  |
|                | 誤差<br>Error    | +0.005 | +0.003 | +0.004 | +0.005 |
|                | 刃先 R<br>Edge R | 0.0018 | 0.0027 | 0.0025 | 0.0025 |

刃先 R はエッジ狙いになっています  
Edge R is aimed sharp edge

| 加工工程<br>Process                           | 荒取り 1<br>Roughing 1 | 仕上げ 1<br>Finishing 1 | 荒取り 2<br>Roughing 2   | 荒取り 3<br>Roughing 3  | 中仕上げ<br>Semi-Finishing | 仕上げ 2<br>Finishing 2                                             |
|-------------------------------------------|---------------------|----------------------|-----------------------|----------------------|------------------------|------------------------------------------------------------------|
| 使用工具<br>Tool                              | MRBSH330<br>R1 × 3  |                      | MRBSH330<br>R0.5 × 2  | MRBSH330<br>R0.3 × 1 |                        | MRBSH330<br>R0.3 × 1                                             |
| 回転数 [min <sup>-1</sup> ]<br>Spindle speed | 20,000              |                      |                       | 25,000               |                        |                                                                  |
| 送り速度 [mm/min]<br>Feed                     | 3,000               | 1,500                | 2,100                 | 1,080                |                        | 800                                                              |
| 切込み量 [mm]<br>ap × ae<br>Depth of cut      | 0.23 × 0.3          | ae 0.05              | 0.02 × 0.1            | 0.015 × 0.05         | Zピッチ 0.02<br>Pitch Z   | 立壁:Zピッチ<br>Side: Pitch Z<br>0.003 ~ 0.01<br>底面:ae 0.05<br>bottom |
| 残し代 [mm]<br>Stock                         | 0.05                | 0                    | 0.03                  | 0.015                | 0.005                  | 0                                                                |
| 加工時間<br>Machining time                    | 37分<br>37 min       | 33分<br>33 min        | 1時間26分<br>1 hr 26 min | 42分<br>42 min        | 39分<br>39 min          | 2時間55分<br>2 hr 55 min                                            |

微細形状に小径サイズでも高能率を実現する切込み・送り速度

Even micro shape with small diameter also supports depth of cut and feed rate for high efficiency

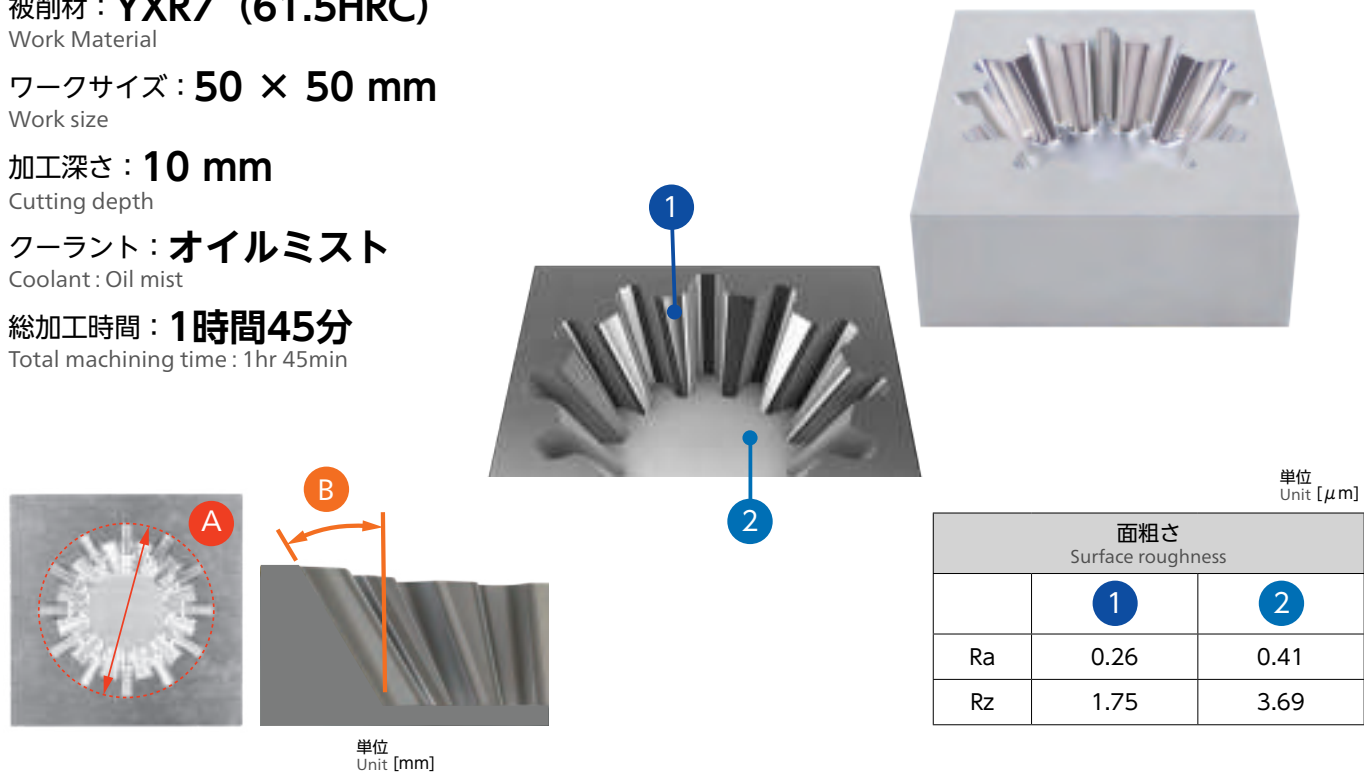
被削材：YXR7 (61.5HRC)  
Work Material

ワークサイズ：50 × 50 mm  
Work size

加工深さ：10 mm  
Cutting depth

クーラント：オイルミスト  
Coolant : Oil mist

総加工時間：1時間45分  
Total machining time : 1hr 45min



| 精度<br>Accuracy | A 幅<br>Width | B 勾配角<br>Inclined angle |
|----------------|--------------|-------------------------|
| 狙い値<br>Target  | 37.073       | 30° 45'                 |
| 実測値<br>Actual  | 37.069       | 30° 48'                 |
| 誤差<br>Error    | - 0.004      | +0° 3'                  |

| 工具摩耗<br>Tool Wear                      | すくい<br>Rake | 外周<br>Peripheral cutting edge | 先端中心<br>Center | 加工時間<br>Machining time |
|----------------------------------------|-------------|-------------------------------|----------------|------------------------|
| MRBSH330<br>R1 × 6<br>荒取り<br>Roughing  |             |                               |                | 57分<br>57 min          |
| MRBSH330<br>R1 × 6<br>仕上げ<br>Finishing |             |                               |                | 36分<br>36 min          |

| 加工工程<br>Process                           | 荒取り<br>Roughing    | 中仕上げ<br>Semi-finishing | 仕上げ<br>Finishing   |
|-------------------------------------------|--------------------|------------------------|--------------------|
| 使用工具<br>Tool                              | MRBSH330<br>R1 × 6 |                        | MRBSH330<br>R1 × 6 |
| 回転数 [min <sup>-1</sup> ]<br>Spindle speed | 20,000             |                        |                    |
| 送り速度 [mm/min]<br>Feed                     | 2,400              | 2,400                  | 1,200              |
| 切込み量 [mm]<br>ap × ae<br>Depth of cut      | 0.225 × 0.3        | pf : 0.09              | pf : 0.05          |
| 残し代 [mm]<br>Stock                         | 0.03               | 0.01                   | 0                  |
| 加工時間<br>Machining time                    | 57分<br>57 min      | 12分<br>12 min          | 36分<br>36 min      |

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### 警告 CAUTION 安全上の注意 Attention on Safety

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>1) 工具をケースから取り出す際は、工具の飛び出しや、刃先が素手に直接触れない様に、充分に注意してください。</li><li>2) 切れ刃を直接素手で触れない様にしてください。</li><li>3) 工具を使用する際は、破損する危険がありますので、必ずカバー・保護メガネ等を使用してください。</li><li>4) ホルダ等は、工具や加工内容に見合った物を使用してください。<br/>工具はホルダにしっかりと固定し、振れを抑えるようにしてください。</li><li>5) 被削材は、しっかりと固定してください。</li><li>6) 工具及び被削材の寸法は、あらかじめ確認しておいてください。</li><li>7) 切削条件は、加工物や使用機械に合せて、調整する必要があります。</li><li>8) 用途に応じて切削油を選定してください。不水溶性切削油を使用する場合は、加工時に発生する火花や破損で引火、火災の危険があります。防火対策を必ず行ってください。</li><li>9) 使用中に異常（切削音・煙）が発生した場合は、直ちに機械を止めてください。</li><li>10) 工具の改造はしないでください。</li></ul> | <ul style="list-style-type: none"><li>1) When removing tools from cases, be careful of getting-out of tools and don't touch directly the cutting edges.</li><li>2) Never touch the cutting edges directly with bare hand.</li><li>3) Use safety covers and eye protection, as tools may be broken.</li><li>4) Use holders, etc. that match the tools and nature of the processing operations.<br/>The tool should be firmly attached to the holder to prevent shaking.</li><li>5) The work materials clamp firmly.</li><li>6) Make sure of dimensions of tools and work pieces before starting operation.</li><li>7) It is necessary to adjust conditions according to the dimensions of work materials and the machine.</li><li>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.</li><li>9) If abnormal sound, etc. occurs during processing, stop the machine immediately.</li><li>10) Don't modify tools.</li></ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

42.0

21'10

MRBSH330\_A1\_202110



■本カタログに掲載の製品仕様は、改善・改良のため予告無く変更する場合がございます。  
Specifications may change without notice for improvement.