MITSUBISHI MATERIALS
TOOLS NEWS B247G

Vibration Control End Mills with Multiple Internal Through Coolant Holes for Difficult-to-cut Materials

# CoolStar Series

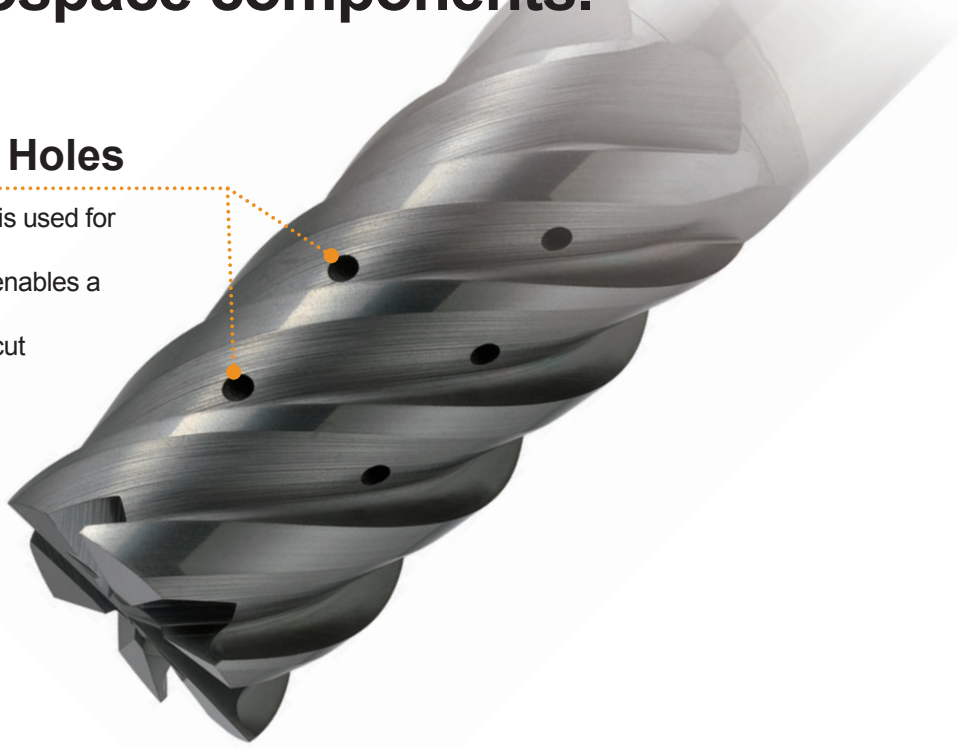
New Product

# High Efficiency Machining of Difficult-to-cut Materials by Multiple Internal Coolant Holes

Vibration Control End Mills with Multiple Internal Through Coolant Holes for Difficult-to-cut Materials

# CoolStar Series

## Effective for machining titanium and stainless steel used in Aerospace components.

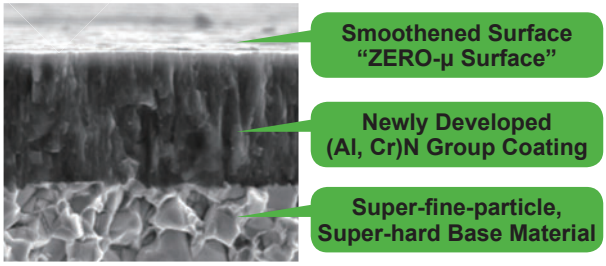


## Multiple Internal Coolant Holes

The multiple internal through coolant system is used for improved welding resistance.
The spiral arrangement of the coolant holes enables a wide range of machining applications.
Especially suitable for machining difficult-to-cut materials, offering stable machining.

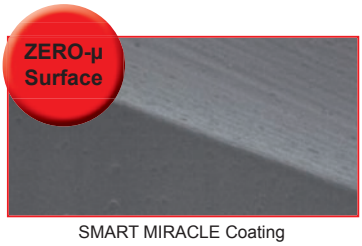
## SMART MIRACLE Coating

Smart Miracle end mills have been treated with a newly developed (Al,Cr)N group coating which delivers substantially better wear resistance. The surface of the coating has been given a smoothening treatment resulting in better machined surfaces, reduced cutting resistance and improved chip discharge. This is the next generation of coated end mills that delivers long tool life when machining stainless steels and other difficult-to-cut materials.

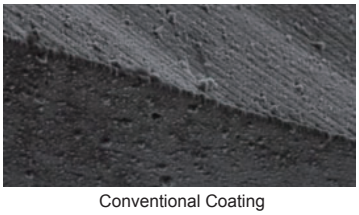


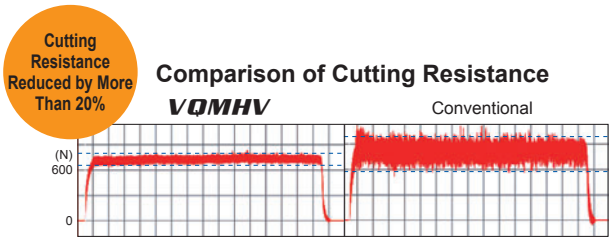

## ZERO-μ Surface

With the unique ZERO-μ Surface, the cutting edge retains its sharpness. While previous technologies often resulted in diminished sharpness, the ZERO-μ Surface achieves both smoothness and sharpness, as well as longer tool life.



SMART MIRACLE Coating


Conventional Coating




<Cutting Conditions>

| | | | |
|---|---|---|---|
| Work Material | : AISI 304 | Depth of Cut | : 6mm |
| Tool | : VQMHVD0600 (DC=6mm) | Overhang Length | : 20mm |
| | | Cutting Mode | : Down(Climb) Cut Internal Coolant (Emulsion) |
| Revolution | : 2650min$^{-1}$ | | |
| Cutting Speed | : 50m/min | | |
| Feed Rate | : 320mm/min (0.03mm/t.) | Machine | : Vertical M/C(BT50) |

# VQ6MHVCH

**4 Sizes（DC=10mm, 12mm, 16mm, 20mm）**

End mill, Medium cut length,
6 flute, Irregular helix flutes,
with multiple internal through coolant

# VQ6MHVRBCH

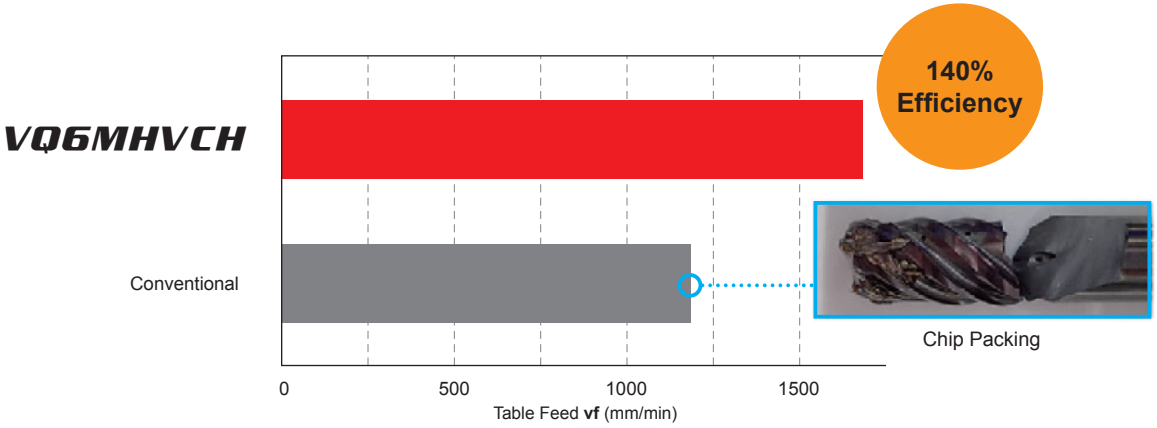
**10 Sizes（DC=10mm, 12mm, 16mm, 20mm）**

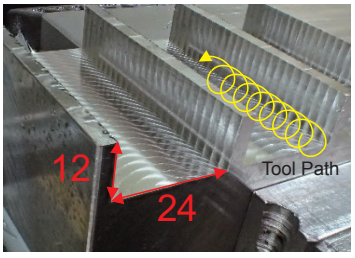
Corner radius end mill, Medium cut length,
6 flute, Irregular helix flutes,
with multiple internal through coolant

## Cutting Performance

### AISI 304 Efficiency Comparison in Trochoid Milling

VQ6MHVCH achieves machine 140% more efficiently compared to conventional.




<Cutting Conditions>
Work Material : AISI 304
Tool : VQ6MHVCHD1600 (DC=16mm)
Revolution : 2000min-1 (100m/min)
Depth of Cut : ap=12mm, ae (Trochoid Pitch)=2.4mm
Cutting Mode : Trochoid Milling, Down(Climb) Cut
Internal Coolant(Emulsion)
Machine : Vertical M/C (BT50)

# Vibration Control End Mills with Multiple Internal Through Coolant Holes for Difficult-to-cut Materials

## VQ6MHVCH

End mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through coolant

| Carbon Steel, Alloy Steel (<30HRC) | Pre-hardened Steel (≤45HRC) | Hardened Steel (≤55HRC) | Hardened Steel (>55HRC) | Austenitic Stainless Steel | Titanium Alloy, Heat Resistant Alloy | Copper Alloy | Aluminum Alloy |
|---|---|---|---|---|---|---|---|
| | | | | ◎ | ◎ | | |

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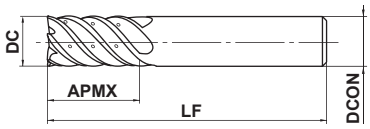


Type1

| DC≤12 | DC>12 | | | |
|---|---|---|---|---|
| 0 - 0.020 | 0 - 0.030 | | | |
| DCON=10 | DCON=12 | DCON=16 | DCON=20 | |
| 0 - 0.009 | 0 - 0.011 | 0 - 0.011 | 0 - 0.013 | |

h6

● Vibration control end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

(mm)

| Order Number | DC | APMX | LF | DCON | * No.F | Stock | Type |
|---|---|---|---|---|---|---|---|
| **VQ6MHVCHD1000** | 10 | 22 | 70 | 10 | 6 | ● | 1 |
| **VQ6MHVCHD1200** | 12 | 26 | 75 | 12 | 6 | ● | 1 |
| **VQ6MHVCHD1600** | 16 | 32 | 90 | 16 | 6 | ● | 1 |
| **VQ6MHVCHD2000** | 20 | 38 | 100 | 20 | 6 | ● | 1 |

* Number of Flutes

● : Inventory maintained in Japan.

# VQ6MHVRBCH

Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through coolant

| Carbon Steel, Alloy Steel (<30HRC) | Pre-hardened Steel (≤45HRC) | Hardened Steel (≤55HRC) | Hardened Steel (>55HRC) | Austenitic Stainless Steel | Titanium Alloy, Heat Resistant Alloy | Copper Alloy | Aluminum Alloy |
|---|---|---|---|---|---|---|---|
| | | | | ◎ | ◎ | | |

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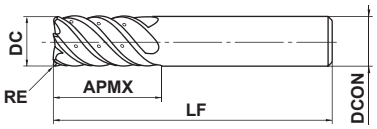



Type1

| R | | | | | |
|---|---|---|---|---|---|
| 0.5≤RE≤4 | | | | | |
| ±0.015 | | | | | |
| DC≤12 | DC>12 | | | | |
| 0<br>- 0.020 | 0<br>- 0.030 | | | | |
| h6 | | | | | |
| DCON=10 | DCON=12 | DCON=16 | DCON=20 | | |
| 0<br>- 0.009 | 0<br>- 0.011 | 0<br>- 0.011 | 0<br>- 0.013 | | |

● Vibration control corner radius end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

(mm)

| Order Number | DC | RE | APMX | LF | DCON | * No.F | Stock | Type |
|---|---|---|---|---|---|---|---|---|
| **VQ6MHVRBCHD1000R050** | 10 | 0.5 | 22 | 70 | 10 | 6 | ● | 1 |
| **VQ6MHVRBCHD1000R100** | 10 | 1 | 22 | 70 | 10 | 6 | ● | 1 |
| **VQ6MHVRBCHD1200R050** | 12 | 0.5 | 26 | 75 | 12 | 6 | ● | 1 |
| **VQ6MHVRBCHD1200R100** | 12 | 1 | 26 | 75 | 12 | 6 | ● | 1 |
| **VQ6MHVRBCHD1600R100** | 16 | 1 | 32 | 90 | 16 | 6 | ● | 1 |
| **VQ6MHVRBCHD1600R300** | 16 | 3 | 32 | 90 | 16 | 6 | ● | 1 |
| **VQ6MHVRBCHD1600R400** | 16 | 4 | 32 | 90 | 16 | 6 | ● | 1 |
| **VQ6MHVRBCHD2000R100** | 20 | 1 | 38 | 100 | 20 | 6 | ● | 1 |
| **VQ6MHVRBCHD2000R300** | 20 | 3 | 38 | 100 | 20 | 6 | ● | 1 |
| **VQ6MHVRBCHD2000R400** | 20 | 4 | 38 | 100 | 20 | 6 | ● | 1 |

* Number of Flutes

# Vibration Control End Mills with Multiple Internal Through Coolant Holes for Difficult-to-cut Materials

End mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through coolant **VQ6MHVCH**

Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through coolant **VQ6MHVRBCH**

## Recommended Cutting Conditions

### Shoulder Milling

(mm)

| Work Material | Austenitic Stainless Steel (≤200HB), Titanium Alloy<br>AISI 304, AISI 316, Ti-6Al-4V | | Heat Resistant Alloys<br>Inconel 718 | |
|---|---|---|---|---|
| DC | vc ($min^{-1}$) | vf (mm/min) | vc ($min^{-1}$) | vf (mm/min) |
| **10** | 4800 | 2000 | 1300 | 260 |
| **12** | 4000 | 2000 | 1100 | 230 |
| **16** | 3000 | 1600 | 800 | 180 |
| **20** | 2400 | 1400 | 640 | 150 |
| Depth of Cut | ≤0.12DC<br>0.5DC—1.5DC | | ≤0.05DC<br>0.5DC—1.5DC | |

DC:Dia.

### Trochoid Milling

(mm)

| Work Material | Austenitic Stainless Steel (≤200HB), Titanium Alloy<br>AISI 304, AISI 316, Ti-6Al-4V | |
|---|---|---|
| DC | vc ($min^{-1}$) | vf (mm/min) |
| **10** | 4800 | 1400 |
| **12** | 4000 | 1200 |
| **16** | 3000 | 1100 |
| **20** | 2400 | 900 |
| Depth of Cut | 1.5DC≤<br>≤0.12DC<br>0.5DC—1.5DC | |

DC:Dia.

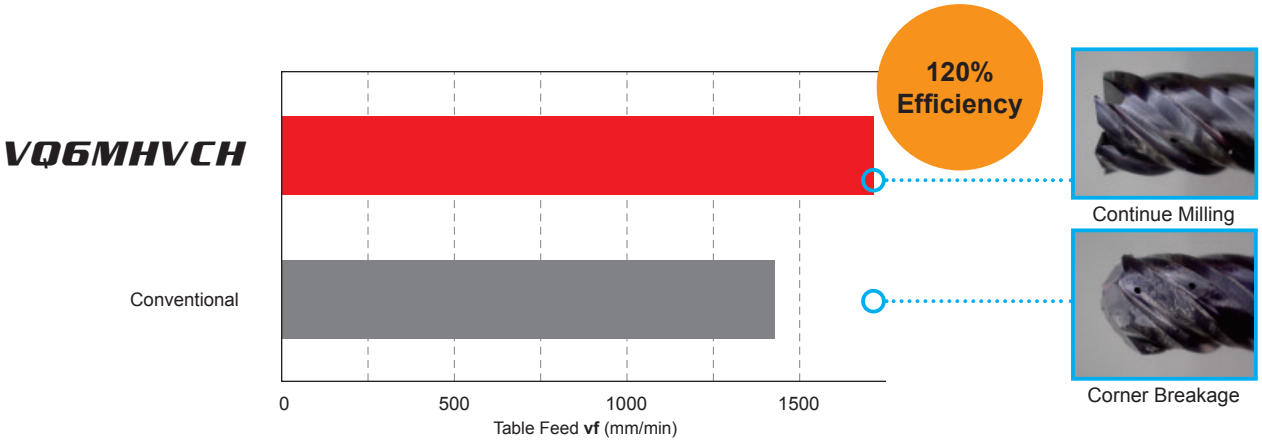
(Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.

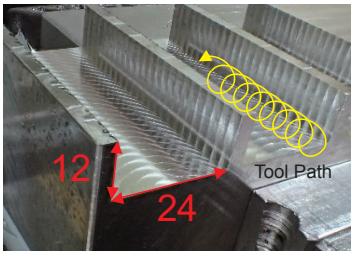
(Note 2) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately.

# Cutting Performance

## Ti-6Al-4V Efficiency Comparison in Trochoid Milling

VQ6MHVCH achieves machine 120% more efficiently compared to conventional.




<Cutting Conditions>
Work Material : Ti-6Al-4V
Tool : VQ6MHVCHD1600 (DC=16mm)
Revolution : 2000min-1 (100m/min)
Depth of Cut : ap=12mm, ae (Trochoid Pitch)=2.4mm
Cutting Mode : Trochoid Milling, Down(Climb) Cut
Internal Coolant (Emulsion)
Machine : Vertical M/C (BT50)

## Vibration Control End Mills with Multiple Internal Through Coolant Holes for Difficult-to-cut Materials

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For Your Safety
●Don't handle inserts and chips without gloves. ●Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage. ●Please use safety covers and wear safety glasses. ●When using compounded cutting oils, please take fire precautions. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

MITSUBISHI MATERIALS CORPORATION

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**http://www.mitsubishicarbide.com/en/**
(Tools specifications subject to change without notice.)

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