

**mitsubishi**

**MITSUBISHI CARBIDE**

**TOOLS NEWS**

**B011G**

**High Power, Corner Radius, Medium, 4 flute**

**VC-MHDRB**



**Great for  
Difficult-to-cut materials  
like stainless steel,  
titanium alloy and inconel.**

- Due to high helix angle and newly designed corner radius, it is suitable for milling difficult-to-cut materials like stainless steel, titanium alloy and inconel.

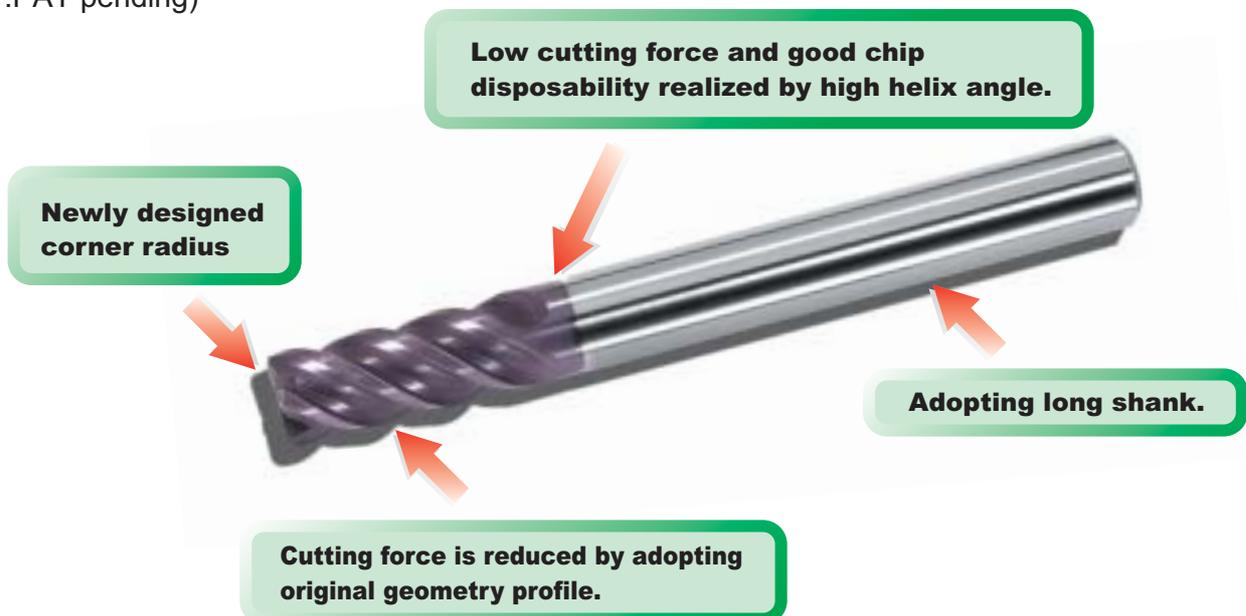
# MIRACLE END MILLS

# VC-MHDRB

## Miracle High Power Corner Radius Endmill

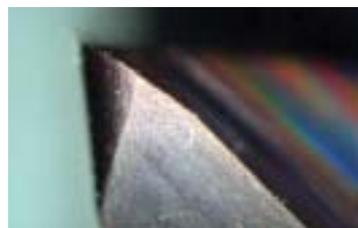
**Great for difficult to cut materials.** Stainless steel, titanium alloy, inconel

In case of milling hard-to-cut material like stainless steel, titanium alloy and inconel at Aviation or Dynamo industry, due to the new geometry with suitable helix angle, cross section and corner radius design<sup>(\*1)</sup>, high efficient milling is made possible.  
(\*1: PAT pending)



## Feature

① Newly designed three geometry profile is applied to the part of corner radius.

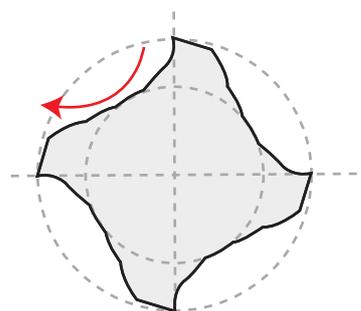


**VC-MHDRB**

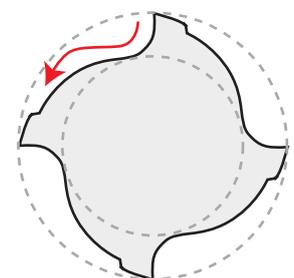


Competitor

② Cutting force is reduced by adopting original geometry profile. The chip flow is very smooth and long tool life is made possible.



**VC-MHDRB**

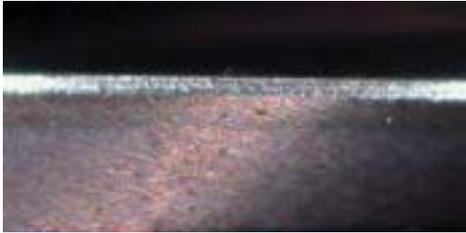


Competitor

# Machining example

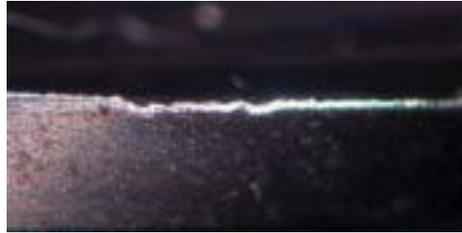
## Milling of inconel

Cutting length 5m



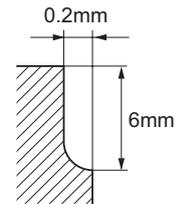
**VC-MHDRB**

Cutting length 2m



Competitor

End mill	φ 6-R0.5
Work material	Inconel 718
Revolution	2,600min <sup>-1</sup> (49m/min)
Feed rate	260mm/min(0.025mm/tooth)
Cutting method	Climb cut, Air blow



## Milling of SUS630

### Example 1 (Cutting length 4m)

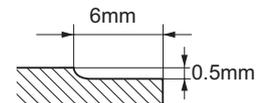


**VC-MHDRB**

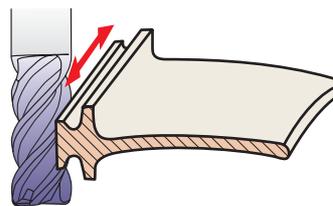
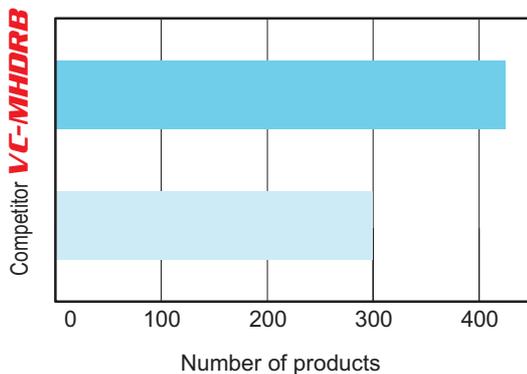


Competitor

End mill	φ 10-R0.5
Work material	SUS630(31HRC)
Revolution	10,000min <sup>-1</sup> (314m/min)
Feed rate	4,000mm/min(0.1mm/tooth)
Cutting method	Climb cut, Air blow

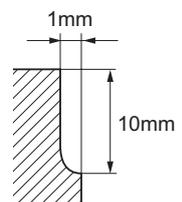


### Example 2 (Milling of turbine blade)



Roughing milling of turbine blade

End mill	φ 10-R0.5
Work material	SUS630 (35HRC)
Revolution	10,500min <sup>-1</sup> (330m/min)
Feed rate	4,200mm/min(0.1mm/tooth)
Cutting method	Climb cut, Air blow

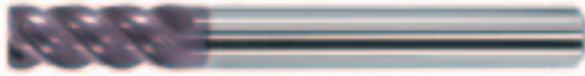


# MIRACLE END MILLS

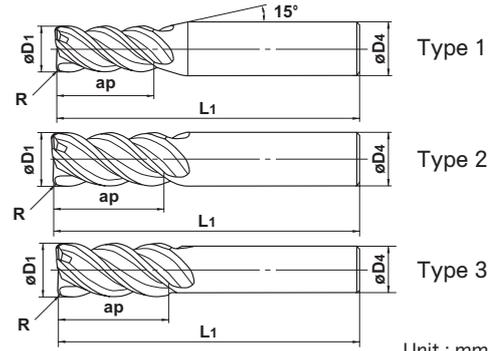
**VC-MHDRB** NEW  
High Power, Corner Radius, Medium, 4 flute



$D_1 \leq 12$  0 - -0.02  
 $16 \leq D_1$  0 - -0.03



- Due to high helix angle and newly designed corner radius, it is suitable for milling difficult-to-cut materials like stainless steel, titanium alloy and inconel.



Unit : mm

Order Number	Dia. D <sub>1</sub>	Length of Cut ap	Overall Length L <sub>1</sub>	Shank Dia. D <sub>4</sub>	Corner R R	No. of Flute N	Stock	Type
VCMHDRBD0200R020S04	2	6	40	4	0.2	4	●	1
VCMHDRBD0200R030S04	2	6	40	4	0.3	4	●	1
VCMHDRBD0300R020S06	3	8	50	6	0.2	4	●	1
VCMHDRBD0300R030S06	3	8	50	6	0.3	4	●	1
VCMHDRBD0300R050S06	3	8	50	6	0.5	4	●	1
VCMHDRBD0400R020S06	4	11	50	6	0.2	4	●	1
VCMHDRBD0400R030S06	4	11	50	6	0.3	4	●	1
VCMHDRBD0400R050S06	4	11	50	6	0.5	4	●	1
VCMHDRBD0500R020S06	5	13	60	6	0.2	4	●	1
VCMHDRBD0500R030S06	5	13	60	6	0.3	4	●	1
VCMHDRBD0500R050S06	5	13	60	6	0.5	4	●	1
VCMHDRBD0500R100S06	5	13	60	6	1	4	●	1
VCMHDRBD0600R030S06	6	13	60	6	0.3	4	●	2
VCMHDRBD0600R050S06	6	13	60	6	0.5	4	●	2
VCMHDRBD0600R100S06	6	13	60	6	1	4	●	2
VCMHDRBD0800R030S08	8	19	70	8	0.3	4	●	2
VCMHDRBD0800R050S08	8	19	70	8	0.5	4	●	2
VCMHDRBD0800R100S08	8	19	70	8	1	4	●	2
VCMHDRBD0800R150S08	8	19	70	8	1.5	4	●	2
VCMHDRBD1000R030S08	10	22	90	8	0.3	4	●	3
VCMHDRBD1000R050S08	10	22	90	8	0.5	4	●	3
VCMHDRBD1000R100S08	10	22	90	8	1	4	●	3
VCMHDRBD1000R150S08	10	22	90	8	1.5	4	●	3
VCMHDRBD1000R200S08	10	22	90	8	2	4	●	3
VCMHDRBD1000R030S10	10	22	90	10	0.3	4	●	2
VCMHDRBD1000R050S10	10	22	90	10	0.5	4	●	2
VCMHDRBD1000R100S10	10	22	90	10	1	4	●	2
VCMHDRBD1000R150S10	10	22	90	10	1.5	4	●	2
VCMHDRBD1000R200S10	10	22	90	10	2	4	●	2
VCMHDRBD1200R050S10	12	26	90	10	0.5	4	●	3
VCMHDRBD1200R100S10	12	26	90	10	1	4	●	3
VCMHDRBD1200R150S10	12	26	90	10	1.5	4	●	3
VCMHDRBD1200R200S10	12	26	90	10	2	4	●	3
VCMHDRBD1200R300S10	12	26	90	10	3	4	●	3
VCMHDRBD1200R050S12	12	26	90	12	0.5	4	●	2
VCMHDRBD1200R100S12	12	26	90	12	1	4	●	2
VCMHDRBD1200R150S12	12	26	90	12	1.5	4	●	2
VCMHDRBD1200R200S12	12	26	90	12	2	4	●	2

MIRACLE END MILLS

SOLID  
ENDMILL



Unit : mm

Order Number	Dia. D <sub>1</sub>	Length of Cut ap	Overall Length L <sub>1</sub>	Shank Dia. D <sub>4</sub>	Corner R R	No. of Flute N	Stock	Type
VCMHDRBD1200R300S12	12	26	90	12	3	4	●	2
VCMHDRBD1600R100S16	16	32	110	16	1	4	●	2
VCMHDRBD1600R150S16	16	32	110	16	1.5	4	●	2
VCMHDRBD1600R200S16	16	32	110	16	2	4	●	2
VCMHDRBD1600R300S16	16	32	110	16	3	4	●	2
VCMHDRBD1800R100S16	18	32	110	16	1	4	●	3
VCMHDRBD1800R150S16	18	32	110	16	1.5	4	●	3
VCMHDRBD1800R200S16	18	32	110	16	2	4	●	3
VCMHDRBD1800R300S16	18	32	110	16	3	4	●	3
VCMHDRBD2000R100S20	20	38	110	20	1	4	●	2
VCMHDRBD2000R150S20	20	38	110	20	1.5	4	●	2
VCMHDRBD2000R200S20	20	38	110	20	2	4	●	2
VCMHDRBD2000R300S20	20	38	110	20	3	4	●	2
VCMHDRBD2200R100S20	22	38	140	20	1	4	●	3
VCMHDRBD2200R150S20	22	38	140	20	1.5	4	●	3
VCMHDRBD2200R200S20	22	38	140	20	2	4	●	3
VCMHDRBD2200R300S20	22	38	140	20	3	4	●	3
VCMHDRBD2500R100S25	25	45	140	25	1	4	●	2
VCMHDRBD2500R150S25	25	45	140	25	1.5	4	●	2
VCMHDRBD2500R200S25	25	45	140	25	2	4	●	2
VCMHDRBD2500R300S25	25	45	140	25	3	4	●	2



MIRACLE END MILLS

# STANDARD CUTTING CONDITIONS OF MIRACLE END MILL

## VC-MHDRB

High Power, Radius Medium, 4 flute

### Side milling

Work material	Carbon steel, Alloy steel (-30HRC) SS400, AISI 1049, SCM Cast iron, FC250		Alloy steel, Tool steel Pre-hardened steel (30-45HRC) AISI H13, NAK		Austenitic stainless steel AISI 304, AISI 316		Hardened steel (45-55HRC) AISI H13		Heat resistant alloy Inconel etc.	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
2	14,000	500	10,000	320	10,000	280	6,400	160	2,400	50
3	11,000	800	7,400	500	7,400	480	4,800	250	2,100	90
4	8,000	900	5,600	540	5,600	520	3,600	270	1,600	120
5	6,400	1,000	4,500	600	4,500	580	2,900	300	1,300	120
6	5,900	1,100	3,700	640	3,700	600	2,400	320	1,100	120
8	4,400	1,100	2,800	660	2,800	600	1,800	330	800	110
10	3,500	1,000	2,300	640	2,300	560	1,400	320	640	100
12	2,900	1,000	1,900	640	1,900	530	1,200	320	530	90
16	2,200	800	1,400	500	1,400	450	900	250	400	65
20	1,800	750	1,100	460	1,100	440	720	230	320	50
25	1,400	600	900	400	900	380	570	200	250	40

Depth of cut	0.2D		0.1D		0.05D	

D: Dia.

### Slotting

Work material	Carbon steel, Alloy steel (-30HRC) SS400, AISI 1049, SCM Cast iron, FC250		Alloy steel, Tool steel Pre-hardened steel (30-45HRC) AISI H13, NAK		Austenitic stainless steel AISI 304, AISI 316		Hardened steel (45-55HRC) AISI H13		Heat resistant alloy Inconel etc.	
	Dia. (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
2	12,000	400	6,400	180	6,400	100	4,200	80	2,300	40
3	9,000	600	5,300	300	5,300	150	3,200	130	1,900	70
4	7,200	720	4,000	360	4,000	180	2,400	140	1,400	95
5	5,800	720	3,200	360	3,200	180	1,900	150	1,100	95
6	5,000	800	2,700	400	2,700	200	1,600	160	950	95
8	3,700	800	2,000	400	2,000	200	1,200	170	720	90
10	3,000	720	1,600	360	1,600	180	960	160	570	80
12	2,500	720	1,300	360	1,300	180	800	160	480	70
16	2,000	600	1,000	280	1,000	150	600	130	360	50
20	1,600	540	800	250	800	130	480	120	290	40
25	1,300	480	640	220	640	120	380	100	230	35

Depth of cut	1D		0.5D		0.2D	

D: Dia.

- 1) In cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective.
- 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
- 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and feed rate proportionately, or set the depth of cut smaller.
- 4) For side milling, climb cut is recommended.

# SAFETY OF CARBIDE TOOL PRODUCTS

## 1. Use of Carbide Tool Products

Packages of Mitsubishi products carry a safety warning label. However, tools are not labeled with detailed warning indications. Please read the "Safety of carbide tool products" in this catalog before handling carbide tool products and cemented carbide materials. Moreover, as a part of your workers' safety education, please notify the contents of the "Safety of Carbide Tool Products" to all workers.

## 2. Basic Characteristics of Hard Tool Materials

### In Terms of "Safety of Carbide Tool Products"

Hard Tool Materials : General term for tool materials like cemented carbide alloy, cermet, ceramics, sintered CBN, and sintered diamond etc.

### Physical Characteristics

Appearance : Varies depending on the type of material. Eg. grey, black, gold, etc.

Smell : None

Hardness,

Specific Gravity :

Hard Tool Materials	Hardness (HV)	Specific Gravity	Hard Tool Materials	Hardness (HV)	Specific Gravity
High speed steel (HSS)	200 – 1200kg/mm <sup>2</sup>	7 – 9	Sintered CBN	2000 – 5000kg/mm <sup>2</sup>	3 – 5
Cemented Carbide	500 – 3000kg/mm <sup>2</sup>	9 – 16	Sintered Diamond	8000 – 12000kg/mm <sup>2</sup>	3 – 5
Cermet	500 – 3000kg/mm <sup>2</sup>	5 – 9	Alloy Steel	200 – 1200kg/mm <sup>2</sup>	7 – 9
Ceramics	1000 – 4000kg/mm <sup>2</sup>	2 – 7	Diamond electroforming product	8000 – 12000kg/mm <sup>2</sup>	3 – 5

### Constituents

Carbide, nitride, carbon nitride, oxide, such as W, Ti, Al, Si, Ta, B, V and metals such as Fe, Co, Ni, Cr, Mo.

## 3. Suggestions on Handling Hard Tool Materials

○Hard tool materials have a large specific gravity. Thus, they require special attention as heavy materials when the size or quantity is large.

○Cutting tool products generate dust and mist during grinding operations or heating. These dusts and mist can be harmful to human body when coming in contact with the eyes or skin, or if substantial quantities are swallowed. When grinding and machining, it is recommended to use local exhaust ventilation and respirators, a dust protective mask, glasses, glove and so on. If dust makes contact with the hands, thoroughly wash the affected area with soap and water. Don't eat in the exposed area, and wash hands thoroughly before eating. Remove dust from the clothing by a cleaner or washing, but don't shake off.

○Cobalt dust can affect the skin, respiratory organs and heart through repeated or prolonged contact.

○For further information, please refer to **MSDS** (Material Safety Data Sheet).

**MSDS**=Material Safety Data Sheet (Safety Data sheet)

**Home page:** <http://www.mitsubishicarbide.com/msds/>

## 4. Suggestions for Grinding Cutting Tools

○Surface conditions affect toughness of cutting tools. Therefore, use a diamond grinding wheel for finishing.

○Hard tool materials are extremely hard and brittle at the same time. Thus, they may be broken by shocks and tightening with excess force.

○Hard tool materials and ferrous materials have different thermal expansion ratios. Shrinkage or swell fit products may suffer from cracks when applied temperature is higher or lower than the appropriate temperature for the tool.

○Pay special attention on storing hard tool materials. Toughness of hard tool materials is lowered when they corrode due to coolant and other liquid.

○When brazing hard tool materials, if the temperature is too high or too low from the melting point of the brazing material, loosening and breakage may occur.

○After regrinding cutting tools, make sure that there are no cracks.

○Machining hard tool materials on EDM may cause cracks on the surface due to remaining electrons resulting in lowering the toughness. Eliminate cracks by grinding, etc.

# **MITSUBISHI MATERIALS KOBE TOOLS**



JQA-2522  
JQA-EM0941

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