MITSUBISHI
MITSUBISHI MATERIALS

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.

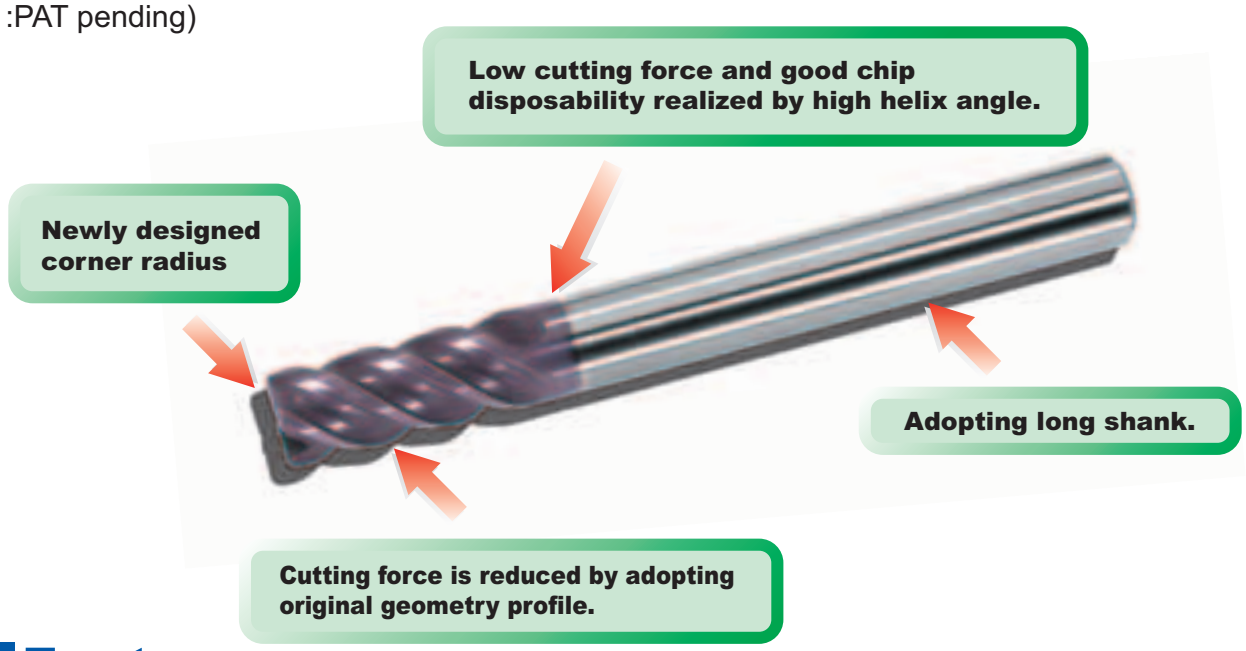
MIRACLE END MILLS

VC-MHDRB

Miracle High Power Corner Radius Endmill

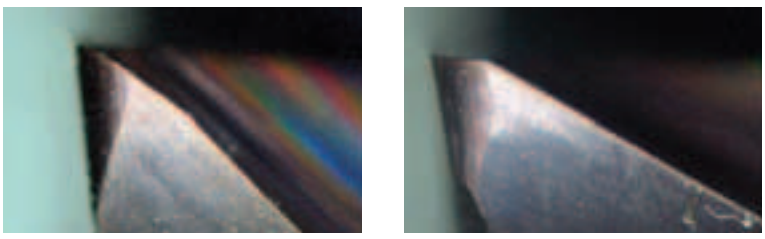
Great for difficult to cut materials. Stainless steel, titanium alloy, inconel

In case of milling hard-to-cut materials 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(*1), high efficient milling is made possible.
(*1:PAT pending)



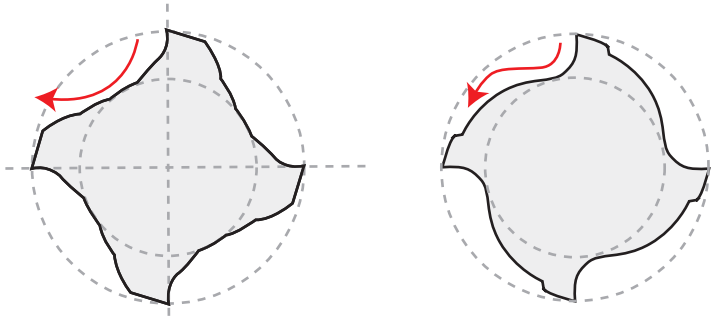
Feature

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



VC-MHDRB　　Competitor

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



VC-MHDRB　　Competitor

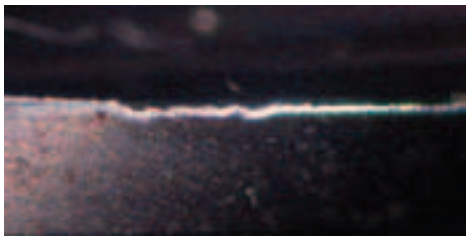
Machining example

Milling of inconel

Cutting length 5m

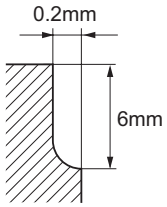
VC-MHDRB

Cutting length 2m



Competitor

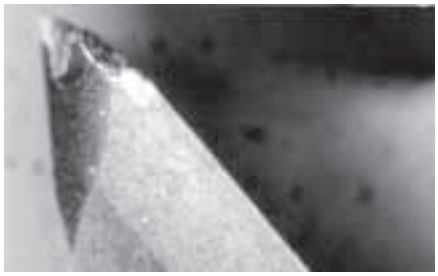
End mill	ϕ6—R0.5
Work material	Inconel 718
Revolution	2,600min^{-1}(49m/min)
Feed rate	260mm/min(0.025mm/tooth)
Cutting method	Climb cut, Air blow



Milling of SUS630

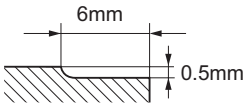
Example 1 (Cutting length 4m)

VC-MHDRB

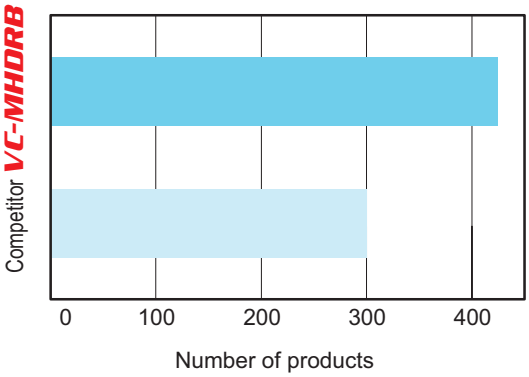


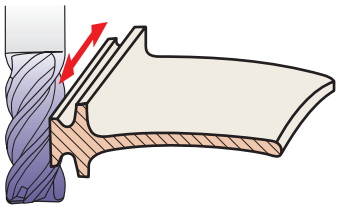
Competitor

End mill	ϕ10—R0.5
Work material	SUS630(31HRC)
Revolution	10,000min^{-1}(314m/min)
Feed rate	4,000mm/min(0.1mm/tooth)
Cutting method	Climb cut, Air blow



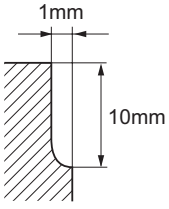
Example 2 (Milling of turbine blade)





Roughing milling of turbine blade

End mill	ϕ10—R0.5
Work material	SUS630 (35HRC)
Revolution	10,500min^{-1}(330m/min)
Feed rate	4,200mm/min(0.1mm/tooth)
Cutting method	Climb cut, Air blow

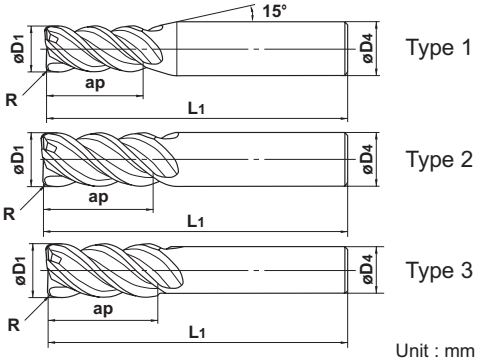


MIRACLE END MILLS

VC-MHDRB NEW

High Power, Corner Radius, Medium, 4 flute

D1≤12 0 — -0.02
16≤D1 0 — -0.03



Unit : mm

- 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.

Order Number	Dia. D1	Length of Cut ap	Overall Length L1	Shank Dia. D4	Corner R R	No. of Flute N	Stock	Type
VCMHDRBD0200R020S04	2	6	40	4	0.2	4	●	1
D0200R030S04	2	6	40	4	0.3	4	●	1
D0300R020S06	3	8	50	6	0.2	4	●	1
D0300R030S06	3	8	50	6	0.3	4	●	1
D0300R050S06	3	8	50	6	0.5	4	●	1
D0400R020S06	4	11	50	6	0.2	4	●	1
D0400R030S06	4	11	50	6	0.3	4	●	1
D0400R050S06	4	11	50	6	0.5	4	●	1
D0500R020S06	5	13	60	6	0.2	4	●	1
D0500R030S06	5	13	60	6	0.3	4	●	1
D0500R050S06	5	13	60	6	0.5	4	●	1
D0500R100S06	5	13	60	6	1	4	●	1
D0600R030S06	6	13	60	6	0.3	4	●	2
D0600R050S06	6	13	60	6	0.5	4	●	2
D0600R100S06	6	13	60	6	1	4	●	2
D0800R030S08	8	19	70	8	0.3	4	●	2
D0800R050S08	8	19	70	8	0.5	4	●	2
D0800R100S08	8	19	70	8	1	4	●	2
D0800R150S08	8	19	70	8	1.5	4	●	2
D1000R030S08	10	22	90	8	0.3	4	●	3
D1000R050S08	10	22	90	8	0.5	4	●	3
D1000R100S08	10	22	90	8	1	4	●	3
D1000R150S08	10	22	90	8	1.5	4	●	3
D1000R200S08	10	22	90	8	2	4	●	3
D1000R030S10	10	22	90	10	0.3	4	●	2
D1000R050S10	10	22	90	10	0.5	4	●	2
D1000R100S10	10	22	90	10	1	4	●	2
D1000R150S10	10	22	90	10	1.5	4	●	2
D1000R200S10	10	22	90	10	2	4	●	2
D1200R050S10	12	26	90	10	0.5	4	●	3
D1200R100S10	12	26	90	10	1	4	●	3
D1200R150S10	12	26	90	10	1.5	4	●	3
D1200R200S10	12	26	90	10	2	4	●	3
D1200R300S10	12	26	90	10	3	4	●	3
D1200R050S12	12	26	90	12	0.5	4	●	2
D1200R100S12	12	26	90	12	1	4	●	2
D1200R150S12	12	26	90	12	1.5	4	●	2
D1200R200S12	12	26	90	12	2	4	●	2

● : Inventory maintained.

Unit : mm

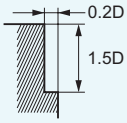
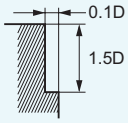
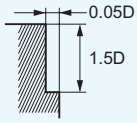
Order Number	Dia. D_1	Length of Cut ap	Overall Length L_1	Shank Dia. D_4	Corner R R	No. of Flute N	Stock	Type
VCMHDRBD1200R300S12	12	26	90	12	3	4	●	2
D1600R100S16	16	32	110	16	1	4	●	2
D1600R150S16	16	32	110	16	1.5	4	●	2
D1600R200S16	16	32	110	16	2	4	●	2
D1600R300S16	16	32	110	16	3	4	●	2
D1800R100S16	18	32	110	16	1	4	●	3
D1800R150S16	18	32	110	16	1.5	4	●	3
D1800R200S16	18	32	110	16	2	4	●	3
D1800R300S16	18	32	110	16	3	4	●	3
D2000R100S20	20	38	110	20	1	4	●	2
D2000R150S20	20	38	110	20	1.5	4	●	2
D2000R200S20	20	38	110	20	2	4	●	2
D2000R300S20	20	38	110	20	3	4	●	2
D2200R100S20	22	38	140	20	1	4	●	3
D2200R150S20	22	38	140	20	1.5	4	●	3
D2200R200S20	22	38	140	20	2	4	●	3
D2200R300S20	22	38	140	20	3	4	●	3
D2500R100S25	25	45	140	25	1	4	●	2
D2500R150S25	25	45	140	25	1.5	4	●	2
D2500R200S25	25	45	140	25	2	4	●	2
D2500R300S25	25	45	140	25	3	4	●	2

MIRACLE END MILL

VC-MHDRB

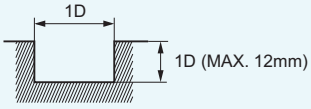
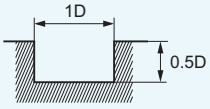
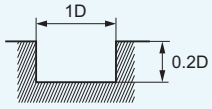
High Power, Radius Medium, 4 flute

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 Titanium alloy Ti-6Al-4V		Hardened steel (45—55HRC) AISI H13		Heat resistant alloy Inconel etc.	
Dia. (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)
2	15,000	550	10,000	340	10,000	320	6,400	160	4,800	100
3	11,000	800	7,400	500	7,400	480	4,800	250	4,000	170
4	8,000	900	5,600	540	5,600	520	3,600	270	3,200	240
5	6,400	1,000	4,500	600	4,500	580	2,900	300	2,600	240
6	5,900	1,100	3,700	640	3,700	600	2,400	320	2,100	230
8	4,400	1,100	2,800	660	2,800	600	1,800	330	1,600	220
10	3,500	1,000	2,300	640	2,300	560	1,400	320	1,300	200
12	2,900	1,000	1,900	640	1,900	530	1,200	320	1,100	170
16	2,200	800	1,400	500	1,400	450	900	250	800	130
20	1,800	750	1,100	460	1,100	440	720	230	640	100
25	1,400	600	900	400	900	380	570	200	510	80
Depth of cut										

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^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)
2	12,000	400	7,000	200	7,000	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										

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 CUTTING TOOL PRODUCTS

1. Use of Cutting 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 Cutting Tool Products" in this catalogue before handling cutting tool products and cemented carbide materials. Moreover, as a part of your workers' safety education, please notify the contents of the "Safety of Cutting Tool Products" to all workers.

2. Basic Characteristics of Hard Tool Materials

In Terms of "Safety of Cutting Tool Products"

Hard Tool Materials : General term for tool materials like cemented carbide alloy, cermet, ceramics, sintered CBN, sintered diamond, high speed steel and alloy steel, 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^2	7—9	Sintered CBN	2000—5000kg/mm^2	3—5
Cemented Carbide	500—3000kg/mm^2	9—16	Sintered Diamond	8000—12000kg/mm^2	3—5
Cermet	500—3000kg/mm^2	5—9	Alloy Steel	200—1200kg/mm^2	7—9
Ceramics	1000—4000kg/mm^2	2—7	Diamond Electroforming Product	8000—12000kg/mm^2	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. Safety of Cutting Tool Products

○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. This dust and mist can be harmful 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, gloves etc. 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 cleaning or washing, but don't shake off.

○Cobalt and nickel contained in carbide or other cutting tool materials are reported as possibly carcinogenic to humans. It is also reported that cobalt and nickel dust and mist can affect the skin, respiratory organs and heart through repeated or prolonged contact.

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

Home page: http://www.mitsubishicarbide.com/msds/

4. Handling Cutting Tool Products

○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 electrons remaining after the EDM operation, resulting in lowering of the toughness. Eliminate these cracks by grinding, etc.

JQA-2522
JQA-EM0941

MITSUBISHI MATERIALS KOBE TOOLS

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