MITSUBISHI MATERIALS

VQT5MVRB

CORNER RADIUS END MILL FOR HIGH EFFICIENCY TITANIUM ALLOY MACHINING





TOOL NEWS **B230A**

Corner Radius End Mill for High Efficiency Titanium Alloy Machining

VQT5MVRB

Combining 5 flutes and a through coolant hole enables high efficiency rough machining of titanium alloys.

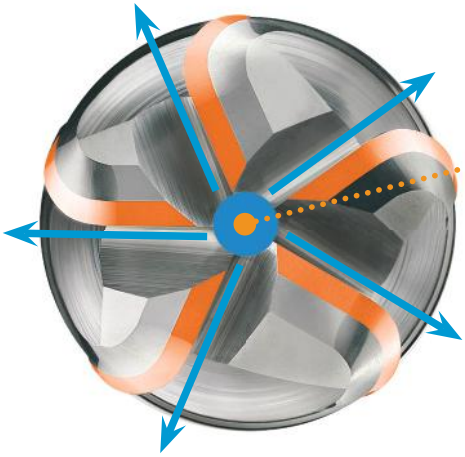


Corner Radius (Emphasis on Sharpness)

A unique rake angle improves cutting resistance and chip discharge.
The seamless blend between the corner radius and peripheral cutting edge suppresses abnormal wear and provides a stable tool life.

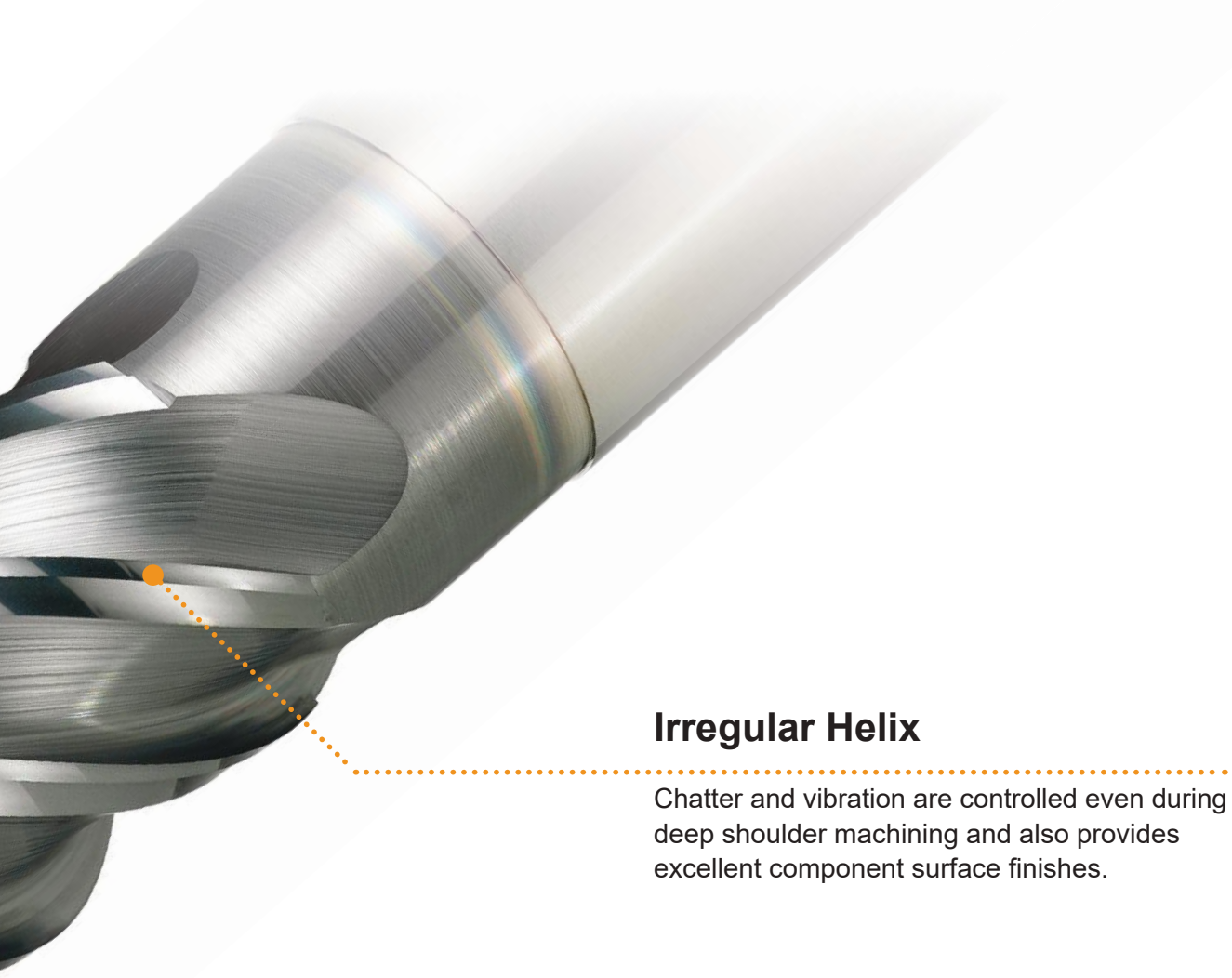
5 Flutes

Having the same chip evacuation properties of a 4 flute type enables deep slot milling.
The additional flute and deep cutting capability reduces the number of passes.



Coolant Hole

The center coolant provides a stable supply of cutting fluid and dramatically improves chip evacuation.
This also cools the cutting edge and prevents chip biting.



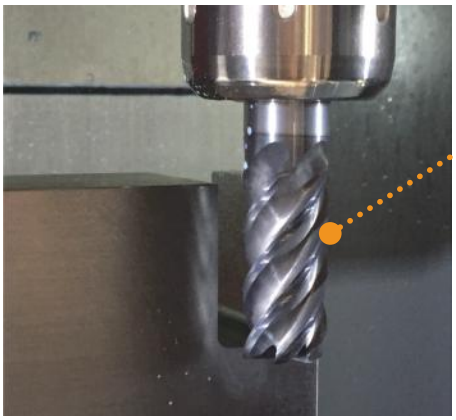
Irregular Helix

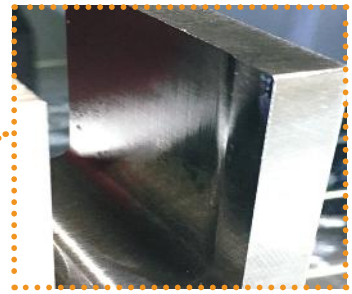
Chatter and vibration are controlled even during deep shoulder machining and also provides excellent component surface finishes.

Application Example

Material removal rate : 250cc/min achieved!

Large depths of cut when slotting (DC x 2) in titanium alloy dramatically shortens rough machining times.





Machined Surface

<Cutting Conditions>
Workpiece Material : Ti-6Al-4V
Tool : VQT5MVRB250R400N075C
Revolution : n=636min^{-1}
Feed Rate : vf=8.110 IPM
Depth of Cut : ap=1.969 inch (DC×2)
Width of Cut : ae=.984 inch (Slot)
Overhang Length : 2.953 inch (DC×3)
Cutting Mode : Slot Milling
Internal Coolant +
External Coolant (Emulsion)
Machine : Vertical MC (BT50)

Corner Radius End Mill for High Efficiency Titanium Alloy Machining

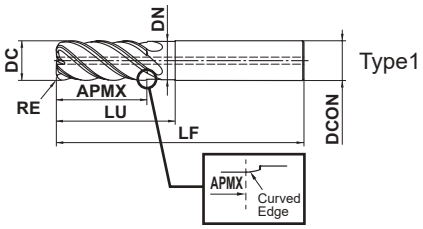
VQT5MVRB NEW

Corner radius, Medium cut length, 5 flute, Irregular helix flutes, With coolant hole



Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel,Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
				◎	◎		





RE				
±0.02				
DC≤16	20≤DC≤25			
0 - 0.03	0 - 0.04			
DCON=16	20≤DCON≤25			
0 - 0.011	0 - 0.013			

- Flute geometry suitable for deep slotting and effective chip evacuation.
- Sharp cutting edges provide long tool life when machining titanium alloys.

(mm)

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No.F *	Stock	Type
VQT5MVRB160R100N48C	16	1	34	48	15.5	120	16	5	●	1
VQT5MVRB160R300N48C	16	3	34	48	15.5	120	16	5	●	1
VQT5MVRB160R400N48C	16	4	34	48	15.5	120	16	5	●	1
VQT5MVRB200R100N60C	20	1	44	60	19.5	135	20	5	●	1
VQT5MVRB200R300N60C	20	3	44	60	19.5	135	20	5	●	1
VQT5MVRB200R400N60C	20	4	44	60	19.5	135	20	5	●	1
VQT5MVRB200R600N60C	20	6	44	60	19.5	135	20	5	●	1
VQT5MVRB250R100N75C	25	1	54	75	24.5	155	25	5	●	1
VQT5MVRB250R300N75C	25	3	54	75	24.5	155	25	5	●	1
VQT5MVRB250R400N75C	25	4	54	75	24.5	155	25	5	●	1
VQT5MVRB250R600N75C	25	6	54	75	24.5	155	25	5	●	1

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.

* Number of Flutes

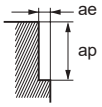
DC = Dia.
RE = Corner Radius
APMX = Length of Cut
LU = Neck Length
DN = Neck Dia.
LF = Overall Length
DCON = Shank Dia.

● : **Inventory maintained.**

Recommended Cutting Conditions

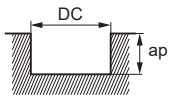
■Shoulder Milling

Overhang Length DC×1 (DC=Dia.) (inch)

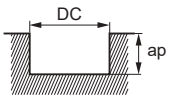
Workpiece Material		Titanium Alloys Ti-6Al-4V etc.						
DC		RE		Cutting Speed **vc** (SFM)	Revolution **n** (min-1)	Feed Rate **vf** (IPM)	Depth of Cut **ap**	Width of Cut **ae**
(mm)	(inch)	(mm)	(inch)					
16	**.630**	**1**	**.039**	260	1600	31.5	1.260	.097
		3	**.118**	260	1600	31.5	1.260	.094
		4	**.157**	260	1600	31.5	1.260	.094
20	**.787**	**1**	**.039**	260	1300	25.6	1.575	.118
		3	**.118**	260	1300	25.6	1.575	.118
		4	**.157**	260	1300	25.6	1.575	.118
		6	**.236**	260	1300	25.6	1.575	.118
25	**.984**	**1**	**.039**	260	1000	19.7	1.969	.150
		3	**.118**	260	1000	19.7	1.969	.150
		4	**.157**	260	1000	19.7	1.969	.150
		6	**.236**	260	1000	19.7	1.969	.150
Depth of Cut								

■Slot Milling

Depth of Cut DC×1 (inch)

Workpiece Material		Titanium Alloys Ti-6Al-4V etc.					
DC		RE		Cutting Speed **vc** (SFM)	Revolution **n** (min-1)	Feed Rate **vf** (IPM)	Depth of Cut **ap**
(mm)	(inch)	(mm)	(inch)				
16	**.630**	**1**	**.039**	195	1200	16.5	.630
		3	**.118**	195	1200	16.5	.630
		4	**.157**	195	1200	11.8	.630
20	**.787**	**1**	**.039**	195	950	13.0	.787
		3	**.118**	195	950	13.0	.787
		4	**.157**	195	950	13.0	.787
		6	**.236**	195	950	9.4	.787
25	**.984**	**1**	**.039**	165	640	8.7	.984
		3	**.118**	165	640	8.7	.984
		4	**.157**	165	640	8.7	.984
		6	**.236**	165	640	6.3	.984
Depth of Cut		 DC=Dia.					

Depth of Cut DC×2 (inch)

Workpiece Material		Titanium Alloys Ti-6Al-4V etc.					
DC		RE		Cutting Speed **vc** (SFM)	Revolution **n** (min-1)	Feed Rate **vf** (IPM)	Depth of Cut **ap**
(mm)	(inch)	(mm)	(inch)				
16	**.630**	**1**	**.039**	195	1200	9.4	1.260
		3	**.118**	195	1200	9.4	1.260
		4	**.157**	195	1200	7.1	1.260
20	**.787**	**1**	**.039**	195	950	7.5	1.575
		3	**.118**	195	950	7.5	1.575
		4	**.157**	195	950	7.5	1.575
		6	**.236**	195	950	5.6	1.575
25	**.984**	**1**	**.039**	165	640	5.1	1.969
		3	**.118**	165	640	5.1	1.969
		4	**.157**	165	640	5.1	1.969
		6	**.236**	165	640	3.8	1.969
Depth of Cut		 DC=Dia.					

(Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
(Note 2) When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
(Note 3) 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 work material installation is poor, vibration or abnormal sound can occur.
In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.
(Note 4) If the depth of cut is smaller, the revolution and the feed rate can be increased.
(Note 5) When machining deep slots where the depth of cut exceeds the diameter DC, use a high strength holder or one equipped with a retaining mechanism.
Additionally ensure the clamping and workpiece material rigidity are sufficient.
Refer to page 9 for Holder recommendation.
(Note 6) When machining a deep slot exceeding 1D, use a holder with a high gripping strength or an anti slippage mechanism.
Also, make sure that the clamping force and rigidity are sufficient before use.

Cutting Performance

Slot Milling with Deep Depths of Cut in Titanium Alloy

The seamless corner radii achieves stable tool life.

Conventional



Fractures (After 6 slots)



<Cutting Conditions>
Workpiece Material : Ti-6Al-4V
Tool : VQT5MVRB160R300N048C
Revolution : n=1200min^{-1}
Feed Rate : vf=26.0 IPM
Depth of Cut : ap=.630 inch
Width of Cut : ae=.630 inch (slot)
Cutting Length : 2.362 inch (1 slot)
Overhang Length : 1.890 inch (DC×3)
Cutting Mode : Slot Milling
Internal Coolant +
External Coolant (Emulsion)
Machine : Vertical MC (BT50)

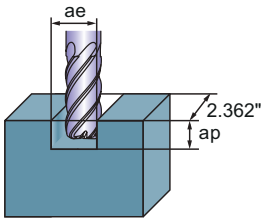
VQT5MVRB



After 17 slots

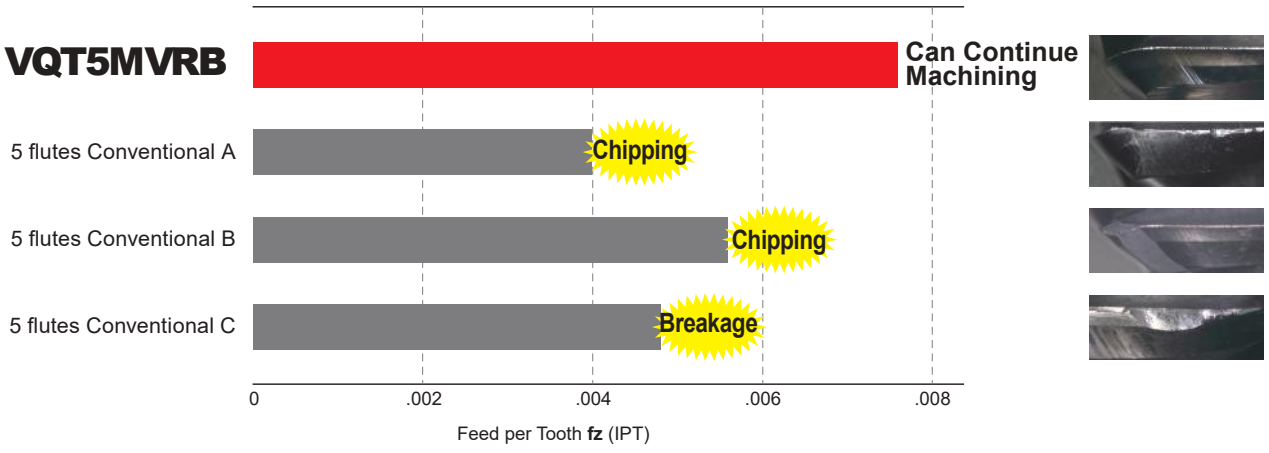


Triple Tool Life



Comparison of Maximum Cutting Feed for Titanium Alloy Slot Milling

When compared with conventional products, high efficiency milling can be achieved.



<Cutting Conditions>
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Key Point for High Efficiency Machining of Titanium Alloys

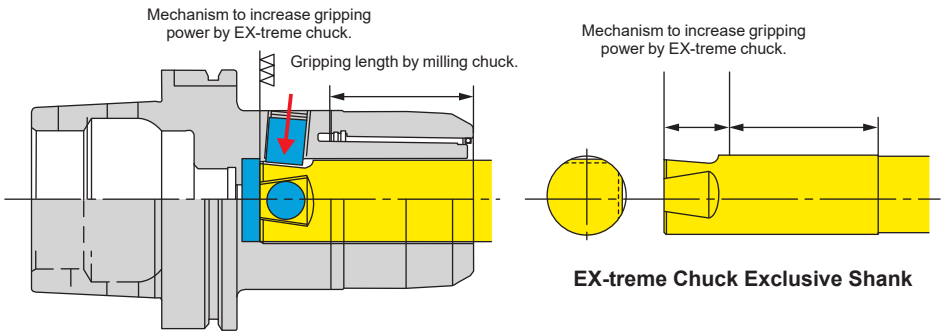
For high efficiency machining, it is recommended to use a precision, high strength holder to prevent pull out of the tool. Some high strength holders require modification of the cutting tool shank.

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Great Reliability in the Aircraft Industry

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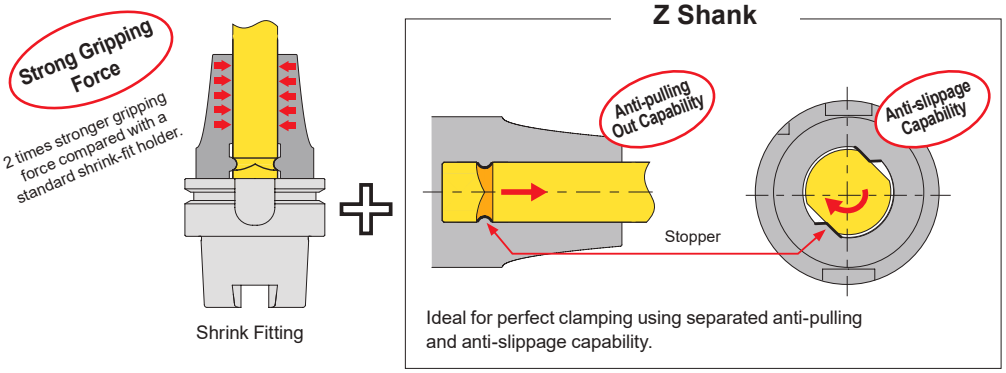
MST corporation

Superior Rigidity and Thick Body Design

Shrink-fit Holder with Anti Slippage Capability

SLIMLINE Z





http://www.mst-corp.co.jp/en/slimline/z/

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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 attaching inserts or spare parts, please use only the correct wrench or driver.
- When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

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Tools specifications subject to change without notice.

B230A-US-2022.4