2019.05

B236E

VQ

LATEST TECHNOLOGY HIGH PERFORMANCE END MILLS FOR STAINLESS AND DIFFICULT-TO-CUT MATERIALS

DIA EDGE

MITSUBISHI MATERIALS

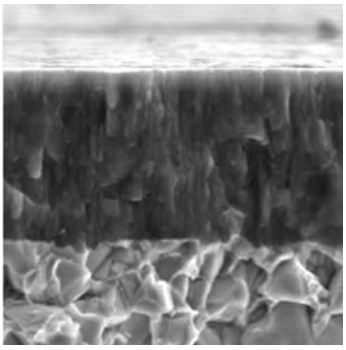
VQ

REVOLUTIONARY PERFORMANCE FOR DIFFICULT-TO-CUT MATERIALS

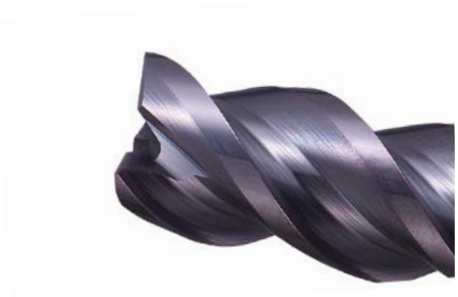
INNOVATIVE TECHNOLOGY

VQ 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.

VQ coating



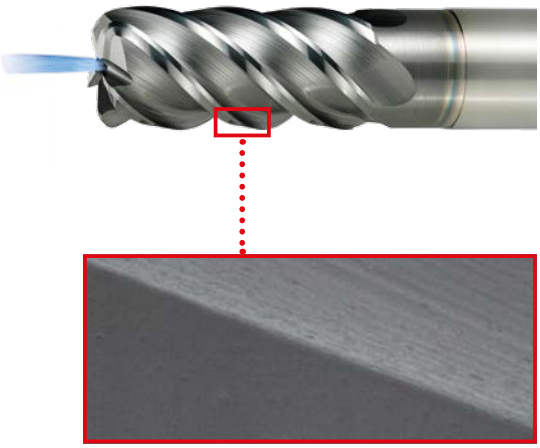
- Smoothened "ZERO-μ Surface"
- Newly developed (Al, Cr)N PVD coating
- Super-fine-particle, super-hard base material



Competitor coating

ZERO-M 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.



VQ coating

Competitor coating

NEW

VQT6UR

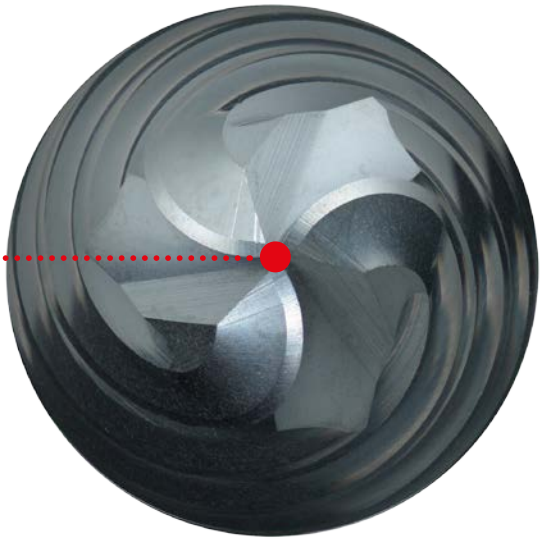
CONICAL TAPER BARREL END MILL FOR FINISH MACHINING OF TITANIUM ALLOYS

RADIAL ACCURACY
RE1 and RE2 ± 0.01 mm

OPTIMUM CUTTING EDGE DESIGN
Conical taper barrel geometry is highly sutitable for blade surface machining. Nose radius is ideal for root form milling.

6-FLUTE PERIPHAL CUTTING
Multi-cutting edge design achieves higher efficiency machining. Irregular pitch geometry prevents chattering.

3-FLUTE END CUTTING
A wide, end flute geometry improves chip evacuation.

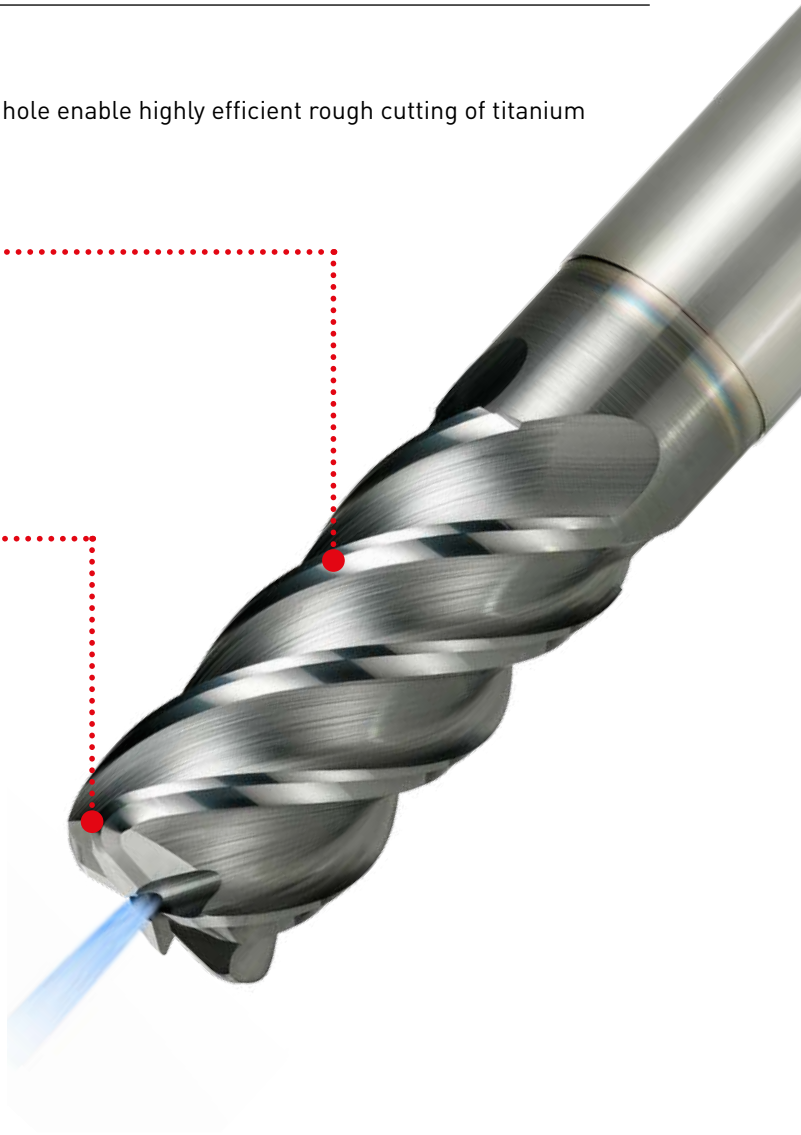


NEW

VQT5MVRB

IMPROVED EFFICIENCY FOR DEEP SLOT MILLING

The combination of 5 flutes and a centre through coolant hole enable highly efficient rough cutting of titanium alloys.



IRREGULAR HELIX

Chatter and vibration are controlled even during deep shoulder machining.

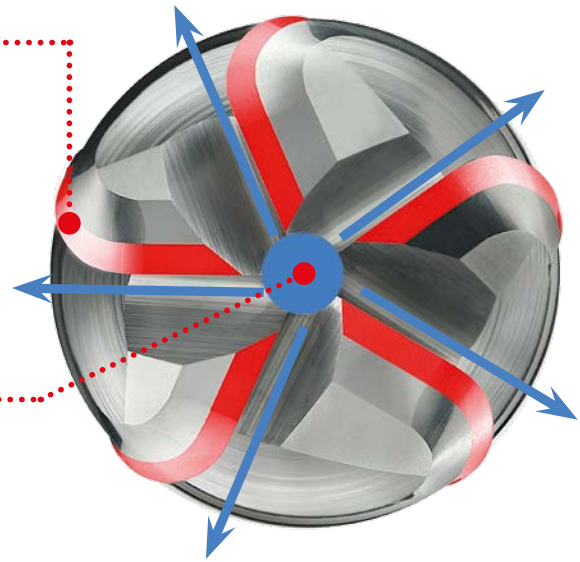
CORNER RADIUS (EMPHASIS ON EDGE SHARPNESS)

The seamless blend between the corner radius and peripheral cutting edge suppresses abnormal wear and provides a stable tool life.

(Non-standard corner radius sizes are available by special order.)

OPTIMUM FLUTE DESIGN

Optimisation of the 5-flute geometry improves chip evacuation and is ideal for deep slot and shoulder milling.



CENTRE THROUGH COOLANT HOLE

Ample cutting fluid is supplied to the cuuting edges and also enables a smooth and efficient discharge of chips.

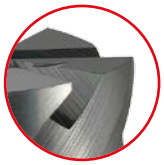
NEW

COOLSTAR

EFFECTIVE FOR MACHINING TITANIUM AND STAINLESS STEEL COMPONENTS

MULTIPLE INTERNAL COOLANT HOLES

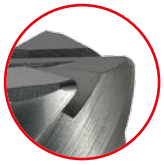
The multiple internal through coolant hole system is effective for improved welding resistance.
The spiral arrangement of the coolant holes enables a wide range of machining applications.
Especially suitable for machining difficult-to-cut materials, and offers a stable and secure machining process.



VQ6MHVCH

DC **10 – 20mm**

End mill, medium cut length,
6 flute, irregular helix flutes,
with multiple internal through coolant holes



VQ6MHVRBCH

DC **10 – 20mm**
RE **0.5 – 4mm**

Corner radius end mill, medium cut length,
6 flute, irregular helix flutes,
with multiple internal through coolant holes

VQ

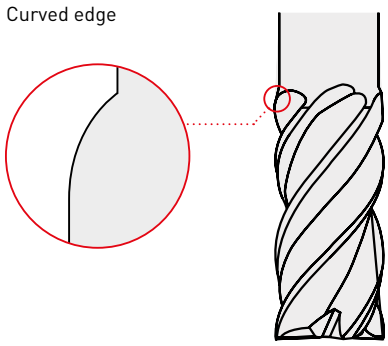
CLASSIFICATION

	Product Code	Shape		DC	P	H	M	S	N	
		RADIUS END MILLS								
NEW	**VQT5MVRB**	Corner radius, Medium cut length, 5 flute, Irregular helix, With through coolant hole		DC 16-25				◎		9
NEW	**VQ6MHVRBCH**	Corner radius end mill, medium cut length, 6 flute, irregular helix flutes, with multiple internal through coolant holes		DC 10-20			◎	◎		11
	VQMHVRB	Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes		DC 2 – 20	◎		◎	◎	○	13
	VQMHVRBF	Corner radius **finishing** end mill, Medium cut length, 4 flute, Irregular helix flutes		DC 6 – 16	◎		◎	◎	○	18
		SQUARE END MILLS								
NEW	**VQ6MHVCH**	End mill, medium cut length, 6 flute, irregular helix flutes, with multiple internal through coolant holes		DC 10-20			◎	◎		20
	VQXL	End mill, Short cut length, 4 flute, Long neck		DC 0.2–1	◎		◎	◎	○	22
	VQMHZV	End mill, Medium cut length, 3 flute for plunging and slotting		DC 1 – 20	◎		◎	◎	○	25
	VQMHZVOH	End mill, Medium cut length, 3 flute for plunging and slotting, with multiple internal through coolant holes		DC 6 – 16	◎		◎	◎	○	31
	VQMHV	End mill, Medium cut length, 4 flute, Irregular helix flutes, Offset types for vertical wall machining and deep applications		DC 1 – 25	◎		◎	◎	○	34
	VQJHV	End mill, Semi-long cut length, 4 flute, Irregular helix flutes		DC 1 – 20	◎		◎	◎	○	38
	VQSVR	**Roughing** end mill, Short cut length, 4 flute, Irregular helix flutes		DC 3 – 20	◎		◎	◎	○	40

Product Code	Shape		DC	P	H	M	S	N	
	BALL NOSE END MILLS								
VQ4SVB	Ball nose, Short cut length, 4 flute,Variable curve		RE 1 – 6	◎		◎	◎	○	43
	FORMED END MILL								
NEW **VQT6UR**	Conical Tapper Barrel, Medium cut length, 6 flute		DC 8-12	○		○	◎	○	45

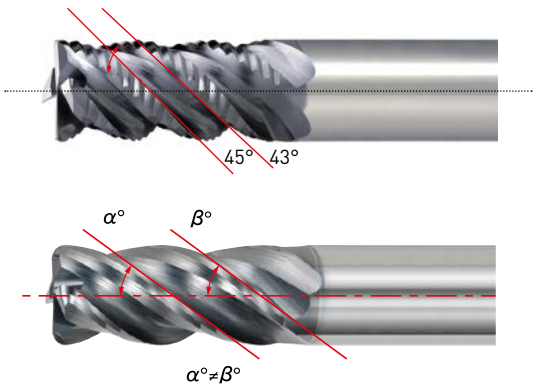
CURVED EDGE

A curved edge at the end of the flute is used in the undercut shank type 4 flute VQMHV end mills. This achieves good surface finishes because the undercut allows deep faces to be finished in steps and minimizes the blend mark between steps.



IRREGULAR HELIX

The irregular helix and assymetrical roughing geometry provides long tool life and reduces vibration even in difficult applications that usually generate vibration.

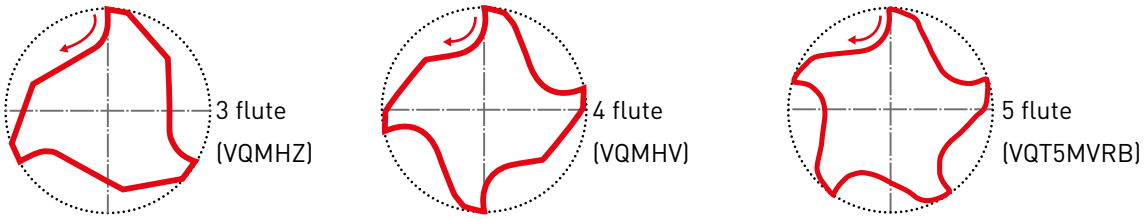


GEOMETRY

IMPROVED CHIP EVACUATION
Additionally, an optimised pocket size helps improve chip discharge performance.

SPECIAL FLUTE GEOMETRY

Improved chip disposal

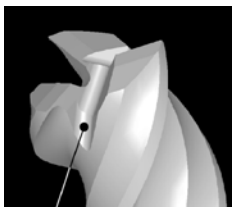


New flute geometry with low resistance for smooth chip evacuation.

IMPROVED GASH GEOMETRY

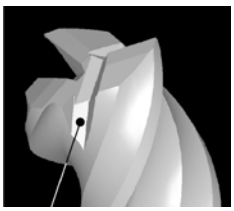
In addition to employing a conventional two-stage gash, the bottom of the gash has been rounded to avoid the concentration of stresses, thereby improving fracture resistance.

VQMHZV



2 stage gash with rounded geometry

Competitor



Standard 2 stage gash shape

EFFECTS OF THE NEW GASH GEOMETRY

Vertical feed performance has been greatly improved by the effect of the new geometry and smart Miracle coating. Due to the stable chip evacuation, vertical feed rates can be doubled compared to regular products.

VQT5MVRB

CORNER RADIUS, MEDIUM CUT LENGTH, 5 FLUTE, IRREGULAR HELIX, WITH THROUGH COOLANT HOLE

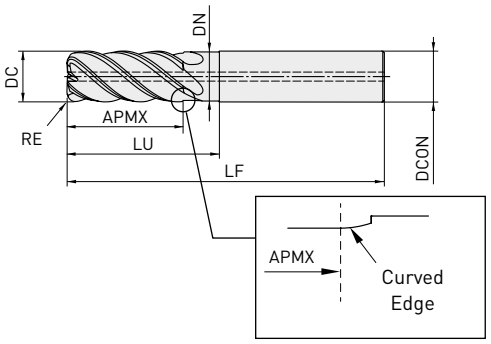
S

RE
±0.02

DC <16	20< DC <25
0	0
- 0.03	- 0.04

DCON = 16	20<DCON<25
0	0
- 0.011	- 0.013

Type1



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

	Order Number	DC	RE	APMX	LU	DN	LF	DCON	ZEFP	Stock	Type
NEW	VQT5MVRB160R300N048C	16	3	34	48	15.5	100	16	5	●	1
NEW	VQT5MVRB200R400N060C	20	4	44	60	19.5	120	20	5	●	1
NEW	VQT5MVRB250R400N075C	25	4	54	75	24.5	140	25	5	●	1

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 a contact type (non-electrical) or a laser tool setter.
2. Non-standard corner R sizes are available by special order. Please contact us for details.

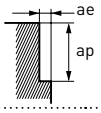
SPECIAL CORNER R SIZE RANGE

DC	RE
16	1-5
20 / 25	1-6

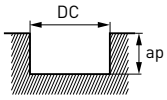
VQT5MVRB

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

	S			
Material	**Titanium Alloys**			
	Overhang Length DC×3			
DC	**n (min^{-1})**	**Vf (mm/min)**	**ap (mm)**	**ae (mm)**
16	1400	700	32	2.4
20	1100	550	40	3
25	890	440	50	3.8
Depth of Cut	 DC=Dia.			

SLOT MILLING

	S					
Material	**Titanium Alloys**					
	Depth of Cut DC×1			**Depth of Cut DC×2**		
DC	**n (min^{-1})**	**Vf (mm/min)**	**ap (mm)**	**n (min^{-1})**	**Vf (mm/min)**	**ap (mm)**
16	1200	420	16	1200	240	32
20	950	330	20	950	190	40
25	640	220	25	640	130	50
Depth of Cut	 DC=Dia.					

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 a contact type (non-electrical) or a laser tool setter.
2. When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
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 speed and feed rate proportionately, or set a lower depth of cut.
4. If the depth of cut is smaller, the speed and feed rate can be increased.
5. For slot milling, use a chuck with a high clamping force.

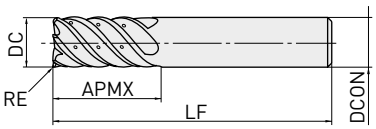
● : Inventory maintained. ★ : Inventory maintained in Japan.

VQ6MHVRBCH

CORNER RADIUS END MILL, MEDIUM CUT LENGTH, 6 FLUTE, IRREGULAR HELIX FLUTES, WITH MULTIPLE INTERNAL THROUGH COOLANT HOLES

M S

Type1



0.5 ≤RE ≤4

±0.015

DC ≤12	DC >12
0	0
- 0.020	- 0.030

DCON = 10	DCON = 12	DCON = 16	DCON =20
0	0	0	0
- 0.009	- 0.011	- 0.011	- 0.013

- Multiple coolant channels ensure improved chip removal for reliable machining of difficult-to-cut materials

Order Number	DC	RE	APMX	LF	DCON	ZEFP	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

VQ6MHVRBCH

RECOMMENDED CUTTING CONDITIONS

Shoulder Milling

	M		S	
Material	**Austenitic Stainless Steel (<200HB), Titanium Alloy**		**Heat Resistant Alloys**	
DC	**n (min^{-1})**	**Vf (mm/min)**	**n (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
	⩽0.12 DC 0.5 DC – 1.5 DC		⩽0.05 DC 0.5 DC – 1.5 DC	

Trochoidal Milling

	M	
Material	**Austenitic Stainless Steel (<200HB), Titanium Alloy**	
DC	**n (min^{-1})**	**Vf (mm/min)**
10	4800	1400
12	4000	1200
16	3000	1100
20	2400	900
	⩽1.5 DC ⩽0.12 DC 0.5 DC – 1.5 DC	

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

● : Inventory maintained. ★ : Inventory maintained in Japan.

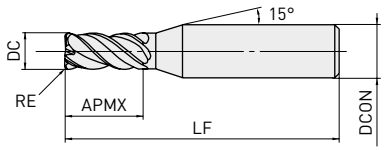
VQMHVRB

37°
40°

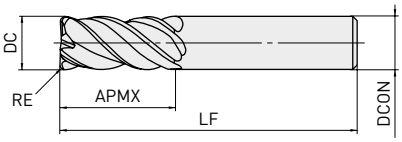
CORNER RADIUS END MILL, MEDIUM CUT LENGTH, 4 FLUTE, IRREGULAR HELIX FLUTES

P M S N

Type1



Type2



0.2 <R <6.35				
±0.015				
DC <12	DC >12			
0 - 0.02	0 - 0.03			
4< D4 <6	8< D4 <10	12< D4 <16	D4 = 12	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

- VQ vibration control end mills for reduced chattering, a stable performance on difficult-to-cut materials and long overhang applications.

Order Number	DC	RE	APMX	LF	DCON	ZEFP	Stock	Type
VQMHVRBD0200R020	2	0.2	4	45	4	4	●	1
VQMHVRBD0200R030	2	0.3	4	45	4	4	●	1
VQMHVRBD0300R020	3	0.2	8	45	6	4	●	1
VQMHVRBD0300R030	3	0.3	8	45	6	4	●	1
VQMHVRBD0300R050	3	0.5	8	45	6	4	●	1
VQMHVRBD0400R020	4	0.2	11	45	6	4	●	1
VQMHVRBD0400R030	4	0.3	11	45	6	4	●	1
VQMHVRBD0400R050	4	0.5	11	45	6	4	●	1
VQMHVRBD0500R020	5	0.2	13	50	6	4	●	1
VQMHVRBD0500R030	5	0.3	13	50	6	4	●	1
VQMHVRBD0500R050	5	0.5	13	50	6	4	●	1
VQMHVRBD0500R100	5	1	13	50	6	4	●	1
VQMHVRBD0600R030	6	0.3	13	50	6	4	●	2
VQMHVRBD0600R050	6	0.5	13	50	6	4	●	2
VQMHVRBD0600R100	6	1	13	50	6	4	●	2
VQMHVRBD0800R030	8	0.3	19	60	8	4	●	2
VQMHVRBD0800R050	8	0.5	19	60	8	4	●	2
VQMHVRBD0800R100	8	1	19	60	8	4	●	2
VQMHVRBD0800R150	8	1.5	19	60	8	4	●	2
VQMHVRBD1000R030	10	0.3	22	70	10	4	●	2
VQMHVRBD1000R050	10	0.5	22	70	10	4	●	2
VQMHVRBD1000R100	10	1	22	70	10	4	●	2
VQMHVRBD1000R150	10	1.5	22	70	10	4	●	2
VQMHVRBD1000R200	10	2	22	70	10	4	●	2
VQMHVRBD1200R050	12	0.5	26	75	12	4	●	2
VQMHVRBD1200R100	12	1	26	75	12	4	●	2

VQMHVRB

Order Number	DC	RE	APMX	LF	DCON	ZEFP	Stock	Type
VQMHVRBD1200R150	12	1.5	26	75	12	4	●	2
VQMHVRBD1200R200	12	2	26	75	12	4	●	2
VQMHVRBD1200R250	12	2.5	26	75	12	4	●	2
VQMHVRBD1200R300	12	3	26	75	12	4	●	2
VQMHVRBD1600R100	16	1	35	90	16	4	●	2
VQMHVRBD1600R150	16	1.5	35	90	16	4	●	2
VQMHVRBD1600R200	16	2	35	90	16	4	●	2
VQMHVRBD1600R250	16	2.5	35	90	16	4	●	2
VQMHVRBD1600R300	16	3	35	90	16	4	●	2
VQMHVRBD1600R400	16	4	35	90	16	4	●	2
VQMHVRBD1600R500	16	5	35	90	16	4	●	2
VQMHVRBD2000R100	20	1	45	110	20	4	●	2
VQMHVRBD2000R150	20	1.5	45	110	20	4	●	2
VQMHVRBD2000R200	20	2	45	110	20	4	●	2
VQMHVRBD2000R250	20	2.5	45	110	20	4	●	2
VQMHVRBD2000R300	20	3	45	110	20	4	●	2
VQMHVRBD2000R400	20	4	45	110	20	4	●	2
VQMHVRBD2000R500	20	5	45	110	20	4	●	2
VQMHVRBD2000R635	20	6.35	45	110	20	4	●	2

● : Inventory maintained. ★ : Inventory maintained in Japan.

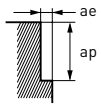
VQMHVRB

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

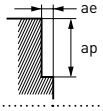
HIGH EFFICIENCY CUTTING CONDITIONS

	P								M	S			M			
Material	Carbon steel, Alloy steels (180-280 HB), Cast Iron				Carbon steels, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
2	24000	2400	3	0.6	19000	1100	3	0.6	16000	830	3	0.6	12000	720	3	0.4
3	16000	2600	4.5	0.9	13000	1200	4.5	0.9	11000	880	4.5	0.9	8000	770	4.5	0.6
4	12000	2600	6	1.2	9500	1300	6	1.2	8000	900	6	1.2	6000	790	6	0.8
5	9500	2500	7.5	1.5	7600	1300	7.5	1.5	6400	900	7.5	1.5	4800	810	7.5	1
6	8000	2600	9	1.8	6400	1300	9	1.8	5300	1100	9	1.8	4000	800	9	1.2
8	6000	2500	12	2.4	4800	1300	12	2.4	4000	1200	12	2.4	3000	840	12	1.6
10	4800	2300	15	3	3800	1200	15	3	3200	1300	15	3	2400	770	15	2
12	4000	1900	18	3.6	3200	1200	18	3.6	2700	1200	18	3.6	2000	720	18	2.4
16	3000	1600	24	4.8	2400	960	24	4.8	2000	960	24	4.8	1500	600	24	3.2
20	2400	1300	30	6	1900	760	30	6	1600	770	30	6	1200	480	30	4
25	1900	1100	37	7.5	1500	600	37	7.5	1300	620	37	7.5	950	380	37	5



GENERAL PURPOSE CUTTING CONDITIONS

	P								M	S			M			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
2	19000	1300	3	0.6	16000	630	3	0.6	13000	450	1.5	0.2	11000	440	3	0.4
3	13000	1400	4.5	0.9	11000	700	4.5	0.9	8500	450	2.25	0.3	7400	470	4.5	0.6
4	9500	1400	6	1.2	8000	700	6	1.2	6400	470	3	0.6	5600	490	6	0.8
5	7600	1300	7.5	1.5	6400	710	7.5	1.5	5100	470	4.5	0.9	4500	500	7.5	1
6	6400	1400	9	1.8	5300	700	9	1.8	4200	580	6	1.2	3700	490	9	1.2
8	4800	1300	12	2.4	4000	740	12	2.4	3200	630	7.5	1.5	2800	520	12	1.6
10	3800	1200	15	3	3200	680	15	3	2500	660	9	1.8	2200	460	15	2
12	3200	1000	18	3.6	2700	640	18	3.6	2100	610	12	2.4	1900	450	18	2.4
16	2400	860	24	4.8	2000	530	24	4.8	1600	510	15	3	1400	370	24	3.2
20	1900	680	30	6	1600	420	30	6	1300	410	18	3.6	1100	290	30	4
25	1500	390	37.5	7.5	1300	340	37.5	7.5	1000	210	24	4.8	890	230	37.5	5



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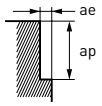
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

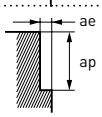
HIGH EFFICIENCY CUTTING CONDITIONS

	S				N			
Material	Heat resistant alloys				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
2	6400	230	3	0.2	29000	2900	3	0.6
3	4200	240	4.5	0.3	19000	3000	4.5	0.9
4	3200	240	6	0.4	14000	3100	6	1.2
5	2500	240	7.5	0.5	11000	2900	7.5	1.5
6	2100	250	9	0.6	9500	3000	9	1.8
8	1600	260	12	0.8	7200	3000	12	2.4
10	1300	290	15	1	5700	2700	15	3
12	1100	280	18	1.2	4800	2300	18	3.6
16	800	200	24	1.6	3600	1900	24	4.8
20	640	160	30	2	2900	1600	30	6
25	510	130	37.5	2.5	2300	1300	37	7.5



GENERAL PURPOSE CUTTING CONDITIONS

	S				N			
Material	Heat resistant alloys				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
2	4800	110	3	0.2	22000	1500	3	0.6
3	3200	120	4.5	0.3	15000	1600	4.5	0.9
4	2400	120	6	0.4	11000	1600	6	1.2
5	1900	120	7.5	0.5	8900	1500	7.5	1.5
6	1600	130	9	0.6	7400	1600	9	1.8
8	1200	130	12	0.8	5600	1600	12	2.4
10	950	140	15	1	4500	1400	15	3
12	800	140	18	1.2	3700	1200	18	3.6
16	600	100	24	1.6	2800	1000	24	4.8
20	480	81	30	2	2200	780	30	6
25	380	64	37.5	2.5	1800	670	37.5	7.5



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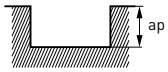
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

SLOTTING

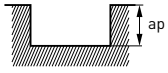
HIGH EFFICIENCY CUTTING CONDITIONS

	P						M	S		M			S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)
2	24000	1200	2	19000	610	2	16000	640	2	9500	300	1	4800	130	0.6	29000	1500	2
3	16000	1500	3	13000	730	3	11000	660	3	6400	360	1.5	3200	150	0.9	19000	1700	3
4	12000	1900	4	9500	910	4	8000	700	4	4800	460	2	2400	170	1.2	14000	2200	4
5	9500	1900	5	7600	910	5	6400	720	5	3800	460	2.5	1900	170	1.5	11000	2200	5
6	8000	1900	6	6400	1000	6	5300	740	6	3200	510	3	1600	180	1.8	9500	2300	6
8	6000	1700	8	4800	960	8	4000	800	8	2400	480	4	1200	190	2.4	7200	2000	8
10	4800	1500	10	3800	840	10	3200	900	10	1900	420	5	950	210	3	5700	1800	10
12	4000	1300	12	3200	770	12	2700	860	12	1600	380	6	800	200	3.6	4800	1500	12
16	3000	1100	12	2400	670	12	2000	640	12	1200	340	8	600	150	4.8	3600	1300	12
20	2400	860	12	1900	530	12	1600	510	12	950	270	10	480	120	6	2900	1000	12
25	1900	760	12	1500	420	12	1300	420	12	760	210	12	380	100	7.5	2300	920	12



GENERAL PURPOSE CUTTING CONDITIONS

	P						M	S		M			S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)
2	16000	550	2	13000	270	2	9500	250	2	8000	170	1	4000	74	0.6	19000	650	2
3	11000	670	3	8500	310	3	6400	250	3	5300	200	1.5	2700	86	0.9	13000	790	3
4	8000	840	4	6400	410	4	4800	280	4	4000	250	2	2000	93	1.2	9500	1000	4
5	6400	840	5	5100	400	5	3800	280	5	3200	250	2.5	1600	95	1.5	7600	1000	5
6	5300	840	6	4200	440	6	3200	300	6	2700	290	3	1300	96	1.8	6400	1000	6
8	4000	740	8	3200	420	8	2400	320	8	2000	260	4	990	100	2.4	4800	890	8
10	3200	680	10	2500	360	10	1900	350	10	1600	230	5	800	120	3	3800	800	10
12	2700	570	12	2100	330	12	1600	340	12	1300	210	6	660	110	3.6	3200	680	12
16	2000	480	12	1600	300	12	1200	250	12	990	180	8	500	84	4.8	2400	570	12
20	1600	380	12	1300	240	12	950	200	12	800	150	10	400	68	6	1900	450	12
25	1300	340	12	1000	180	12	760	160	12	640	120	12	320	50	7.5	1500	400	12



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

● : Inventory maintained. ★ : Inventory maintained in Japan.

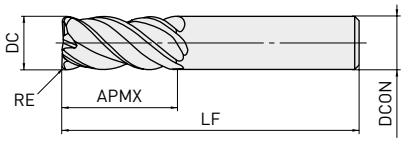
VQMHVRBF

37°
40°

CORNER RADIUS END MILL, MEDIUM CUT LENGTH, 4 FLUTE, IRREGULAR HELIX FLUTES

P M S N

Type1



0.3< R <2			
±0.015			
DC <12	DC >12		
0 - 0.02	0 - 0.03		
D4 = 6	8< D4 <10	12< D4 <16	
0 - 0.008	0 - 0.009	0 - 0.011	

- 4 flute irregular helix end mill for reduced vibration when machining difficult-to-cut materials.
- Ideal for finishing.

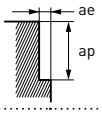
Order Number	RE	DC	APMX	LF	DCON	ZEFP	Stock	Type
VQMHVRBFD0600R030	0.3	6	13	50	6	4	●	1
VQMHVRBFD0600R050	0.5	6	13	50	6	4	●	1
VQMHVRBFD0600R100	1	6	13	50	6	4	●	1
VQMHVRBFD0800R050	0.5	8	19	60	8	4	●	1
VQMHVRBFD0800R100	1	8	19	60	8	4	●	1
VQMHVRBFD1000R030	0.3	10	22	70	10	4	●	1
VQMHVRBFD1000R050	0.5	10	22	70	10	4	●	1
VQMHVRBFD1000R100	1	10	22	70	10	4	●	1
VQMHVRBFD1000R200	2	10	22	70	10	4	●	1
VQMHVRBFD1200R100	1	12	26	75	12	4	●	1
VQMHVRBFD1200R200	2	12	26	75	12	4	●	1
VQMHVRBFD1200R300	3	12	26	75	12	4	●	1
VQMHVRBFD1600R100	1	16	35	90	16	4	●	1
VQMHVRBFD1600R200	2	16	35	90	16	4	●	1

VQMHVRBF

RECOMMENDED CUTTING CONDITIONS

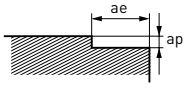
SHOULDER MILLING

	P								M				S				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Hardened stainless steels, Cobalt chromium alloy				Heat resistant alloys				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
6	8000	2600	9	0.3	6400	1300	9	0.3	4000	800	9	0.3	2100	250	9	0.1	9500	3000	9	0.3
8	6000	2500	12	0.4	4800	1300	12	0.4	3000	840	12	0.4	1600	260	12	0.2	7200	3000	12	0.4
10	4800	2300	15	0.5	3800	1200	15	0.5	2400	770	15	0.5	1300	290	15	0.3	5700	2700	15	0.5
12	4000	1900	18	0.6	3200	1200	18	0.6	2000	720	18	0.6	1100	280	18	0.3	4800	2300	18	0.6
16	3000	1600	24	0.8	2400	960	24	0.8	1500	600	24	0.8	800	200	24	0.4	3600	1900	24	0.8



FACE MILLING

	P								M				S				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Hardened stainless steels, Cobalt chromium alloy				Heat resistant alloys				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
6	5800	1400	0.3	4.8	4800	770	0.3	4.8	2900	460	0.3	4.8	1600	180	0.18	4.8	6900	1700	0.3	4.8
8	4400	1200	0.4	6.4	3600	720	0.4	6.4	2200	440	0.4	6.4	1200	190	0.24	6.4	5200	1500	0.4	6.4
10	3500	1100	0.5	8	2900	640	0.5	8	1800	400	0.5	8	950	210	0.3	8	4100	1300	0.5	8
12	2900	930	0.6	9.6	2400	580	0.6	9.6	1500	360	0.6	9.6	800	200	0.36	9.6	3400	1100	0.6	9.6
16	2200	790	0.8	12.8	1800	500	0.8	12.8	1100	310	0.8	12.8	600	150	0.48	12.8	2600	940	0.8	12.8



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient.
   In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

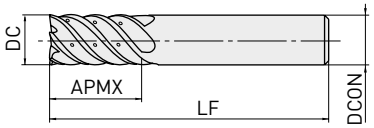
● : Inventory maintained. ★ : Inventory maintained in Japan.

VQ6MHVCH

END MILL, MEDIUM CUT LENGTH, 6 FLUTE, IRREGULAR HELIX FLUTES, WITH MULTIPLE INTERNAL THROUGH COOLANT HOLES

M S

Type1



DC ≤12	DC >12
0	0
- 0.020	- 0.030

h6

DCON = 10	DCON = 12	DCON = 16	DCON = 20
0	0	0	0
- 0.009	- 0.011	- 0.011	- 0.013

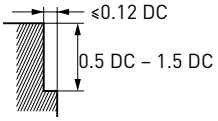
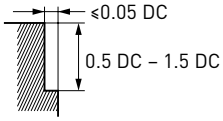
- Multiple coolant channels ensure improved chip removal for reliable machining of difficult-to-cut materials

Order Number	DC	APMX	LF	DCON	ZEFP	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

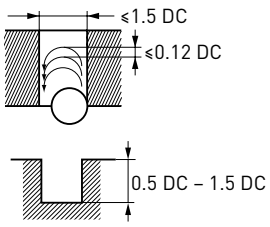
VQ6MHVCH

RECOMMENDED CUTTING CONDITIONS

Shoulder Milling

	M		S	
Material	**Austenitic Stainless Steel (<200HB), Titanium Alloy**		**Heat Resistant Alloys**	
DC	**n (min^{-1})**	**Vf (mm/min)**	**n (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
				

Trochoidal Milling

	M	
Material	**Austenitic Stainless Steel (<200HB), Titanium Alloy**	
DC	**n (min^{-1})**	**Vf (mm/min)**
10	4800	1400
12	4000	1200
16	3000	1100
20	2400	900
		

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

VQXL

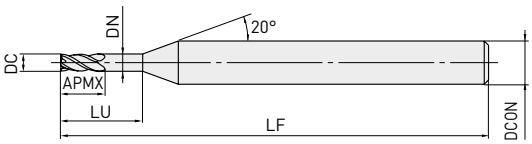
35°

DC<0.3 DC>0.4

END MILL, SHORT CUT LENGTH, 4 FLUTE, LONG NECK

P M S N

Type1



DC <12
0
- 0.010

D4 = 4
0
- 0.005

- Enhancing efficiency with improved chip disposal by adopting the VQ coating.
- Increased number of flutes provides high efficiency and longer tool life.

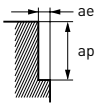
Order Number	DC	APMX	LU	DN	LF	DCON	ZEFP	Stock	Type
VQXLD0020N006	0.2	0.3	0.6	0.18	40	4	3	●	1
VQXLD0030N009	0.3	0.5	0.9	0.28	40	4	3	●	1
VQXLD0030N015	0.3	0.5	1.5	0.28	40	4	3	●	1
VQXLD0040N010	0.4	0.6	1	0.37	40	4	4	●	1
VQXLD0040N018	0.4	0.6	1.8	0.37	40	4	4	●	1
VQXLD0050N015	0.5	0.7	1.5	0.46	40	4	4	●	1
VQXLD0050N025	0.5	0.7	2.5	0.46	40	4	4	●	1
VQXLD0050N030	0.5	0.7	3	0.46	40	4	4	●	1
VQXLD0060N030	0.6	0.9	3	0.57	40	4	4	●	1
VQXLD0070N035	0.7	1	3.5	0.67	40	4	4	●	1
VQXLD0080N024	0.8	1.2	2.4	0.77	40	4	4	●	1
VQXLD0080N030	0.8	1.2	3	0.77	40	4	4	●	1
VQXLD0080N040	0.8	1.2	4	0.77	40	4	4	●	1
VQXLD0100N050	1	1.5	5	0.96	40	4	4	●	1

VQXL

RECOMMENDED CUTTING CONDITIONS

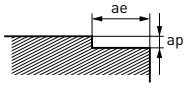
SHOULDER MILLING

		P	M	S	N	P	H	S	
Material		Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steels, Titanium alloys Cobalt chromium alloy, Copper, Copper alloy				Heat resistant alloys, Pre-hardened steel, Hardened steel			
DC	LU	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
0.2	0.6	40000	360	0.03	0.01	32000	290	0.03	0.01
0.3	0.9	40000	480	0.04	0.01	21000	250	0.04	0.01
0.3	1.5	40000	360	0.04	0.01	21000	190	0.04	0.01
0.4	1.2	40000	800	0.06	0.02	16000	320	0.06	0.02
0.4	2	40000	560	0.06	0.02	16000	220	0.06	0.02
0.5	1.5	38000	910	0.07	0.02	13000	310	0.07	0.02
0.5	2.5	38000	610	0.07	0.02	13000	210	0.07	0.02
0.5	3	38000	550	0.07	0.02	13000	180	0.07	0.02
0.6	3	32000	640	0.09	0.03	10500	210	0.09	0.03
0.7	3.5	27000	650	0.11	0.03	9100	200	0.11	0.03
0.8	2.4	24000	960	0.12	0.04	8000	260	0.12	0.04
0.8	3	24000	860	0.12	0.04	8000	230	0.12	0.04
0.8	4	24000	670	0.12	0.04	8000	190	0.12	0.04
1	5	20000	800	0.15	0.05	6500	210	0.15	0.05



FACE MILLING

		P	M	S	N	P	H	S	
Material		Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steels, Titanium alloys Cobalt chromium alloy, Copper, Copper alloy				Heat resistant alloys, Pre-hardened steel, Hardened steel			
DC	LU	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
0.2	0.6	40000	360	0.01	<0.2	32000	290	0.015	<0.1
0.3	0.9	40000	480	0.02	<0.3	21000	250	0.025	<0.1
0.3	1.5	40000	360	0.02	<0.3	21000	190	0.02	<0.1
0.4	1.2	40000	800	0.03	<0.4	16000	320	0.03	<0.2
0.4	2	40000	560	0.02	<0.4	16000	220	0.02	<0.2
0.5	1.5	38000	910	0.04	<0.5	13000	310	0.04	<0.2
0.5	2.5	38000	610	0.03	<0.5	13000	210	0.03	<0.2
0.5	3	38000	550	0.03	<0.5	13000	180	0.03	<0.2
0.6	3	32000	640	0.03	<0.6	10500	210	0.035	<0.3
0.7	3.5	27000	640	0.03	<0.7	9100	190	0.035	<0.3
0.8	2.4	24000	960	0.06	<0.8	8000	260	0.06	<0.4
0.8	3	24000	840	0.05	<0.8	8000	230	0.05	<0.4
0.8	4	24000	670	0.04	<0.8	8000	190	0.04	<0.4
1	5	20000	800	0.05	<1	6500	210	0.05	<0.5

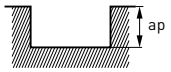


1. VQ coating has less electrical conductivity; therefore an external contact type (electrically transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electrical type) tool setter or a laser type tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

RECOMMENDED CUTTING CONDITIONS

SLOTTING

		P	M	S	N	P	H	S
Material		**Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steels, Titanium alloys Cobalt chromium alloy, Copper, Copper alloy**				**Heat resistant alloys, Pre-hardened steel, Hardened steel**		
DC	**LU**	**n (min^{-1})**	**Vf (mm/min)**	**ap (mm)**		**n (min^{-1})**	**Vf (mm/min)**	**ap (mm)**
0.2	0.6	30000	270	0.03		24000	220	0.03
0.3	0.9	30000	360	0.04		15000	180	0.04
0.3	1.5	30000	270	0.04		15000	140	0.04
0.4	1.2	30000	600	0.06		12000	240	0.06
0.4	2	30000	420	0.06		12000	170	0.06
0.5	1.5	28000	670	0.07		9500	230	0.07
0.5	2.5	28000	450	0.07		9500	150	0.07
0.5	3	28000	390	0.07		9500	130	0.07
0.6	3	24000	480	0.09		7800	160	0.09
0.7	3.5	20000	480	0.1		6800	140	0.1
0.8	2.4	18000	720	0.1		6000	190	0.1
0.8	3	18000	650	0.1		6000	170	0.1
0.8	4	18000	500	0.1		6000	140	0.1
1	5	15000	600	0.1		4800	150	0.1



1. VQ coating has less electrical conductivity; therefore an external contact type (electrically transmitted) tool setter may not work.
   When measuring the tool length, please use an internal contact type (non-electrical type) tool setter or a laser type tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient.
   In these cases the feed and speed should be reduced proportionately.

VQMHZV

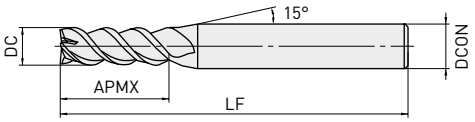
42°
43.5°
45°

END MILL, MEDIUM CUT LENGTH, 3 FLUTE FOR PLUNGING AND SLOTTING

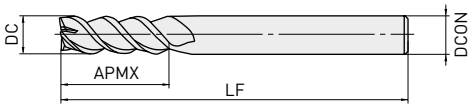
P M S N

DC <12	DC >12		
0	0		
- 0.02	- 0.03		
4< D4 <6	8< D4 <10	12< D4 <16	D4 = 20
0	0	0	0
- 0.008	- 0.009	- 0.011	- 0.013

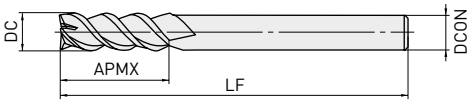
Type1



Type2



Type3



- 3 flute end mill for both plunging and slotting.
- Featuring irregular helical geometry for reduced chattering.

Order Number	DC	APMX	LF	DCON	ZEFP	Stock	Type
VQMHZVD0100	1	2	45	4	3	●	1
VQMHZVD0110	1.1	2.2	45	4	3	●	1
VQMHZVD0120	1.2	2.4	45	4	3	●	1
VQMHZVD0130	1.3	2.6	45	4	3	●	1
VQMHZVD0140	1.4	2.8	45	4	3	●	1
VQMHZVD0150	1.5	3	45	4	3	●	1
VQMHZVD0160	1.6	3.2	45	4	3	●	1
VQMHZVD0170	1.7	3.4	45	4	3	●	1
VQMHZVD0180	1.8	3.6	45	4	3	●	1
VQMHZVD0190	1.9	3.8	45	4	3	●	1
VQMHZVD0200	2	4	50	6	3	●	1
VQMHZVD0210	2.1	4.2	50	6	3	●	1
VQMHZVD0220	2.2	4.4	50	6	3	●	1
VQMHZVD0230	2.3	4.6	50	6	3	●	1
VQMHZVD0240	2.4	4.8	50	6	3	●	1
VQMHZVD0250	2.5	5	50	6	3	●	1
VQMHZVD0260	2.6	5.2	50	6	3	●	1
VQMHZVD0270	2.7	5.4	50	6	3	●	1
VQMHZVD0280	2.8	5.6	50	6	3	●	1
VQMHZVD0290	2.9	5.8	50	6	3	●	1
VQMHZVD0300	3	6	50	6	3	●	1

VQMHZV

Order Number	DC	APMX	LF	DCON	ZEFP	Stock	Type
VQMHZVD0310	3.1	7	50	6	3	●	1
VQMHZVD0320	3.2	7	50	6	3	●	1
VQMHZVD0330	3.3	7	50	6	3	●	1
VQMHZVD0340	3.4	7	50	6	3	●	1
VQMHZVD0350	3.5	8	50	6	3	●	1
VQMHZVD0360	3.6	8	50	6	3	●	1
VQMHZVD0370	3.7	8	50	6	3	●	1
VQMHZVD0380	3.8	8	50	6	3	●	1
VQMHZVD0390	3.9	8	50	6	3	●	1
VQMHZVD0400	4	8	50	6	3	●	1
VQMHZVD0450	4.5	10	50	6	3	●	1
VQMHZVD0500	5	10	50	6	3	●	1
VQMHZVD0550	5.5	13	50	6	3	●	1
VQMHZVD0600	6	13	60	6	3	●	2
VQMHZVD0650	6.5	16	60	8	3	●	1
VQMHZVD0700	7	16	60	8	3	●	1
VQMHZVD0750	7.5	16	60	8	3	●	1
VQMHZVD0800	8	19	70	8	3	●	2
VQMHZVD0850	8.5	19	70	10	3	●	1
VQMHZVD0900	9	19	70	10	3	●	1
VQMHZVD0950	9.5	19	70	10	3	●	1
VQMHZVD1000	10	22	80	10	3	●	2
VQMHZVD1100	11	22	80	12	3	●	1
VQMHZVD1200	12	26	90	12	3	●	2
VQMHZVD1300	13	26	90	12	3	●	3
VQMHZVD1400	14	26	90	12	3	●	3
VQMHZVD1500	15	26	110	16	3	●	1
VQMHZVD1600	16	30	110	16	3	●	2
VQMHZVD2000	20	32	140	20	3	●	2

● : Inventory maintained. ★ : Inventory maintained in Japan.

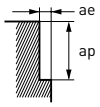
VQMHZV

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

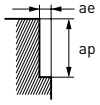
HIGH EFFICIENCY CUTTING CONDITIONS

	P								M				S	M			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)		n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
1	32000	720	1.5	0.2	25000	530	1.5	0.2	19000	430	1.5	0.2		16000	340	1.5	0.1
1.5	28000	1300	2.2	0.3	21000	630	2.2	0.3	18000	540	2.2	0.3		14000	420	2.2	0.1
2	24000	1800	3	0.6	19000	860	3	0.6	16000	620	3	0.6		12000	540	3	0.4
3	16000	1900	4.5	0.9	13000	940	4.5	0.9	11000	660	4.5	0.9		8000	580	4.5	0.6
4	12000	2000	6	1.2	9500	940	6	1.2	8000	670	6	1.2		6000	590	6	0.8
5	9500	1900	7.5	1.5	7600	960	7.5	1.5	6400	670	7.5	1.5		4800	600	7.5	1
6	8000	1900	9	1.8	6400	960	9	1.8	5300	830	9	1.8		4000	600	9	1.2
8	6000	1900	12	2.4	4800	1000	12	2.4	4000	900	12	2.4		3000	630	12	1.6
10	4800	1700	15	3	3800	910	15	3	3200	960	15	3		2400	580	15	2
12	4000	1400	18	3.6	3200	860	18	3.6	2700	890	18	3.6		2000	540	18	2.4
16	3000	1200	24	4.8	2400	720	24	4.8	2000	720	24	4.8		1500	450	24	3.2
20	2400	970	30	6	1900	570	30	6	1600	580	30	6		1200	360	30	4



GENERAL PURPOSE CUTTING CONDITIONS

	P								M				S	M			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)		n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
1	32000	480	1.5	0.2	25000	350	1.5	0.2	19000	280	1.5	0.2		16000	220	1.5	0.1
1.5	25000	740	2.2	0.3	21000	420	2.2	0.3	17000	340	2.2	0.3		14000	280	2.2	0.1
2	19000	940	3	0.6	16000	480	3	0.6	13000	330	3	0.6		11000	330	3	0.4
3	13000	1000	4.5	0.9	11000	520	4.5	0.9	8500	340	4.5	0.9		7400	350	4.5	0.6
4	9500	1000	6	1.2	8000	520	6	1.2	6400	350	6	1.2		5600	370	6	0.8
5	7600	980	7.5	1.5	6400	530	7.5	1.5	5100	350	7.5	1.5		4500	370	7.5	1
6	6400	1000	9	1.8	5300	520	9	1.8	4200	290	9	1.8		3700	370	9	1.2
8	4800	1000	12	2.4	4000	550	12	2.4	3200	310	12	2.4		2800	390	12	1.6
10	3800	900	15	3	3200	510	15	3	2500	500	15	3		2200	350	15	2
12	3200	760	18	3.6	2700	480	18	3.6	2100	460	18	3.6		1900	340	18	2.4
16	2400	640	24	4.8	2000	400	24	4.8	1600	250	24	4.8		1400	280	24	3.2
20	1900	510	30	6	1600	320	30	6	1300	200	30	6		1100	220	30	4



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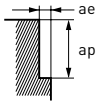
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

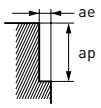
SHOULDER MILLING
HIGH EFFICIENCY CUTTING CONDITIONS

	S				N			
Material	Heat resistant alloys				Copper, Copper alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
1	13000	160	1.5	0.05	38000	860	1.5	0.2
1.5	8500	170	2.2	0.08	32000	1400	2.2	0.3
2	6400	170	3	0.2	29000	2200	3	0.6
3	4200	180	4.5	0.3	19000	2300	4.5	0.9
4	3200	180	6	0.4	14000	2300	6	1.2
5	2500	180	7.5	0.5	11000	2100	7.5	1.5
6	2100	190	9	0.6	9500	2300	9	1.8
8	1600	190	12	0.8	7200	2300	12	2.4
10	1300	220	15	1	5700	2100	15	3
12	1100	210	18	1.2	4800	1700	18	3.6
16	800	150	24	1.6	3600	1500	24	4.8
20	640	120	30	2	2900	1200	30	6



GENERAL PURPOSE CUTTING CONDITIONS

	S				N			
Material	Heat resistant alloys				Copper, Copper alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
1	9500	75	1.5	0.05	38000	560	1.5	0.2
1.5	6400	82	2.2	0.07	30000	890	2.2	0.3
2	4800	86	3	0.2	22000	1100	3	0.6
3	3200	89	4.5	0.3	15000	1200	4.5	0.9
4	2400	90	6	0.4	11000	1200	6	1.2
5	1900	90	7.5	0.5	8900	1100	7.5	1.5
6	1600	95	9	0.6	7400	1200	9	1.8
8	1200	95	12	0.8	5600	1200	12	2.4
10	950	110	15	1	4500	1100	15	3
12	800	100	18	1.2	3700	880	18	3.6
16	600	76	24	1.6	2800	750	24	4.8
20	480	61	30	2	2200	590	30	6

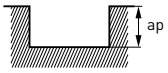


1. VQ coating is less electro conductive; therefore an external contact type (electric transmitted) tool setter may not work.
   When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient.
   In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

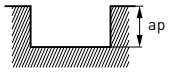
SLOTTING
HIGH EFFICIENCY CUTTING CONDITIONS

	P						M S			M			S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)
1	32000	380	0.5	25000	150	0.5	19000	100	0.5	14000	80	0.3	9500	60	0.2	38000	460	0.5
1.5	28000	590	0.7	21000	250	0.7	18000	220	0.7	12000	140	0.4	6400	80	0.3	32000	670	0.7
2	24000	940	2	19000	460	2	16000	480	2	9500	230	1	4800	100	0.6	29000	1100	2
3	16000	1100	3	13000	550	3	11000	500	3	6400	270	1.5	3200	120	0.9	19000	1300	3
4	12000	1400	4	9500	680	4	8000	530	4	4800	350	2	2400	130	1.2	14000	1700	4
5	9500	1400	5	7600	680	5	6400	540	5	3800	340	2.5	1900	130	1.5	11000	1700	5
6	8000	1400	6	6400	770	6	5300	560	6	3200	380	3	1600	130	1.8	9500	1700	6
8	6000	1300	8	4800	720	8	4000	600	8	2400	360	4	1200	140	2.4	7200	1500	8
10	4800	1200	10	3800	630	10	3200	670	10	1900	310	5	950	160	3	5700	1400	10
12	4000	960	12	3200	580	12	2700	650	12	1600	290	6	800	150	3.6	4800	1200	12
16	3000	810	12	2400	500	12	2000	480	12	1200	250	8	600	120	4.8	3600	970	12
20	2400	650	12	1900	400	12	1600	380	12	950	200	10	480	90	6	2900	780	12



GENERAL PURPOSE CUTTING CONDITIONS

	P						M S			M			S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)
1	32000	250	0.5	25000	99	0.5	19000	80	0.5	14000	60	0.3	8000	30	0.2	38000	300	0.5
1.5	21000	290	0.7	17000	130	0.7	13000	100	0.7	11000	87	0.4	5300	40	0.3	25000	350	0.7
2	16000	410	2	13000	210	2	9500	190	2	8000	130	1	4000	55	0.6	19000	490	2
3	11000	500	3	8500	240	3	6400	190	3	5300	150	1.5	2700	64	0.9	13000	590	3
4	8000	630	4	6400	300	4	4800	210	4	4000	190	2	2000	70	1.2	9500	750	4
5	6400	630	5	5100	300	5	3800	210	5	3200	190	2.5	1600	71	1.5	7600	750	5
6	5300	630	6	4200	330	6	3200	220	6	2700	210	3	1300	72	1.8	6400	760	6
8	4000	550	8	3200	320	8	2400	240	8	2000	200	4	990	78	2.4	4800	670	8
10	3200	510	10	2500	270	10	1900	260	10	1600	170	5	800	89	3	3800	600	10
12	2700	430	12	2100	250	12	1600	250	12	1300	150	6	660	84	3.6	3200	510	12
16	2000	360	12	1600	220	12	1200	190	12	990	140	8	500	63	4.8	2400	430	12
20	1600	290	12	1300	180	12	950	150	12	800	110	10	400	50	6	1900	340	12



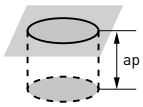
1. VQ coating has less electrical conductivity; therefore an external contact type (electrically transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electrical type) tool setter or a laser type tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

PLUNGING

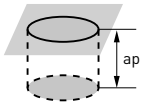
HIGH EFFICIENCY CUTTING CONDITIONS

	P								M		S		M				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)
1	20000	160	0.5	0.1	16000	100	0.5	0.1	16000	50	0.5	0.05	9500	30	0.5	0.05	24000	190	0.5	0.1
1.5	18000	270	0.7	0.3	13000	120	0.7	0.3	13000	80	0.7	0.1	7400	40	0.7	0.1	21000	320	0.7	0.3
2	16000	480	2	0.5	11000	200	2	0.4	9500	90	1	0.1	6400	60	1	0.1	19000	570	2	0.5
3	11000	660	3	1	7400	270	3	0.6	6400	100	1.5	0.2	4200	60	1.5	0.2	13000	780	3	0.9
4	8000	800	4	2	5600	340	4	0.8	4800	100	2	0.4	3200	60	2	0.4	9500	950	4	2
5	6400	960	5	2.5	4500	410	5	1	3800	100	2.5	0.5	2500	60	2.5	0.5	7600	1100	5	2.5
6	5300	950	6	3	3700	440	6	1.2	3200	100	3	0.6	2100	60	3	0.6	6400	1200	6	3
8	4000	720	8	4	2800	340	8	1.6	2400	70	4	0.6	1600	50	4	0.6	4800	860	8	4
10	3200	580	10	5	2200	260	10	2.5	1900	60	5	0.6	1300	40	5	0.6	3800	680	10	5
12	2700	490	12	5	1900	230	12	3	1600	50	6	0.6	1100	30	6	0.6	3200	580	12	5
16	2000	360	16	5	1400	170	16	4	1200	40	8	0.6	800	20	8	0.6	2400	430	16	5
20	1600	290	20	5	1100	130	20	5	950	30	10	0.6	640	20	10	0.6	1900	340	20	5



GENERAL PURPOSE CUTTING CONDITIONS

	P								M		S		M				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)
1	20000	160	0.5	0.05	16000	100	0.5	0.05	16000	50	0.5	0.05	9500	30	0.5	0.05	24000	190	0.5	0.05
1.5	18000	270	0.7	0.1	13000	120	0.7	0.1	13000	80	0.7	0.05	7400	40	0.7	0.05	21000	320	0.7	0.1
2	16000	480	2	0.2	11000	200	2	0.2	9500	90	1	0.05	6400	60	1	0.05	19000	570	2	0.2
3	11000	660	3	0.3	7400	270	3	0.3	6400	100	1.5	0.1	4200	60	1.5	0.1	13000	780	3	0.3
4	8000	800	4	0.4	5600	340	4	0.4	4800	100	2	0.2	3200	60	2	0.2	9500	950	4	0.4
5	6400	960	5	0.5	4500	410	5	0.5	3800	100	2.5	0.2	2500	60	2.5	0.2	7600	1100	5	0.5
6	5300	950	6	0.6	3700	440	6	0.6	3200	100	3	0.3	2100	60	3	0.3	6400	1200	6	0.6
8	4000	720	8	0.7	2800	340	8	0.7	2400	70	4	0.3	1600	50	4	0.3	4800	860	8	0.7
10	3200	580	10	0.7	2200	260	10	0.7	1900	60	5	0.3	1300	40	5	0.3	3800	680	10	0.7
12	2700	490	12	0.7	1900	230	12	0.7	1600	50	6	0.3	1100	30	6	0.3	3200	580	12	0.7
16	2000	360	16	0.7	1400	170	16	0.7	1200	40	8	0.3	800	20	8	0.3	2400	430	16	0.7
20	1600	290	20	0.7	1100	130	20	0.7	950	30	10	0.3	640	20	10	0.3	1900	340	20	0.7



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

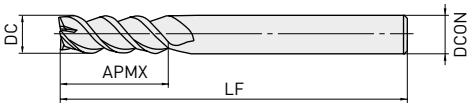
VQMHZVOH

42°
43.5°
45°

END MILL, MEDIUM CUT LENGTH, 3 FLUTE FOR PLUNGING AND SLOTTING, WITH MULTIPLE INTERNAL THROUGH COOLANT HOLES

P M S N

Type1



DC <12	DC = 16	
0	0	
- 0.02	- 0.03	

D4 = 6	8< D4 <10	12< D4 <16
0	0	0
- 0.008	- 0.009	- 0.011

- 3 flute end mill for both plunging and slotting.
- Through coolant holes for high performance plunging and pocketing.

Order Number	DC	APMX	LF	DCON	ZEFP	Stock	Type
VQMHZVOHD0600	6	13	60	6	3	●	1
VQMHZVOHD0800	8	19	70	8	3	●	1
VQMHZVOHD1000	10	22	80	10	3	●	1
VQMHZVOHD1200	12	26	90	12	3	●	1
VQMHZVOHD1600	16	30	110	16	3	●	1

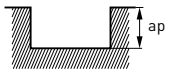
VQMHZVOH

RECOMMENDED CUTTING CONDITIONS

SLOTTING

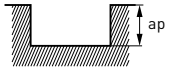
HIGH EFFICIENCY CUTTING CONDITIONS

	P						M S			M			S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)
6	8000	1400	6	6400	770	6	5300	560	6	3200	380	3	1600	130	1.8	9500	1700	6
8	6000	1300	8	4800	720	8	4000	600	8	2400	360	4	1200	140	2.4	7200	1500	8
10	4800	1200	10	3800	630	10	3200	670	10	1900	310	5	950	160	3	5700	1400	10
12	4000	960	12	3200	580	12	2700	650	12	1600	290	6	800	150	3.6	4800	1200	12
16	3000	810	12	2400	500	12	2000	480	12	1200	250	8	600	120	4.8	3600	970	12



GENERAL PURPOSE CUTTING CONDITIONS

	P						M S			M			S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)
6	5300	630	6	4200	330	6	3200	220	6	2700	210	3	1300	72	1.8	6400	760	6
8	4000	550	8	3200	320	8	2400	240	8	2000	200	4	990	78	2.4	4800	670	8
10	3200	510	10	2500	270	10	1900	260	10	1600	170	5	800	89	3	3800	600	10
12	2700	430	12	2100	250	12	1600	250	12	1300	150	6	660	84	3.6	3200	510	12
16	2000	360	12	1600	220	12	1200	190	12	990	140	8	500	63	4.8	2400	430	12



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient.
   In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

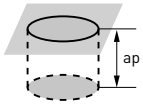
● : Inventory maintained. ★ : Inventory maintained in Japan.

RECOMMENDED CUTTING CONDITIONS

PLUNGING

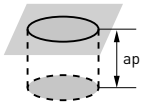
HIGH EFFICIENCY CUTTING CONDITIONS

	P								M	S			M				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)
6	5300	950	9	3	3700	440	9	1.2	3200	100	6	0.6	2100	60	6	0.6	6400	1200	9	3
8	4000	720	12	4	2800	340	12	1.6	2400	70	8	0.6	1600	50	8	0.6	4800	860	12	4
10	3200	580	15	5	2200	260	15	2.5	1900	60	10	0.6	1300	40	10	0.6	3800	680	15	5
12	2700	490	18	5	1900	230	18	3	1600	50	12	0.6	1100	30	12	0.6	3200	580	18	5
16	2000	360	24	5	1400	170	24	4	1200	40	16	0.6	800	20	16	0.6	2400	430	24	5



GENERAL PURPOSE CUTTING CONDITIONS

	P								M	S			M				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	p (mm)
6	5300	950	9	0.6	3700	440	9	0.6	3200	100	6	0.3	2100	60	6	0.3	6400	1200	9	0.6
8	4000	720	12	0.7	2800	340	12	0.7	2400	70	8	0.3	1600	50	8	0.3	4800	860	12	0.7
10	3200	580	15	0.75	2200	260	15	0.75	1900	60	10	0.3	1300	40	10	0.3	3800	680	15	0.75
12	2700	490	18	0.75	1900	230	18	0.75	1600	50	12	0.3	1100	30	12	0.3	3200	580	18	0.75
16	2000	360	24	0.75	1400	170	24	0.75	1200	40	16	0.3	800	20	16	0.3	2400	430	24	0.75



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

VQMHV

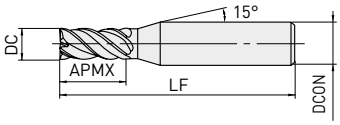
37°
40°

END MILL, MEDIUM CUT LENGTH, 4 FLUTE, IRREGULAR HELIX FLUTES, OFFSET TYPES FOR VERTICAL WALL MACHINING AND DEEP APPLICATIONS

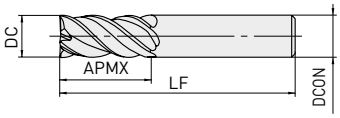
P M S N

DC <12	DC >12		
0 - 0.020	0 - 0.030		
4< D4 <6	8< D4 <10	12< D4 <16	20< D4 <25
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

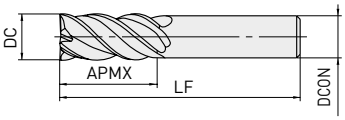
Type1



Type2



Type3



- VQ vibration control end mills for reduced chattering, a stable performance on difficult-to-cut materials and long overhang applications.

	Order Number	DC	APMX	LF	DCON	ZEFP	Stock	Type
NEW	VQMHVD0100	1	2	45	4	4	●	1
NEW	VQMHVD0150	1.5	3	45	4	4	●	1
	VQMHVD0200	2	4	45	4	4	●	1
	VQMHVD0250	2.5	5	45	4	4	●	1
	VQMHVD0300	3	8	45	6	4	●	1
	VQMHVD0350	3.5	8	45	6	4	●	1
	VQMHVD0400	4	11	45	6	4	●	1
	VQMHVD0500	5	13	50	6	4	●	1
	VQMHVD0600	6	13	50	6	4	●	2
	VQMHVD0700	7	19	60	8	4	●	1
	VQMHVD0800	8	19	60	8	4	●	2
	VQMHVD0900	9	22	70	10	4	●	1
	VQMHVD0900S08	9	22	75	8	4	●	3
	VQMHVD1000	10	22	70	10	4	●	2
	VQMHVD1000S08	10	22	100	8	4	●	3
	VQMHVD1100	11	26	75	12	4	●	1
	VQMHVD1100S10	11	26	100	10	4	●	3
	VQMHVD1200	12	26	75	12	4	●	2
	VQMHVD1200S10	12	26	110	10	4	●	3
	VQMHVD1300	13	26	75	12	4	●	3
	VQMHVD1300S12	13	26	110	12	4	●	3
	VQMHVD1400	14	30	90	16	4	●	1
	VQMHVD1400S12	14	32	130	12	4	●	3
	VQMHVD1600	16	35	90	16	4	●	2
	VQMHVD1800	18	40	100	16	4	●	3
	VQMHVD1800S16	18	42	150	16	4	●	3
	VQMHVD2000	20	45	110	20	4	●	2
	VQMHVD2500	25	55	125	25	4	●	2

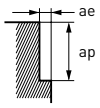
VQMHV

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

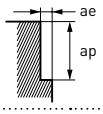
HIGH EFFICIENCY CUTTING CONDITIONS

	P								M				S				M			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys								Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)					n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
2	24000	2400	3	0.6	19000	1100	3	0.6	16000	830	3	0.6					12000	720	3	0.4
3	16000	2600	4.5	0.9	13000	1200	4.5	0.9	11000	880	4.5	0.9					8000	770	4.5	0.6
4	12000	2600	6	1.2	9500	1300	6	1.2	8000	900	6	1.2					6000	790	6	0.8
5	9500	2500	7.5	1.5	7600	1300	7.5	1.5	6400	900	7.5	1.5					4800	810	7.5	1
6	8000	2600	9	1.8	6400	1300	9	1.8	5300	1100	9	1.8					4000	800	9	1.2
8	6000	2500	12	2.4	4800	1300	12	2.4	4000	1200	12	2.4					3000	840	12	1.6
10	4800	2300	15	3	3800	1200	15	3	3200	1300	15	3					2400	770	15	2
12	4000	1900	18	3.6	3200	1200	18	3.6	2700	1200	18	3.6					2000	720	18	2.4
16	3000	1600	24	4.8	2400	960	24	4.8	2000	960	24	4.8					1500	600	24	3.2
20	2400	1300	30	6	1900	760	30	6	1600	770	30	6					1200	480	30	4
25	1900	1100	37	7.5	1500	600	37	7.5	1300	620	37	7.5					950	380	37	5



GENERAL PURPOSE CUTTING CONDITIONS

	P								M				S				M			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys								Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)					n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
2	19000	1300	3	0.6	16000	630	3	0.6	13000	450	1.5	0.2					11000	440	3	0.4
3	13000	1400	4.5	0.9	11000	700	4.5	0.9	8500	450	2.25	0.3					7400	470	4.5	0.6
4	9500	1400	6	1.2	8000	700	6	1.2	6400	470	3	0.6					5600	490	6	0.8
5	7600	1300	7.5	1.5	6400	710	7.5	1.5	5100	470	4.5	0.9					4500	500	7.5	1
6	6400	1400	9	1.8	5300	700	9	1.8	4200	580	6	1.2					3700	490	9	1.2
8	4800	1300	12	2.4	4000	740	12	2.4	3200	630	7.5	1.5					2800	520	12	1.6
10	3800	1200	15	3	3200	680	15	3	2500	660	9	1.8					2200	460	15	2
12	3200	1000	18	3.6	2700	640	18	3.6	2100	610	12	2.4					1900	450	18	2.4
16	2400	860	24	4.8	2000	530	24	4.8	1600	510	15	3					1400	370	24	3.2
20	1900	680	30	6	1600	420	30	6	1300	410	18	3.6					1100	290	30	4
25	1500	390	37.5	7.5	1300	340	37.5	7.5	1000	210	24	4.8					890	230	37.5	5



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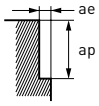
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

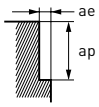
HIGH EFFICIENCY CUTTING CONDITIONS

	S				N			
Material	Heat resistant alloys				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
2	6400	230	3	0.2	29000	2900	3	0.6
3	4200	240	4.5	0.3	19000	3000	4.5	0.9
4	3200	240	6	0.4	14000	3100	6	1.2
5	2500	240	7.5	0.5	11000	2900	7.5	1.5
6	2100	250	9	0.6	9500	3000	9	1.8
8	1600	260	12	0.8	7200	3000	12	2.4
10	1300	290	15	1	5700	2700	15	3
12	1100	280	18	1.2	4800	2300	18	3.6
16	800	200	24	1.6	3600	1900	24	4.8
20	640	160	30	2	2900	1600	30	6
25	510	130	37.5	2.5	2300	1300	37	7.5



GENERAL PURPOSE CUTTING CONDITIONS

	S				N			
Material	Heat resistant alloys				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
2	4800	110	3	0.2	22000	1500	3	0.6
3	3200	120	4.5	0.3	15000	1600	4.5	0.9
4	2400	120	6	0.4	11000	1600	6	1.2
5	1900	120	7.5	0.5	8900	1500	7.5	1.5
6	1600	130	9	0.6	7400	1600	9	1.8
8	1200	130	12	0.8	5600	1600	12	2.4
10	950	140	15	1	4500	1400	15	3
12	800	140	18	1.2	3700	1200	18	3.6
16	600	100	24	1.6	2800	1000	24	4.8
20	480	81	30	2	2200	780	30	6
25	380	64	37.5	2.5	1800	670	37.5	7.5



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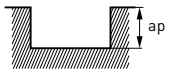
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

SLOTTING

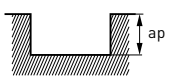
HIGH EFFICIENCY CUTTING CONDITIONS

	P						M		S				S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)
2	24000	1200	2	19000	610	2	16000	640	2	9500	300	1	4800	130	0.6	29000	1500	2
3	16000	1500	3	13000	730	3	11000	660	3	6400	360	1.5	3200	150	0.9	19000	1700	3
4	12000	1900	4	9500	910	4	8000	700	4	4800	460	2	2400	170	1.2	14000	2200	4
5	9500	1900	5	7600	910	5	6400	720	5	3800	460	2.5	1900	170	1.5	11000	2200	5
6	8000	1900	6	6400	1000	6	5300	740	6	3200	510	3	1600	180	1.8	9500	2300	6
8	6000	1700	8	4800	960	8	4000	800	8	2400	480	4	1200	190	2.4	7200	2000	8
10	4800	1500	10	3800	840	10	3200	900	10	1900	420	5	950	210	3	5700	1800	10
12	4000	1300	12	3200	770	12	2700	860	12	1600	380	6	800	200	3.6	4800	1500	12
16	3000	1100	12	2400	670	12	2000	640	12	1200	340	8	600	150	4.8	3600	1300	12
20	2400	860	12	1900	530	12	1600	510	12	950	270	10	480	120	6	2900	1000	12
25	1900	760	12	1500	420	12	1300	420	12	760	210	12	380	100	7.5	2300	920	12



GENERAL PURPOSE CUTTING CONDITIONS

	P						M		S				S			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Heat resistant alloys			Copper, Copper alloy		
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)
2	16000	550	2	13000	270	2	9500	250	2	8000	170	1	4000	74	0.6	19000	650	2
3	11000	670	3	8500	310	3	6400	250	3	5300	200	1.5	2700	86	0.9	13000	790	3
4	8000	840	4	6400	410	4	4800	280	4	4000	250	2	2000	93	1.2	9500	1000	4
5	6400	840	5	5100	400	5	3800	280	5	3200	250	2.5	1600	95	1.5	7600	1000	5
6	5300	840	6	4200	440	6	3200	300	6	2700	290	3	1300	96	1.8	6400	1000	6
8	4000	740	8	3200	420	8	2400	320	8	2000	260	4	990	100	2.4	4800	890	8
10	3200	680	10	2500	360	10	1900	350	10	1600	230	5	800	120	3	3800	800	10
12	2700	570	12	2100	330	12	1600	340	12	1300	210	6	660	110	3.6	3200	680	12
16	2000	480	12	1600	300	12	1200	250	12	990	180	8	500	84	4.8	2400	570	12
20	1600	380	12	1300	240	12	950	200	12	800	150	10	400	68	6	1900	450	12
25	1300	340	12	1000	180	12	760	160	12	640	120	12	320	50	7.5	1500	400	12



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4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

VQJHV

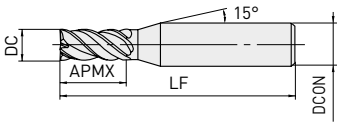
38°
40°
DC<6

37.5°
40°
DC>6

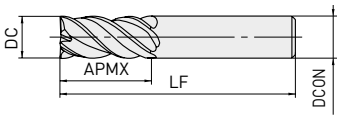
END MILL, SEMI-LONG CUT LENGTH, 4 FLUTE, IRREGULAR HELIX FLUTES

P M S N

Type1



Type2



DC <12	DC >12
0 - 0.020	0 - 0.030

h6

D4 = 6	8< D4 <10	12< D4 <16	D4 = 20
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

- VQ vibration control end mills for reduced chattering, a stable performance on difficult-to-cut materials and long overhang applications.

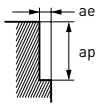
	Order Number	DC	APMX	LF	DCON	ZEFP	Stock	Type
NEW	VQJHVD0100	1	4	45	4	4	●	1
NEW	VQJHVD0150	1.5	6	45	4	4	●	1
	VQJHVD0200	2	8	60	6	4	●	1
	VQJHVD0250	2.5	10	60	6	4	●	1
	VQJHVD0300	3	12	60	6	4	●	1
	VQJHVD0350	3.5	14	60	6	4	●	1
	VQJHVD0400	4	16	60	6	4	●	1
	VQJHVD0450	4.5	18	60	6	4	●	1
	VQJHVD0500	5	20	60	6	4	●	1
	VQJHVD0600	6	24	60	6	4	●	2
	VQJHVD0700	7	25	80	8	4	●	1
	VQJHVD0800	8	28	80	8	4	●	2
	VQJHVD0900	9	32	90	10	4	●	1
	VQJHVD1000	10	35	90	10	4	●	2
	VQJHVD1200	12	40	100	12	4	●	2
	VQJHVD1600	16	55	125	16	4	●	2
	VQJHVD2000	20	70	140	20	4	●	2

VQJHV

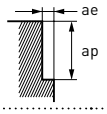
RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

Material	P								M		S		M			
	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
2	21000	700	5	0.2	16000	510	5	0.2	13000	390	5	0.1	12000	360	5	0.1
3	14000	960	7.5	0.3	11000	680	7.5	0.3	8500	490	7.5	0.15	8000	460	7.5	0.15
4	10000	1000	10	0.4	8000	690	10	0.4	6400	540	10	0.2	6000	510	10	0.2
5	8300	1100	12.5	0.5	6400	730	12.5	0.5	5100	570	12.5	0.25	4800	540	12.5	0.25
6	6900	1200	15	0.6	5300	810	15	0.6	4200	630	15	0.3	4000	600	15	0.3
8	5200	1200	20	0.8	4000	840	20	0.8	3200	640	20	0.4	3000	600	20	0.4
10	4100	1100	25	1	3200	810	25	1	2500	590	25	0.5	2400	570	25	0.5
12	3400	1100	30	1.2	2700	780	30	1.2	2100	550	30	0.6	2000	520	30	0.6
16	2600	920	40	1.6	2000	640	40	1.6	1600	450	40	0.8	1500	420	40	0.8
20	2100	820	50	2	1600	570	50	2	1300	420	50	1	1200	390	50	1



Material	S				N			
	Heat resistant alloys				Copper, Copper alloy			
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
2	6400	90	5	0.04	25000	830	5	0.2
3	4200	130	7.5	0.06	17000	1200	7.5	0.3
4	3200	190	10	0.08	13000	1300	10	0.4
5	2500	180	12.5	0.1	10000	1300	12.5	0.5
6	2100	180	15	0.12	8500	1500	15	0.6
8	1600	170	20	0.16	6400	1500	20	0.8
10	1300	170	25	0.2	5100	1300	25	1
12	1100	140	30	0.24	4200	1300	30	1.2
16	800	110	40	0.32	3200	1100	40	1.6
20	640	80	50	0.4	2500	970	50	2



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
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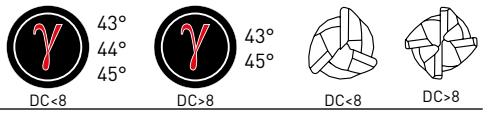
● : Inventory maintained. ★ : Inventory maintained in Japan.

VQSVR

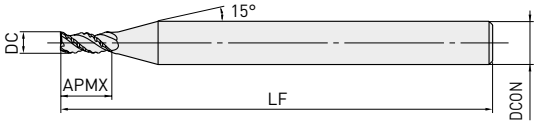


ROUGHING END MILL, SHORT CUT LENGTH, 4 FLUTE, IRREGULAR HELIX FLUTES

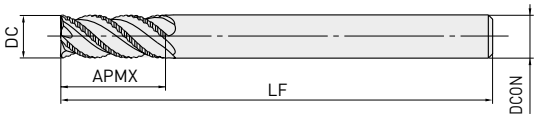
P M S N

h6	D4 = 6	8< D4 <10	12< D4 <16	D4 = 20
	0	0	0	0
	- 0.008	- 0.009	- 0.011	- 0.013

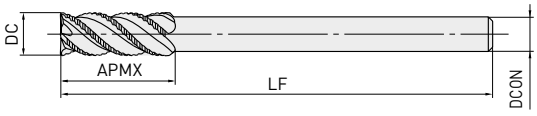
Type1



Type2



Type3



- Achieves excellent vibration resistance due to the adoption of irregular helix flutes.

Order Number	DC	APMX	LF	DCON	ZEFP	Stock	Type
VQSVRD0300	3	6	60	6	3	●	1
VQSVRD0400	4	8	60	6	3	●	1
VQSVRD0500	5	10	60	6	3	●	1
VQSVRD0600	6	12	70	6	3	●	2
VQSVRD0700	7	17	80	8	3	●	1
VQSVRD0800	8	17	80	8	4	●	2
VQSVRD0900	9	22	90	10	4	●	1
VQSVRD1000S08	10	22	90	8	4	●	3
VQSVRD1000	10	22	90	10	4	●	2
VQSVRD1200S10	12	27	100	10	4	●	3
VQSVRD1200	12	27	100	12	4	●	2
VQSVRD1400	14	27	130	12	4	●	3
VQSVRD1600	16	33	125	16	4	●	2
VQSVRD1800	18	33	150	16	4	●	3
VQSVRD2000	20	38	140	20	4	●	2

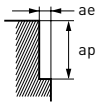
VQSVR

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

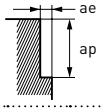
HIGH EFFICIENCY CUTTING CONDITIONS

	P								M	S			M				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
3	16000	960	4.5	1.5	13000	640	4.5	1.5	11000	450	4.5	1.5	8000	330	4.5	0.9	19000	1100	4.5	1.5
4	12000	960	6	2	9500	640	6	2	8000	430	6	2	6000	330	6	1.2	14000	1100	6	2
5	9500	960	7.5	2.5	7600	640	7.5	2.5	6400	440	7.5	2.5	4800	330	7.5	1.5	11000	1100	7.5	2.5
6	8000	960	9	3	6400	680	9	3	5300	480	9	3	4000	360	9	1.8	9500	1100	9	3
7	6800	950	10.5	3.5	5500	730	10.5	3.5	4500	500	10.5	3.5	3400	380	10.5	2.1	8200	1100	10.5	3.5
8	6000	1100	12	4	4800	760	12	4	4000	570	12	4	3000	430	12	2.4	7200	1300	12	4
9	5300	1100	13.5	4.5	4200	760	13.5	4.5	3500	560	13.5	4.5	2700	430	13.5	2.7	6400	1300	13.5	4.5
10	4800	1100	15	5	3800	760	15	5	3200	570	15	5	2400	430	15	3	5700	1200	15	5
12	4000	960	18	6	3200	700	18	6	2700	540	18	6	2000	400	18	3.6	4800	1200	18	6
14	3400	880	21	7	2700	650	21	7	2300	510	21	7	1700	370	21	4.2	4100	1100	21	7
16	3000	840	24	8	2400	620	24	8	2000	500	24	8	1500	380	24	4.8	3600	1000	24	8
18	2700	810	27	9	2100	590	27	9	1800	500	27	9	1300	360	27	5.4	3200	960	27	9
20	2400	760	30	10	1900	560	30	10	1600	510	30	10	1200	380	30	6	2900	920	30	10



GENERAL PURPOSE CUTTING CONDITIONS

	P								M	S			M				N			
Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy			
DC	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)	n (min⁻¹)	Vf (mm/min)	ap (mm)	ae (mm)
3	13000	620	4.5	1.5	11000	430	4.5	1.5	8500	280	4.5	1.5	7400	240	4.5	0.9	15000	720	4.5	1.5
4	9500	610	6	2	8000	430	6	2	6400	280	6	2	5600	240	6	1.2	11000	700	6	2
5	7600	610	7.5	2.5	6400	430	7.5	2.5	5100	280	7.5	2.5	4500	250	7.5	1.5	8900	720	7.5	2.5
6	6400	610	9	3	5300	450	9	3	4200	300	9	3	3700	270	9	1.8	7400	710	9	3
7	5500	620	10.5	3.5	4500	480	10.5	3.5	3600	320	10.5	3.5	3200	290	10.5	2.1	6400	720	10.5	3.5
8	4800	670	12	4	4000	510	12	4	3200	360	12	4	2800	320	12	2.4	5600	780	12	4
9	4200	670	13.5	4.5	3500	500	13.5	4.5	2800	360	13.5	4.5	2500	320	13.5	2.7	5000	800	13.5	4.5
10	3800	670	15	5	3200	510	15	5	2500	360	15	5	2200	310	15	3	4500	790	15	5
12	3200	610	18	6	2700	470	18	6	2100	340	18	6	1900	300	18	3.6	3700	710	18	6
14	2700	560	21	7	2300	440	21	7	1800	320	21	7	1600	280	21	4.2	3200	670	21	7
16	2400	540	24	8	2000	410	24	8	1600	320	24	8	1400	280	24	4.8	2800	630	24	8
18	2100	500	27	9	1800	400	27	9	1400	310	27	9	1200	270	27	5.4	2500	600	27	9
20	1900	480	30	10	1600	380	30	10	1300	330	30	10	1100	280	30	6	2200	560	30	10



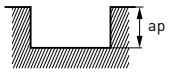
1. VQ coating has less electrical conductivity; therefore an external contact type (electrically transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electrical type) tool setter or a laser type tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

RECOMMENDED CUTTING CONDITIONS

SLOTTING

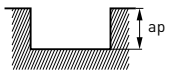
HIGH EFFICIENCY CUTTING CONDITIONS

	P						M		S	M			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Copper, Copper alloy		
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)
3	13000	720	3	11000	440	3	8500	340	3	6400	250	1.5	16000	890	3
4	9500	720	4	8000	450	4	6400	340	4	4800	250	2	12000	910	4
5	7600	720	5	6400	460	5	5100	300	5	3800	230	2.5	9500	900	5
6	6400	720	6	5300	450	6	4200	310	6	3200	240	3	8000	900	6
7	5500	770	7	4500	470	7	3600	330	7	2700	250	3.5	6800	950	7
8	4800	800	8	4000	480	8	3200	350	8	2400	260	4	6000	1000	8
9	4200	810	9	3500	490	9	2800	350	9	2100	260	4.5	5300	1000	9
10	3800	800	10	3200	520	10	2500	340	10	1900	260	5	4800	1000	10
12	3200	750	12	2700	480	12	2100	340	12	1600	260	6	4000	940	12
14	2700	670	14	2300	420	14	1800	300	14	1400	240	7	3400	840	14
16	2400	620	16	2000	380	16	1600	290	16	1200	220	8	3000	780	16
18	2100	570	18	1800	380	18	1400	260	18	1100	210	9	2700	730	18
20	1900	540	20	1600	350	20	1300	260	20	950	190	10	2400	680	20



GENERAL PURPOSE CUTTING CONDITIONS

	P						M		S	M			N		
Material	Carbon steel, Alloy steel, Mild steel			Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel			Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys			Hardened stainless steels, Cobalt chromium alloy			Copper, Copper alloy		
DC	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)
3	11000	490	3	8500	300	3	6400	200	3	5300	170	1.5	13000	580	3
4	8000	490	4	6400	310	4	4800	200	4	4000	170	2	9500	580	4
5	6400	490	5	5100	310	5	3800	180	5	3200	150	2.5	7600	580	5
6	5300	480	6	4200	300	6	3200	190	6	2700	160	3	6400	580	6
7	4500	500	7	3600	320	7	2700	200	7	2300	170	3.5	5500	620	7
8	4000	530	8	3200	330	8	2400	210	8	2000	180	4	4800	640	8
9	3500	540	9	2800	330	9	2100	210	9	1800	180	4.5	4200	650	9
10	3200	540	10	2500	330	10	1900	210	10	1600	180	5	3800	640	10
12	2700	510	12	2100	320	12	1600	210	12	1300	170	6	3200	600	12
14	2300	460	14	1800	300	14	1400	190	14	1100	150	7	2700	540	14
16	2000	410	16	1600	290	16	1200	170	16	990	140	8	2400	500	16
18	1800	390	18	1400	260	18	1100	170	18	880	130	9	2100	460	18
20	1600	360	20	1300	260	20	950	150	20	800	130	10	1900	430	20



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2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

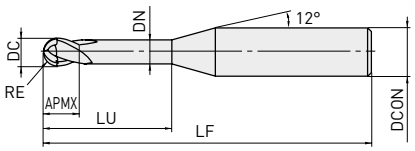
VQ4SVB

45°

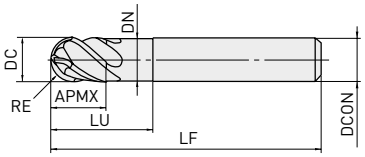
BALL NOSE, SHORT CUT LENGTH, 4 FLUTE, VARIABLE CURVE

P M S N

Type1



Type2



1< R <6			
±0.01			
DC <12			
0 - 0.02			
D4 = 6	8< D4 <10	D4 = 20	
0 - 0.008	0 - 0.009	0 - 0.011	

- 4 flute vibration control ball nose end mill with VQ coating.
- Ideal for finishing.

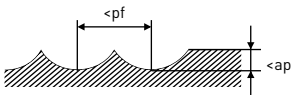
Order Number	DC	RE	APMX	LU	DN	LF	DCON	ZEFP	Stock	Type
VQ4SVBR0100	2	1	3	5	1.9	50	6	4	●	1
VQ4SVBR0150	3	1.5	4.5	7.5	2.9	50	6	4	●	1
VQ4SVBR0200	4	2	6	10	3.9	50	6	4	●	1
VQ4SVBR0250	5	2.5	7.5	12.5	4.9	50	6	4	●	1
VQ4SVBR0300	6	3	9	15	5.85	50	6	4	●	2
VQ4SVBR0400	8	4	12	20	7.85	60	8	4	●	2
VQ4SVBR0500	10	5	15	25	9.7	70	10	4	●	2
VQ4SVBR0600	12	6	18	30	11.7	75	12	4	●	2

VQ4SVB

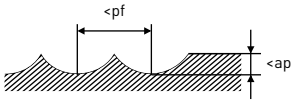
RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING (GROOVING)

Material	P						M						S
	Carbon steel, Alloy steel, Mild steel, Pre-hardened steel						Austenitic stainless steel, Titanium alloy, Hardened stainless steels, Cobalt chromium alloy, Ferritic and Martensitic stainless steels						
RE	α≤15°		α>15°		ap (mm)	pf (mm)	α≤15°		α>15°		ap (mm)	pf (mm)	
	n (min⁻¹)	Vf (mm/min)	n (min⁻¹)	Vf (mm/min)			n (min⁻¹)	Vf (mm/min)	n (min⁻¹)	Vf (mm/min)			
R 1	40000	8000	40000	8000	0.1	0.5	36000	6500	24000	2900	0.1	0.5	
R 1.5	32000	7700	32000	7700	0.2	0.7	24000	4800	16000	1900	0.2	0.7	
R 2	24000	5800	24000	5800	0.3	1	18000	4000	12000	1700	0.3	1	
R 2.5	19000	5300	19000	5300	0.4	1.2	14400	3500	9600	1500	0.4	1.2	
R 3	16000	4800	16000	4800	0.5	1.5	12000	3200	8000	1400	0.5	1.5	
R 4	12000	4300	12000	4300	0.8	2	9000	3200	6000	1400	0.8	2	
R 5	9600	4100	9600	4100	1	2.5	7200	3000	4800	1300	1	2.5	
R 6	8000	4000	8000	4000	1.2	3	6000	3000	4000	1300	1.2	3	



Material	S						N					
	Heat resistant alloys						Copper, Copper alloy					
RE	α≤15°		α>15°		ap (mm)	pf (mm)	α≤15°		α>15°		ap (mm)	pf (mm)
	n (min⁻¹)	Vf (mm/min)	n (min⁻¹)	Vf (mm/min)			n (min⁻¹)	Vf (mm/min)	n (min⁻¹)	Vf (mm/min)		
R 1	9600	960	6400	510	0.08	0.2	40000	8000	38000	4500	0.1	0.5
R 1.5	6400	640	4200	340	0.1	0.3	38000	9100	25000	3800	0.2	0.7
R 2	4800	580	3200	260	0.1	0.4	29000	7000	19000	3300	0.3	1
R 2.5	3800	530	2500	250	0.2	0.5	23000	6400	15000	3100	0.4	1.2
R 3	3200	500	2100	210	0.2	0.6	19000	5700	13000	2600	0.5	1.5
R 4	2400	430	1600	190	0.4	0.8	14000	5000	9600	2300	0.8	2
R 5	2000	420	1300	180	0.5	1	12000	5100	7700	2200	1	2.5
R 6	1700	350	1100	150	0.6	1.2	9600	4800	6400	2200	1.2	3



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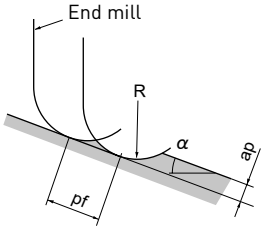
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.



● : Inventory maintained. ★ : Inventory maintained in Japan.

VQT6UR

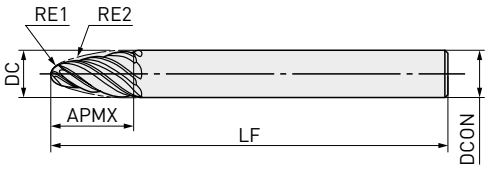
37°
40°

CONICAL TAPER BARREL, MEDIUM CUT LENGTH, 6 FLUTE

P M S N

RE1 ≤4	RE2 ≤100
±0.01	±0.01
DCON ≤10	DCON = 12
0 - 0.009	0 - 0.009

Type1



- Nose and tangential forms have two different radii.
- Irregular pitch flute design prevents chattering.

Order Number	DC	RE1	RE2	APMX	LF	DCON	ZEFP	Stock	Type
VQT6URR020R075S08	8	2	75	21	90	8	6	●	1
VQT6URR020R085S10	10	2	85	26	100	10	6	●	1
VQT6URR030R075S10	10	3	75	22	100	10	6	●	1
VQT6URR040R100S12	12	4	100	25	110	12	6	●	1

1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechical contact type or a laser tool setter.

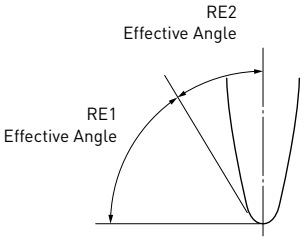
VQT6UR

RECOMMENDED CUTTING CONDITIONS

EFFECTIVE ANGLE

Please refer to the table below for the use of the nose radius RE1 and tangential form radius RE2.

Order Number	Nose Radius		Tangential Form Radius	
	RE1	Effective Angle	RE2	Effective Angle
VQT6URR020R075S08	2	76.6°	75	13.4°
VQT6URR020R085S10	2	74.5°	85	15.5°
VQT6URR030R075S10	3	76.4°	75	13.6°
VQT6URR040R100S12	4	78.3°	100	11.7°

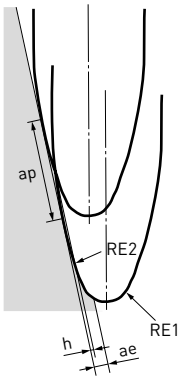


RE2

SIDE MILLING WITH THE USE OF THE TANGENTIAL FORM RADIUS

Material		P				M				S				N			
		Mild Steels (≤180HB) Carbon Steels, Cast Irons (180-280HB)				Austentic Stainless Steels (≤200HB) Titanium Alloys								Aluminium Alloys (Si < 5%)			
DC	RE2	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)					n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
8	75	8000	2400	0.78	0.005-0.3	3200	770	0.78	0.005-0.3					16000	4800	0.78	0.005-0.3
10	85	6400	1900	0.83	0.005-0.3	2500	600	0.83	0.005-0.3					13000	3900	0.83	0.005-0.3
10	75	6400	1900	0.78	0.005-0.3	2500	600	0.78	0.005-0.3					13000	3900	0.78	0.005-0.3
12	100	5300	1600	0.89	0.005-0.3	2100	500	0.89	0.005-0.3					11000	3300	0.89	0.005-0.3

1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechical contact type or a laser tool setter.
2. It is recommended to use this tool only for finish cutting.
3. The tool contact differs between the nose radius and tangential form radius depending on the machining geometries and tilt angles. Select suitable cutting conditions according for the tool contact area.



● : Inventory maintained. ★ : Inventory maintained in Japan.

RECOMMEND CUTTING CONDITIONS

RE2

DEPTH OF CUT CALCULATION TABLE BASED ON TANGENTIAL FORM RADIUS AND CUSP HEIGHT (H)

Material	RE2	Cusp Height h	0.0001	0.0003	0.0005	0.0008	0.001	0.003	0.005	0.008
VQT6URR020R075S08	75	ap	0.245	0.424	0.548	0.693	0.775	1.342	1.732	2.191
VQT6URR020R085S10	75		0.245	0.424	0.548	0.693	0.775	1.342	1.732	2.191
VQT6URR030R075S10	85		0.261	0.452	0.583	0.738	0.825	1.428	1.844	2.332
VQT6URR040R100S12	100		0.283	0.49	0.632	0.8	0.894	1.549	2	2.53

RE1

SIDE MILLING WITH THE USE OF THE NOSE RADIUS

		P				M		S		N			
Material		Mild Steels (≤180HB) Carbon Steels, Cast Irons (180-280HB)				Austentic Stainless Steels (≤200HB) Titanium Alloys				Aluminium Alloys (Si < 5%)			
DC	RE1	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)	n (min^{-1})	Vf (mm/min)	ap (mm)	ae (mm)
8	2	16000	2400	0.4	1	6400	580	0.4	1	32000	4800	0.4	1
10	2	16000	2400	0.4	1	6400	580	0.4	1	32000	4800	0.4	1
10	3	11000	1700	0.6	1.5	4200	380	0.6	1.5	21000	3200	0.6	1.5
12	4	8000	1200	0.8	2	3200	290	0.8	2	16000	2400	0.8	2

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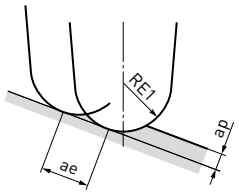

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