B197E

VQ

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

DIAEDGE

MITSUBISHI MATERIALS

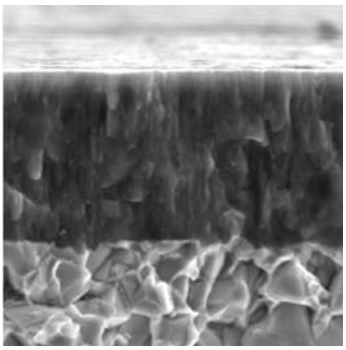
VQ

REVOLUTIONARY PERFORMANCE FOR DIFFICULT TO CUT MATERIALS

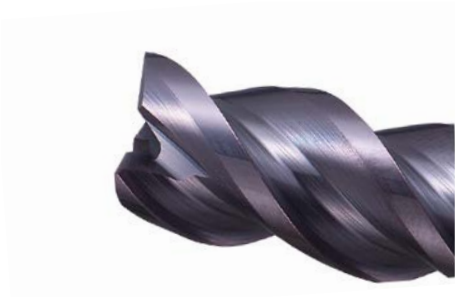
INNOVATIVE TECHNOLOGY

VQ end mills have been treated with a newly developed (Al, Cr)N group coating that 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



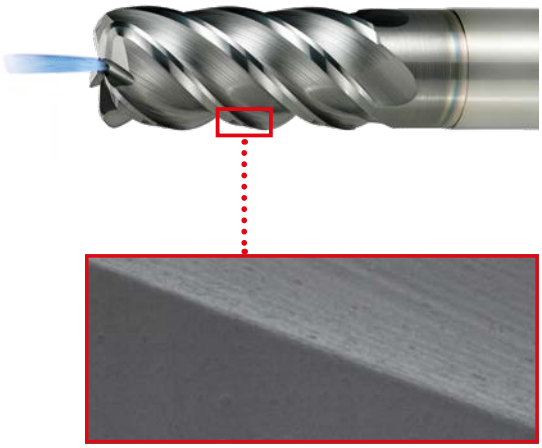
- Smoothened "ZERO-μ Surface".
- Newly developed (Al, Cr)N PVD coating.
- Super-fine-particle, super-hard base material.



Conventional coating

ZERO-μ SURFACE

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



VQ coating

Conventional coating

NEW

VQHVRB

VIBRATION CONTROL CORNER RADIUS END MILLS

Increased feed rates and large depths of cut are achievable with VQHVRB, resulting in highly efficient machining.

SPECIAL GASH

Enables good chip disposal for both increased feed rates and larger depths of cut.

VARIABLE HELIX

Vibration control geometry for smooth, stable cutting.

SMART MIRACLE COATING

Reduced flank wear through the use of SMART MIRACLE coating and an ultra micro-grain cemented carbide substrate.

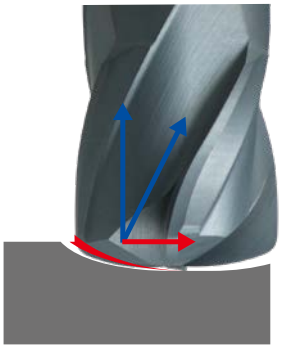
NEW

VQFDRB

DUPLEX RADIUS END MILLS

VQFDRB provides exceptionally long tool life when machining cobalt chrome alloy.

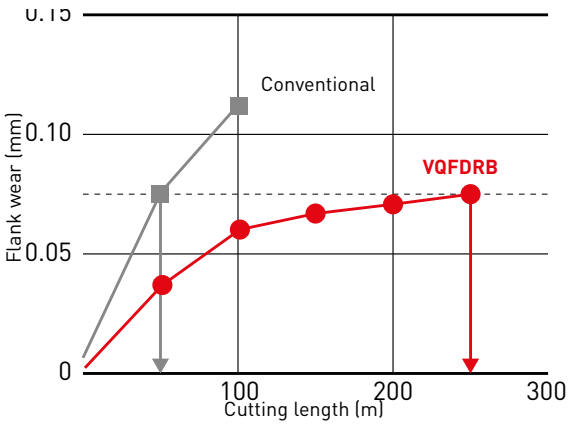
VQFDRB duplex radius end mill provides stable machining with a low radial cutting force.



Improved notch wear due to the reduced side contact of the duplex geometry.

Reduced flank wear through the use of SMART MIRACLE coating and an ultra micro-grain cemented carbide.

VQFDRB gave 5 times longer tool life than a conventional duplex radius end mill when machining cobalt chrome alloy.



NEW

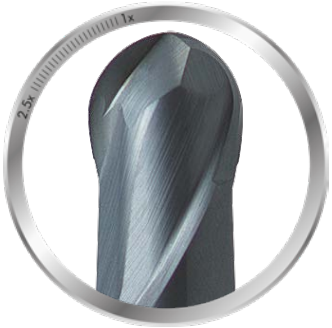
VQ2XLB

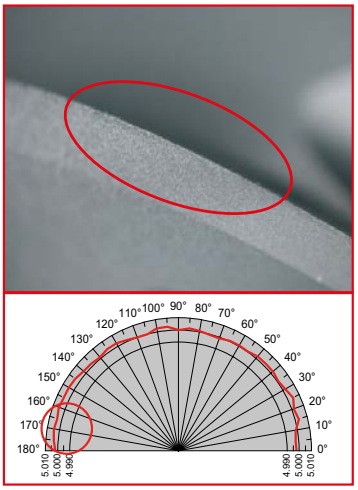
LONG NECK BALL NOSE END MILLS

VQ2XLB provides long tool life and stable cutting when machining cobalt chrome and titanium alloys.

A new cutting edge with a unique, strong S-shaped geometry provides improved resistance to chipping.
High accuracy to ensure precise and reliable machining and consistent workpiece dimensions at all times.

SMART MIRACLE coating providing better wear resistance when machining difficult-to-cut materials.





Radius tolerance	r = ±0.005

NEW

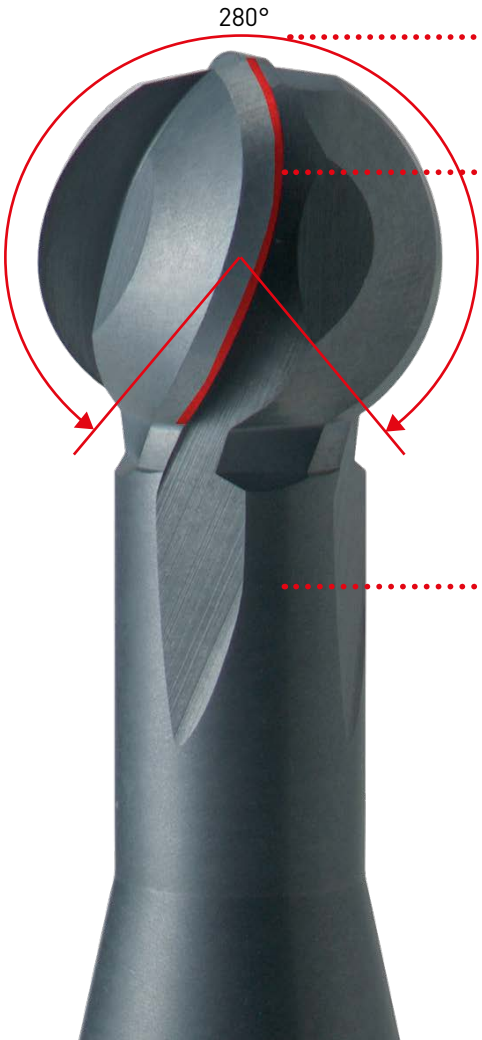
VQ4WB

MULTI-FUNCTIONAL LOLLIPOP END MILL FOR DIFFICULT TO CUT MATERIALS

280º extended cutting zone and special geometry of the cutting edge & rake face realises multi-functional machining over a wide range of applications. the optimal choice for machining undercut and complex shapes when using a 5-axis machine.

HIGH EFFICIENCY

4 flutes, extended cutting edge, specialized geometry and long tool life make for a highly efficient tool.



MULTIPLE-APPLICATIONS

True round ball cutting edge over the full 280º allows stable, accurate machining even during undercut operations.

LOW CUTTING RESISTANCE

Constant edge and rake geometry reduces chattering and helps prevent burrs.

LONG TOOL LIFE

The (AlCr)N based SMART MIRACLE coating provides long tool life when machining carbon steels through to difficult-to-cut materials.

VQ

CLASSIFICATION

Product code		Shape	DC	P	H	M	S	N	
RADIUS END MILLS									
VQT5MVRB	Corner radius, Medium cut length, 5 flute, Irregular helix, With through coolant hole		16-25				◎		9
VQ6MHVRBCH	Corner radius end mill, medium cut length, 6 flute, irregular helix flutes, with multiple internal through coolant holes		10-20			◎	◎		11
VQMHVRB	Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes		2–20	◎		◎	◎	○	13
VQMHVRBF	Corner radius finishing end mill, Medium cut length, 4 flute, Irregular helix flutes		6–16	◎		◎	◎	○	23
NEW **VQHVRB**	Corner radius, Short cut length, 4 flute, Irregular helix flutes		1-4	○		◎	◎	○	26
NEW **VQFDRB**	Duplex corner radius end mill for high speed cutting		3-6	○	○	◎	◎		28
SQUARE END MILLS									
VQ6MHVCH	End mill, medium cut length, 6 flute, irregular helix flutes, with multiple internal through coolant holes		10-20			◎	◎		30
VQXL	End mill, Short cut length, 4 flute, Long neck		0.2–1	◎		◎	◎	○	32
VQMHZV	End mill, Medium cut length, 3 flute for plunging and slotting		1–20	◎		◎	◎	○	36
VQMHZVOH	End mill, Medium cut length, 3 flute for plunging and slotting, with multiple internal through coolant holes		6–16	◎		◎	◎	○	51
VQMHV	End mill, Medium cut length, 4 flute, Irregular helix flutes, Offset types for vertical wall machining and deep applications		1–25	◎		◎	◎	○	56

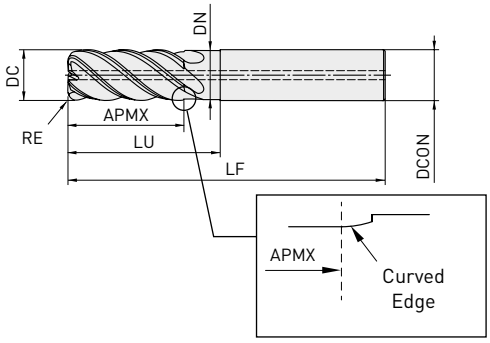
Product code		Shape	DC	P	H	M	S	N	
VQJHV	End mill, Semi-long cut length, 4 flute, Irregular helix flutes		1–20	◎		◎	◎	○	65
VQSVR	Roughing end mill, Short cut length, 4 flute, Irregular helix flutes		3–20	◎		◎	◎	○	68
BALL NOSE END MILLS									
VQ4SVB	Ball nose, Short cut length, 4 flute,Variable curve		1–6	◎		◎	◎	○	77
NEW **VQ2XLB**	Ball nose, Short cut length, 2 flute, Long neck		1-3	○		◎	◎	○	79
NEW **VQ4WB**	Multi-functional Lollipop, Short cut length, 4 flute		1-6	◎		◎	◎	○	81
FORM END MILL									
VQT6UR	Conical taper barrel, Medium cut length, 6 flute		8-12	○		○	◎	○	84

VQT5MVRB

40°
41.5°
43°

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

S



RE
±0.02

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

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

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

Order number	Stock	DC	RE	APMX	LU	DN	LF	DCON	ZEFP
VQT5MVRB160R100N48C	●	16	1	35	48	15.5	120	16	
VQT5MVRB160R300N48C	●	16	3	35	48	15.5	120	16	
VQT5MVRB160R400N48C	●	16	4	35	48	15.5	120	16	
VQT5MVRB200R100N60C	●	20	1	45	60	19.5	135	20	
VQT5MVRB200R300N60C	●	20	3	45	60	19.5	135	20	
VQT5MVRB200R400N60C	●	20	4	45	60	19.5	135	20	5
VQT5MVRB200R600N60C	●	20	6	45	60	19.5	135	20	
VQT5MVRB250R100N75C	●	25	1	55	75	24.5	155	25	
VQT5MVRB250R300N75C	●	25	3	55	75	24.5	155	25	
VQT5MVRB250R400N75C	●	25	4	55	75	24.5	155	25	
VQT5MVRB250R600N75C	●	25	6	55	75	24.5	155	25	

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

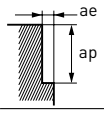
10 Vc

VQT5MVRB

RECOMMENDED CUTTING CONDITIONS

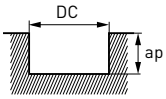
SHOULDER MILLING

	Material	Overhang length DC×3					
		DC	Vc	n	Vf	ap	ae
S	Titanium alloys Ti-6Al-4V etc.	16	80	1600	800	32	2.4
		20	80	1300	650	40	3.0
		25	80	1000	500	50	3.8

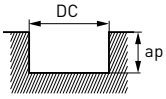


SLOT MILLING

	Material	Depth of cut DC×1					
		RE	DC	Vc	n	Vf	ap
S	Titanium alloys Ti-6Al-4V etc.	1-4	16	60	1200	420	16
			16	60	1200	300	16
			20	60	950	330	20
			20	60	950	238	20
			25	50	640	220	25
			25	50	640	160	25



	Material	Depth of cut DC×2					
		RE	DC	Vc	n	Vf	ap
S	Titanium alloys Ti-6Al-4V etc.	1-4	16	60	1200	240	32
			16	60	1200	180	32
			20	60	950	190	40
			20	60	950	143	40
			25	50	640	130	50
			25	50	640	96	50



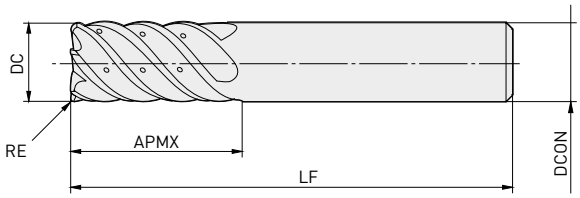
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
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. When machining deep slots where the depth of cut exceeds the diameter DC, use a high strength holder or one equipped with a retaining mechanism. Additionally ensure the clamping and workpiece rigidity are sufficient.

VQ6MHVRBCH

43.5°
45°

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

M S



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

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

Order number	Stock	DC	RE	APMX	LF	DCON	ZEFP
VQ6MHVRBCHD1000R050	●	10	0.5	22	70	10	6
VQ6MHVRBCHD1000R100	●	10	1	22	70	10	
VQ6MHVRBCHD1200R050	●	12	0.5	26	75	12	
VQ6MHVRBCHD1200R100	●	12	1	26	75	12	
VQ6MHVRBCHD1600R100	●	16	1	32	90	16	
VQ6MHVRBCHD1600R300	●	16	3	32	90	16	
VQ6MHVRBCHD1600R400	●	16	4	32	90	16	
VQ6MHVRBCHD2000R100	●	20	1	38	100	20	
VQ6MHVRBCHD2000R300	●	20	3	38	100	20	
VQ6MHVRBCHD2000R400	●	20	4	38	100	20	

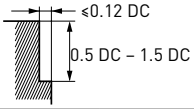
12 Vc

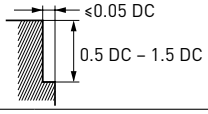
VQ6MHVRBCH

RECOMMENDED CUTTING CONDITIONS

Shoulder Milling

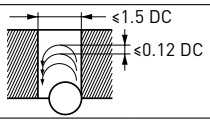
	Material	DC	n	Vf
M	Austenitic stainless steel (<200HB), Titanium alloy	10	4800	2000
		12	4000	2000
		16	3000	1600
		20	2400	1400
S	Heat resistant alloys	10	1300	260
		12	1100	230
		16	800	180
		20	640	150

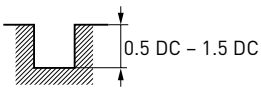
M 

S 

Trochoidal Milling

	Material	DC	n	Vf
M	Austenitic stainless steel (<200HB), Titanium alloy	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.

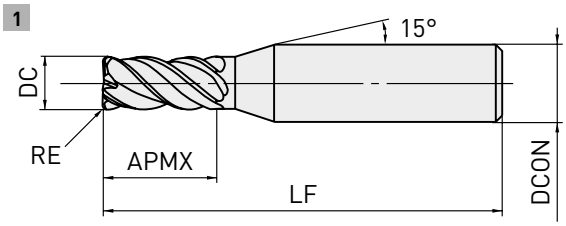
VQMHVRB

37°
40°

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

P M N S

1



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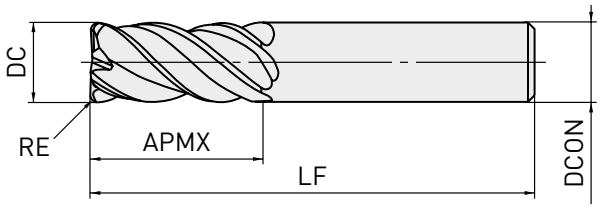


0.2 <R 6.35			
±0.015			
DC <12	DC >12		
0 -0.02	0 -0.03		
4< D4 <6	8< D4 <10	12< D4 <16	D4 = 12
0 -0.008	0 -0.009	0 -0.011	0 -0.013

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

Order number	Stock	DC	RE	APMX	LF	DCON	ZEFP	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

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

VQMHVRB

Order number	Stock	DC	RE	APMX	LF	DCON	ZEFP	Type
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
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

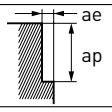
SHOULDER MILLING

HIGH EFFICIENCY CUTTING CONDITIONS

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

VQMHVRB

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



VQMHVRB

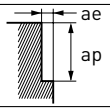
SHOULDER MILLING

GENERAL PURPOSE CUTTING CONDITIONS

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

VQMHVRB

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



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 mechanical contact type or a laser 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.

VQMHVRB

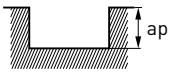
SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	2	24000	1200	2
		3	16000	1500	3
		4	12000	1900	4
		5	9500	1900	5
		6	8000	1900	6
		8	6000	1700	8
		10	4800	1500	10
		12	4000	1300	12
		16	3000	1100	12
		20	2400	860	12
		25	1900	760	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	2	19000	610	2
		3	13000	730	3
		4	9500	910	4
		5	7600	910	5
		6	6400	1000	6
		8	4800	960	8
		10	3800	840	10
		12	3200	770	12
		16	2400	670	12
		20	1900	530	12
		25	1500	420	12
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	2	16000	640	2
		3	11000	660	3
		4	8000	700	4
		5	6400	720	5
		6	5300	740	6
S		8	4000	800	8
		10	3200	900	10
		12	2700	860	12
		16	2000	640	12
		20	1600	510	12
		25	1300	420	12
M	Hardened stainless steels, Cobalt chromium alloy	2	9500	300	1
		3	6400	360	1.5
		4	4800	460	2
		5	3800	460	2.5
		6	3200	510	3
		8	2400	480	4
		10	1900	420	5
		12	1600	380	6
		16	1200	340	8
		20	950	270	10
		25	760	210	12

VQMHVRB

	Material	DC	n	Vf	ap
N	Copper, Copper alloy	2	29000	1500	2
		3	19000	1700	3
		4	14000	2200	4
		5	11000	2200	5
		6	9500	2300	6
		8	7200	2000	8
		10	5700	1800	10
		12	4800	1500	12
		16	3600	1300	12
		20	2900	1000	12
		25	2300	920	12
S	Heat resistant alloys	2	4800	130	0.6
		3	3200	150	0.9
		4	2400	170	1.2
		5	1900	170	1.5
		6	1600	180	1.8
		8	1200	190	2.4
		10	950	210	3
		12	800	200	3.6
		16	600	150	4.8
		20	480	120	6
		25	380	100	7.5



VQMHVRB

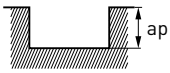
SLOTTING

GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	2	16000	550	2
		3	11000	670	3
		4	8000	840	4
		5	6400	840	5
		6	5300	840	6
		8	4000	740	8
		10	3200	680	10
		12	2700	570	12
		16	2000	480	12
		20	1600	380	12
		25	1300	340	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	2	13000	270	2
		3	8500	310	3
		4	6400	410	4
		5	5100	400	5
		6	4200	440	6
		8	3200	420	8
		10	2500	360	10
		12	2100	330	12
		16	1600	300	12
		20	1300	240	12
		25	1000	180	12
M / S	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	2	9500	250	2
		3	6400	250	3
		4	4800	280	4
		5	3800	280	5
		6	3200	300	6
		8	2400	320	8
		10	1900	350	10
		12	1600	340	12
		16	1200	250	12
		20	950	200	12
		25	760	160	12
M	Hardened stainless steels, Cobalt chromium alloy	2	8000	170	1
		3	5300	200	1.5
		4	4000	250	2
		5	3200	250	2.5
		6	2700	290	3
		8	2000	260	4
		10	1600	230	5
		12	1300	210	6
		16	990	180	8
		20	800	150	10
		25	640	120	12

VQMHVRB

	Material	DC	n	Vf	ap
N	Copper, Copper alloy	2	19000	650	2
		3	13000	790	3
		4	9500	1000	4
		5	7600	1000	5
		6	6400	1000	6
		8	4800	890	8
		10	3800	800	10
		12	3200	680	12
		16	2400	570	12
		20	1900	450	12
		25	1500	400	12
S	Heat resistant alloys	2	4000	74	0.6
		3	2700	86	0.9
		4	2000	93	1.2
		5	1600	95	1.5
		6	1300	96	1.8
		8	990	100	2.4
		10	800	120	3
		12	660	110	3.6
		16	500	84	4.8
		20	400	68	6
		25	320	50	7.5



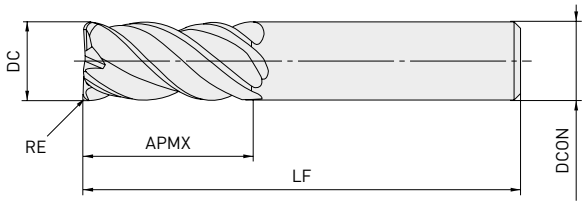
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.

VQMHVRBF

37°
40°

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

P M N S



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

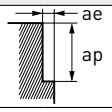
24 Vc

VQMHVRBF

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

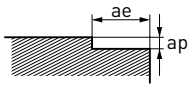
	Material	DC	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel	6	8000	2600	9	0.3
		8	6000	2500	12	0.4
		10	4800	2300	15	0.5
		12	4000	1900	18	0.6
		16	3000	1600	24	0.8
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	6	6400	1300	9	0.3
		8	4800	1300	12	0.4
		10	3800	1200	15	0.5
		12	3200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



VQMHVRBF

FACE MILLING

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



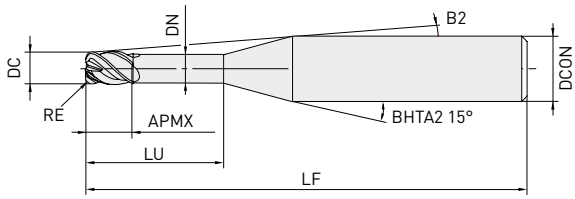
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.

NEW

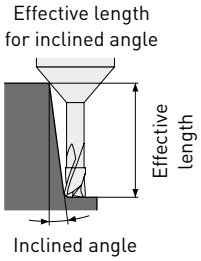
VQHVRB

CORNER RADIUS, SHORT CUT LENGTH, 4 FLUTE, IRREGULAR HELIX FLUTES

S



0.1≤ RE ≤1	+0.01
1≤DC≤4	0 -0.020
DCON=6	0 -0.005



- SMART MIRACLE corner radius end mill for high feed rates and efficient machining.

Order number	Stock	DC	RE	APMX	LF	LU	DN	B2	DCON	ZEFP
VQHVRBD0100R01N080	●	1	0.1	1	50	8	0.94	8.2°	6	4
VQHVRBD0100R01N120	●	1	0.1	1	55	12	0.94	6.7°	6	4
VQHVRBD0200R02N120	●	2	0.2	2	55	12	1.9	5.9°	6	4
VQHVRBD0200R02N160	●	2	0.2	2	60	16	1.9	4.9°	6	4
VQHVRBD0300R05N100	●	3	0.5	3	55	10	2.9	5.6°	6	4
VQHVRBD0300R05N180	●	3	0.5	3	60	18	2.9	3.7°	6	4
VQHVRBD0400R10N120	●	4	1	4	55	12	3.9	3.9°	6	4
VQHVRBD0400R10N200	●	4	1	4	60	20	3.9	2.5°	6	4

27 Vc

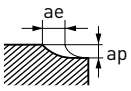
● : Inventory maintained. ★ : Inventory maintained in Japan.

NEW

VQHVRB

RECOMMENDED CUTTING CONDITIONS

	Material	DC	LU	n	Vc	Vf	ap	ae
S	Titanium alloys	1	8	2500	8	500	0.030	0.1
		1	12	2500	8	350	0.030	0.1
		2	12	4800	30	600	0.075	0.3
		2	16	4800	30	340	0.075	0.3
		3	10	8500	80	2400	0.190	1.3
		3	18	8500	80	2000	0.190	1.3
		4	12	6400	80	2000	0.250	1.7
		4	20	6400	80	2000	0.250	1.7
	Cobalt chromium alloys, Precipitation hardening stainless steels	1	8	2500	8	500	0.030	0.1
		1	12	2500	8	350	0.030	0.1
		2	12	4800	30	600	0.075	0.3
		2	16	4800	30	350	0.075	0.3
		3	10	6400	60	2200	0.170	1.3
		3	18	6400	60	1600	0.170	1.3
		4	12	4800	60	1800	0.220	1.7
		4	20	4800	60	1800	0.220	1.7



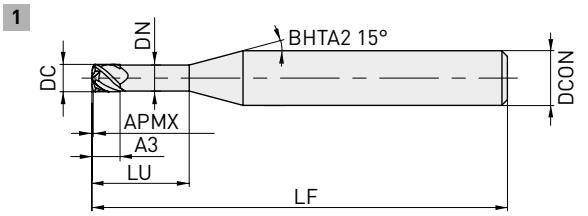
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
3. If the depth of cut is smaller, the revolution and the feed rate can be increased.
4. 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 material installation is poor, vibration or abnormal sound can occur. In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.

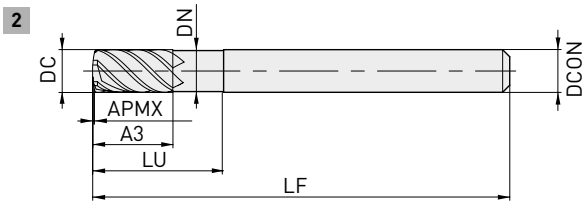
NEW

VQFDRB

DUPLEX CORNER RADIUS END MILL FOR HIGH SPEED CUTTING

S



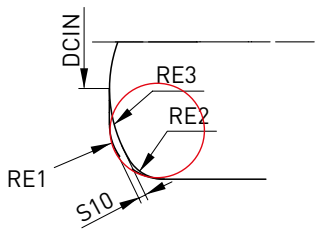


1≤DC≤4
0 -0.020
DCON=6
0 -0.005

- Duplex corner radius type allows a higher, more efficient feed rate.
- High feed cutting realized through the use of multiple flutes.

Order number	Stock	DC	RE1	APMX	LF	A3	LU	DN	DCON	ZEFP	RMPX	Multi-task radius part				Type
												S10	DCIN	RE2	RE3	
VQFDRBD0300N080	●	3	0.64	0.18	50	3	8	2.8	6	4	2.1	0.08	0.75	0.5	2	1
VQFDRBD0300N120	●	3	0.64	0.18	55	3	12	2.8	6	4	2.1	0.08	0.75	0.5	2	1
VQFDRBD0400N120	●	4	0.71	0.25	55	4	12	3.8	6	4	1.9	0.13	1	0.5	3	1
VQFDRBD0400N160	●	4	0.71	0.25	60	4	16	3.8	6	4	1.9	0.13	1	0.5	3	1
VQFDRBD0600N180	●	6	0.92	0.36	60	6	18	5.6	6	4	1.7	0.21	1.5	0.6	5	2

29 Vc



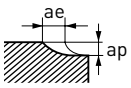
● : Inventory maintained. ★ : Inventory maintained in Japan.

NEW

VQFDRB

RECOMMENDED CUTTING CONDITIONS

	Material	DC	n	Vc	Vf	ap	ae
S	Titanium alloys	3	8500	80	2100	0.2	1.3
		4	6400	80	2200	0.2	1.7
		6	4200	80	1400	0.3	2.0
	Cobalt chromium alloys, Precipitation hardening stainless steels	3	6400	60	3000	0.2	1.3
		4	4800	60	2700	0.2	1.7
		6	3200	60	2100	0.3	2.6
	Heat resistant alloys	3	3200	30	770	0.2	0.6
		4	2400	30	770	0.2	0.8
		6	1600	30	520	0.3	1.3



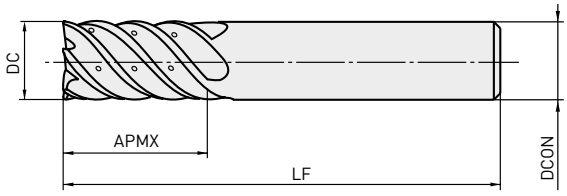
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
3. If the depth of cut is smaller, the revolution and the feed rate can be increased.

VQ6MHVCH

43.5°
45°

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

M S



DC ≤12	DC >12
0 -0.020	0 -0.030

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

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

Order number	Stock	DC	APMX	LF	DCON	ZEFP
VQ6MHVCHD1000	●	10	22	70	10	6
VQ6MHVCHD1200	●	12	26	75	12	
VQ6MHVCHD1600	●	16	32	90	16	
VQ6MHVCHD2000	●	20	38	100	20	

31 Vc

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

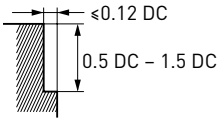
VQ6MHVCH

RECOMMENDED CUTTING CONDITIONS

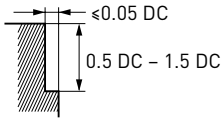
Shoulder Milling

	Material	DC	n	Vf
M	Austenitic stainless steel (<200HB), Titanium alloy	10	4800	2000
		12	4000	2000
		16	3000	1600
		20	2400	1400
S	Heat resistant alloys	10	1300	260
		12	1100	230
		16	800	180
		20	640	150

M

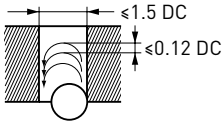


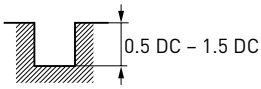
S



Trochoidal Milling

	Material	DC	n	Vf
M	Austenitic stainless steel (<200HB), Titanium alloy	10	4800	1400
		12	4000	1200
		16	3000	1100
		20	2400	900





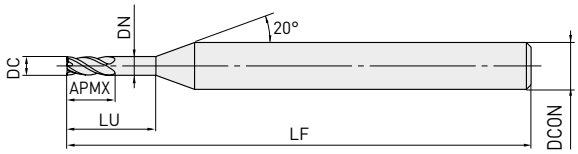
1. If the depth of cut is shallow, the revolution and feed rate can be increased.
2. The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills.
   However, if the rigidity of the machine or the workpiece installation is very low, then vibration 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 N S



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

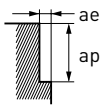
● : Inventory maintained. ★ : Inventory maintained in Japan.

VQXL

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

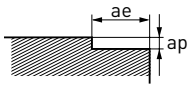
	Material	DC	LU	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steels, Titanium alloys, Cobalt chromium alloy, Copper, Copper alloy	0.2	0.6	40000	360	0.03	0.01
		0.3	0.9	40000	480	0.04	0.01
		0.3	1.5	40000	360	0.04	0.01
M		0.4	1.2	40000	800	0.06	0.02
		0.4	2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



VQXL

FACE MILLING

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

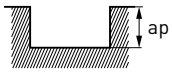


1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.

VQXL

SLOTTING

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



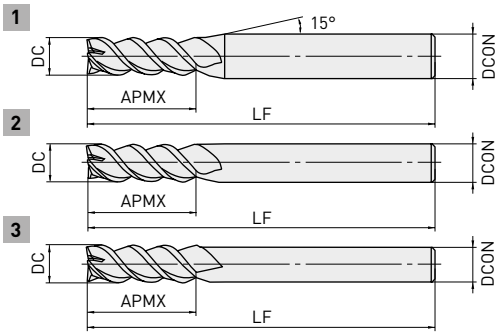
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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 N S



DC <12	DC >12
0 -0.02	0 -0.03

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

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

Order number	Stock	DC	APMX	LF	DCON	ZEFP	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

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

VQMHZV

Order number	Stock	DC	APMX	LF	DCON	ZEFP	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

VQMHZV

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING / HIGH EFFICIENCY CUTTING CONDITIONS

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

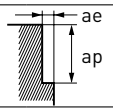
VQMHZV

GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel	1	32000	480	1.5	0.2
		1.5	25000	740	2.2	0.3
		2	19000	940	3	0.6
		3	13000	1000	4.5	0.9
		4	9500	1000	6	1.2
		5	7600	980	7.5	1.5
		6	6400	1000	9	1.8
		8	4800	1000	12	2.4
		10	3800	900	15	3
		12	3200	760	18	3.6
		16	2400	640	24	4.8
		20	1900	510	30	6
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	1	25000	350	1.5	0.2
		1.5	21000	420	2.2	0.3
		2	16000	480	3	0.6
		3	11000	520	4.5	0.9
		4	8000	520	6	1.2
		5	6400	530	7.5	1.5
		6	5300	520	9	1.8
		8	4000	550	12	2.4
		10	3200	510	15	3
		12	2700	480	18	3.6
		16	2000	400	24	4.8
		20	1600	320	30	6
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	1	19000	280	1.5	0.2
		1.5	17000	340	2.2	0.3
		2	13000	330	3	0.6
		3	8500	340	4.5	0.9
		4	6400	350	6	1.2
		5	5100	350	7.5	1.5
		6	4200	290	9	1.8
		8	3200	310	12	2.4
		10	2500	500	15	3
		12	2100	460	18	3.6
		16	1600	250	24	4.8
		20	1300	200	30	6
S						

VQMHZV

	Material	DC	n	Vf	ap	ae
M	Hardened stainless steels, Cobalt chromium alloy	1	16000	220	1.5	0.1
		1.5	14000	280	2.2	0.1
		2	11000	330	3	0.4
		3	7400	350	4.5	0.6
		4	5600	370	6	0.8
		5	4500	370	7.5	1
		6	3700	370	9	1.2
		8	2800	390	12	1.6
		10	2200	350	15	2
		12	1900	340	18	2.4
		16	1400	280	24	3.2
		20	1100	220	30	4



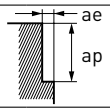
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.

VQMHZV

SHOULDER MILLING

HIGH EFFICIENCY CUTTING CONDITIONS

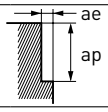
	Material	DC	n	Vf	ap	ae
N	Copper, Copper alloy	1	38000	860	1.5	0.2
		1.5	32000	1400	2.2	0.3
		2	29000	2200	3	0.6
		3	19000	2300	4.5	0.9
		4	14000	2300	6	1.2
		5	11000	2100	7.5	1.5
		6	9500	2300	9	1.8
		8	7200	2300	12	2.4
		10	5700	2100	15	3
		12	4800	1700	18	3.6
		16	3600	1500	24	4.8
		20	2900	1200	30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



VQMHZV

GENERAL PURPOSE CUTTING CONDITIONS

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



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 mechanical contact type or a laser tool setter.
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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.

VQMHZV

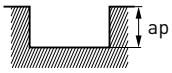
SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	1	32000	380	0.5
		1.5	28000	590	0.7
		2	24000	940	2
		3	16000	1100	3
		4	12000	1400	4
		5	9500	1400	5
		6	8000	1400	6
		8	6000	1300	8
		10	4800	1200	10
		12	4000	960	12
		16	3000	810	12
		20	2400	650	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	1	25000	150	0.5
		1.5	21000	250	0.7
		2	19000	460	2
		3	13000	550	3
		4	9500	680	4
		5	7600	680	5
		6	6400	770	6
		8	4800	720	8
		10	3800	630	10
		12	3200	580	12
		16	2400	500	12
		20	1900	400	12
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	1	19000	100	0.5
		1.5	18000	220	0.7
		2	16000	480	2
		3	11000	500	3
		4	8000	530	4
		5	6400	540	5
		6	5300	560	6
		8	4000	600	8
		10	3200	670	10
S		12	2700	650	12
		16	2000	480	12
		20	1600	380	12
M	Hardened stainless steels, Cobalt chromium alloy	1	14000	80	0.3
		1.5	12000	140	0.4
		2	9500	230	1
		3	6400	270	1.5
		4	4800	350	2
		5	3800	340	2.5
		6	3200	380	3
		8	2400	360	4
		10	1900	310	5
		12	1600	290	6
		16	1200	250	8
		20	950	200	10

VQMHZV

	Material	DC	n	Vf	ap
N	Copper, Copper alloy	1	38000	460	0.5
		1.5	32000	670	0.7
		2	29000	1100	2
		3	19000	1300	3
		4	14000	1700	4
		5	11000	1700	5
		6	9500	1700	6
		8	7200	1500	8
		10	5700	1400	10
		12	4800	1200	12
		16	3600	970	12
		20	2900	780	12
S	Heat resistant alloys	1	9500	60	0.2
		1.5	6400	80	0.3
		2	4800	100	0.6
		3	3200	120	0.9
		4	2400	130	1.2
		5	1900	130	1.5
		6	1600	130	1.8
		8	1200	140	2.4
		10	950	160	3
		12	800	150	3.6
		16	600	120	4.8
		20	480	90	6



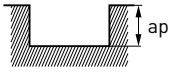
VQMHZV

GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	1	32000	250	0.5
		1.5	21000	290	0.7
		2	16000	410	2
		3	11000	500	3
		4	8000	630	4
		5	6400	630	5
		6	5300	630	6
		8	4000	550	8
		10	3200	510	10
		12	2700	430	12
		16	2000	360	12
		20	1600	290	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	1	25000	99	0.5
		1.5	17000	130	0.7
		2	13000	210	2
		3	8500	240	3
		4	6400	300	4
		5	5100	300	5
		6	4200	330	6
		8	3200	320	8
		10	2500	270	10
		12	2100	250	12
		16	1600	220	12
		20	1300	180	12
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	1	19000	80	0.5
		1.5	13000	100	0.7
		2	9500	190	2
		3	6400	190	3
		4	4800	210	4
		5	3800	210	5
		6	3200	220	6
S		8	2400	240	8
		10	1900	260	10
		12	1600	250	12
		16	1200	190	12
		20	950	150	12
M	Hardened stainless steels, Cobalt chromium alloy	1	14000	60	0.3
		1.5	11000	87	0.4
		2	8000	130	1
		3	5300	150	1.5
		4	4000	190	2
		5	3200	190	2.5
		6	2700	210	3
		8	2000	200	4
		10	1600	170	5
		12	1300	150	6
		16	990	140	8
		20	800	110	10

VQMHZV

	Material	DC	n	Vf	ap
N	Copper, Copper alloy	1	38000	300	0.5
		1.5	25000	350	0.7
		2	19000	490	2
		3	13000	590	3
		4	9500	750	4
		5	7600	750	5
		6	6400	760	6
		8	4800	670	8
		10	3800	600	10
		12	3200	510	12
		16	2400	430	12
		20	1900	340	12
S	Heat resistant alloys	1	8000	30	0.2
		1.5	5300	40	0.3
		2	4000	55	0.6
		3	2700	64	0.9
		4	2000	70	1.2
		5	1600	71	1.5
		6	1300	72	1.8
		8	990	78	2.4
		10	800	89	3
		12	660	84	3.6
		16	500	63	4.8
		20	400	50	6



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

VQMHZV

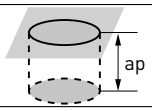
PLUNGING

HIGH EFFICIENCY CUTTING CONDITIONS

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

VQMHZV

	Material	DC	n	Vf	ap	p
N	Copper, Copper alloy	1	24000	190	0.5	0.1
		1.5	21000	320	0.7	0.3
		2	19000	570	2	0.5
		3	13000	780	3	0.9
		4	9500	950	4	2
		5	7600	1100	5	2.5
		6	6400	1200	6	3
		8	4800	860	8	4
		10	3800	680	10	5
		12	3200	580	12	5
		16	2400	430	16	5
		20	1900	340	20	5



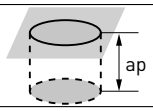
VQMHZV

GENERAL PURPOSE CUTTING CONDITIONS

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

VQMHZV

	Material	DC	n	Vf	ap	p
N	Copper, Copper alloy	1	24000	190	0.5	0.05
		1.5	21000	320	0.7	0.1
		2	19000	570	2	0.2
		3	13000	780	3	0.3
		4	9500	950	4	0.4
		5	7600	1100	5	0.5
		6	6400	1200	6	0.6
		8	4800	860	8	0.7
		10	3800	680	10	0.7
		12	3200	580	12	0.7
		16	2400	430	16	0.7
		20	1900	340	20	0.7



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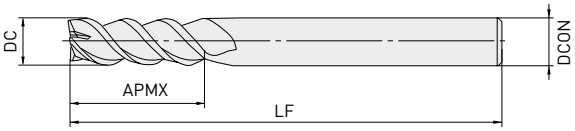
VQMHZVOH

42°
43.5°
45°

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

P M N S



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

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

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

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

52 Vc

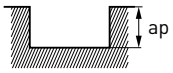
VQMHZVOH

RECOMMENDED CUTTING CONDITIONS

SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

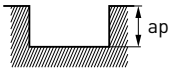
	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	6	8000	1400	6
		8	6000	1300	8
		10	4800	1200	10
		12	4000	960	12
		16	3000	810	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	6	6400	770	6
		8	4800	720	8
		10	3800	630	10
		12	3200	580	12
		16	2400	500	12
M / S	Austenitic,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



VQMHZVOH

GENERAL PURPOSE CUTTING CONDITIONS

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



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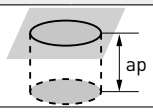
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion coolant.
3. Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
4.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

VQMHZVOH

PLUNGING

HIGH EFFICIENCY CUTTING CONDITIONS

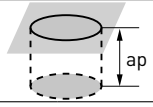
	Material	DC	n	Vf	ap	p
P	Carbon steel, Alloy steel, Mild steel	6	5300	950	9	3
		8	4000	720	12	4
		10	3200	580	15	5
		12	2700	490	18	5
		16	2000	360	24	5
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	6	3700	440	9	1.2
		8	2800	340	12	1.6
		10	2200	260	15	2.5
		12	1900	230	18	3
		16	1400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



VQMHZVOH

GENERAL PURPOSE CUTTING CONDITIONS

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



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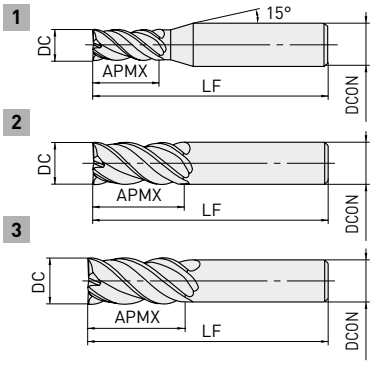
VQMHV

37°
40°

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

P M N S

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



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

Order number	Stock	DC	APMX	LF	DCON	ZEFP	Type
VQMHVD0100	●	1	2	45	4	4	1
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

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

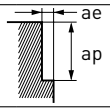
VQMHV

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

HIGH EFFICIENCY CUTTING CONDITIONS

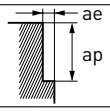
	Material	DC	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel	2	24000	2400	3	0.6
		3	16000	2600	4.5	0.9
		4	12000	2600	6	1.2
		5	9500	2500	7.5	1.5
		6	8000	2600	9	1.8
		8	6000	2500	12	2.4
		10	4800	2300	15	3
		12	4000	1900	18	3.6
		16	3000	1600	24	4.8
		20	2400	1300	30	6
		25	1900	1100	37	7.5
	Pre-hardened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



VQMHV

GENERAL PURPOSE CUTTING CONDITIONS

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



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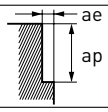
4. When the depth of cut is smaller than shown the revolution and feed rate can be increased.

VQMHV

SHOULDER MILLING

HIGH EFFICIENCY CUTTING CONDITIONS

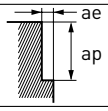
	Material	DC	n	Vf	ap	ae
N	Copper, Copper alloy	2	29000	2900	3	0.6
		3	19000	3000	4.5	0.9
		4	14000	3100	6	1.2
		5	11000	2900	7.5	1.5
		6	9500	3000	9	1.8
		8	7200	3000	12	2.4
		10	5700	2700	15	3
		12	4800	2300	18	3.6
		16	3600	1900	24	4.8
		20	2900	1600	30	6
		25	2300	1300	37	7.5
S	Heat resistant alloys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



VQMHV

GENERAL PURPOSE CUTTING CONDITIONS

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



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

VQMHV

SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	2	24000	1200	2
		3	16000	1500	3
		4	12000	1900	4
		5	9500	1900	5
		6	8000	1900	6
		8	6000	1700	8
		10	4800	1500	10
		12	4000	1300	12
		16	3000	1100	12
		20	2400	860	12
		25	1900	760	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	2	19000	610	2
		3	13000	730	3
		4	9500	910	4
		5	7600	910	5
		6	6400	1000	6
		8	4800	960	8
		10	3800	840	10
		12	3200	770	12
		16	2400	670	12
		20	1900	530	12
		25	1500	420	12
M / S	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	2	16000	640	2
		3	11000	660	3
		4	8000	700	4
		5	6400	720	5
		6	5300	740	6
		8	4000	800	8
		10	3200	900	10
		12	2700	860	12
		16	2000	640	12
		20	1600	510	12
		25	1300	420	12
M	Hardened stainless steels, Cobalt chromium alloy	2	9500	300	1
		3	6400	360	1.5
		4	4800	460	2
		5	3800	460	2.5
		6	3200	510	3
		8	2400	480	4
		10	1900	420	5
		12	1600	380	6
		16	1200	340	8
		20	950	270	10
		25	760	210	12

VQMHV

SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

	Material	DC	n	Vf	ap
N	Copper, Copper alloy	2	29000	1500	2
		3	19000	1700	3
		4	14000	2200	4
		5	11000	2200	5
		6	9500	2300	6
		8	7200	2000	8
		10	5700	1800	10
		12	4800	1500	12
		16	3600	1300	12
		20	2900	1000	12
		25	2300	920	12
S	Heat resistant alloys	2	4800	130	0.6
		3	3200	150	0.9
		4	2400	170	1.2
		5	1900	170	1.5
		6	1600	180	1.8
		8	1200	190	2.4
		10	950	210	3
		12	800	200	3.6
		16	600	150	4.8
		20	480	120	6
		25	380	100	7.5

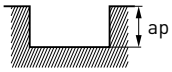
VQMHV

GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	2	16000	550	2
		3	11000	670	3
		4	8000	840	4
		5	6400	840	5
		6	5300	840	6
		8	4000	740	8
		10	3200	680	10
		12	2700	570	12
		16	2000	480	12
		20	1600	380	12
		25	1300	340	12
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	2	13000	270	2
		3	8500	310	3
		4	6400	410	4
		5	5100	400	5
		6	4200	440	6
		8	3200	420	8
		10	2500	360	10
		12	2100	330	12
		16	1600	300	12
		20	1300	240	12
		25	1000	180	12
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	2	9500	250	2
		3	6400	250	3
		4	4800	280	4
		5	3800	280	5
		6	3200	300	6
		8	2400	320	8
S		10	1900	350	10
		12	1600	340	12
		16	1200	250	12
		20	950	200	12
		25	760	160	12
M	Hardened stainless steels, Cobalt chromium alloy	2	8000	170	1
		3	5300	200	1.5
		4	4000	250	2
		5	3200	250	2.5
		6	2700	290	3
		8	2000	260	4
		10	1600	230	5
		12	1300	210	6
		16	990	180	8
		20	800	150	10
		25	640	120	12

VQMHV

	Material	DC	n	Vf	ap
N	Copper, Copper alloy	2	19000	650	2
		3	13000	790	3
		4	9500	1000	4
		5	7600	1000	5
		6	6400	1000	6
		8	4800	890	8
		10	3800	800	10
		12	3200	680	12
		16	2400	570	12
		20	1900	450	12
		25	1500	400	12
S	Heat resistant alloys	2	4000	74	0.6
		3	2700	86	0.9
		4	2000	93	1.2
		5	1600	95	1.5
		6	1300	96	1.8
		8	990	100	2.4
		10	800	120	3
		12	660	110	3.6
		16	500	84	4.8
		20	400	68	6
		25	320	50	7.5



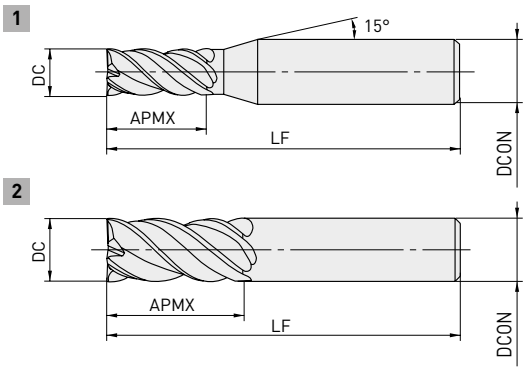
1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.

VQJHV

38° 40° DC<6 | 37.5° 40° DC>6

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

P M N S



DC <12	DC >12		
0 -0.020	0 -0.030		
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	Stock	DC	APMX	LF	DCON	ZEFP	Type
VQJHVD0100	●	1	4	45	4	4	1
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

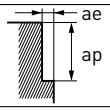
66 Vc

VQJHV

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

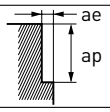
	Material	DC	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel	2	21000	700	5	0.2
		3	14000	960	7.5	0.3
		4	10000	1000	10	0.4
		5	8300	1100	12.5	0.5
		6	6900	1200	15	0.6
		8	5200	1200	20	0.8
		10	4100	1100	25	1
		12	3400	1100	30	1.2
		16	2600	920	40	1.6
		20	2100	820	50	2
	Pre-hardened steel, Carbon steel,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



VQJHV

SHOULDER MILLING

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



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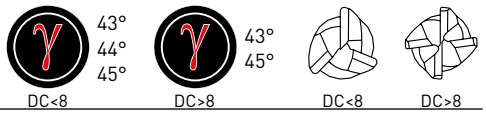
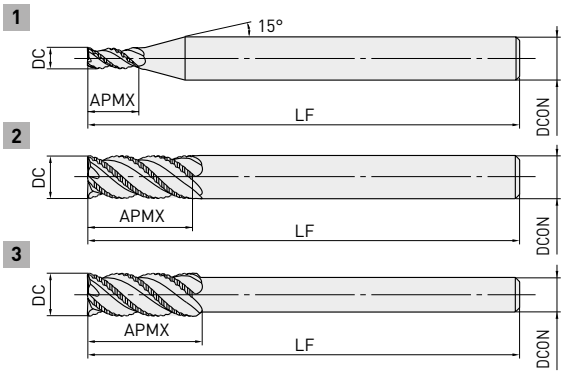
VQSVR



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

P M N S



h6

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

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

Order number	Stock	DC	APMX	LF	DCON	ZEFP	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

69 Vc

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

VQSVR

RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING

HIGH EFFICIENCY CUTTING CONDITIONS

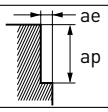
	Material	DC	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel	3	16000	960	4.5	1.5
		4	12000	960	6	2
		5	9500	960	7.5	2.5
		6	8000	960	9	3
		7	6800	950	10.5	3.5
		8	6000	1100	12	4
		9	5300	1100	13.5	4.5
		10	4800	1100	15	5
		12	4000	960	18	6
		14	3400	880	21	7
		16	3000	840	24	8
		18	2700	810	27	9
		20	2400	760	30	10
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	3	13000	640	4.5	1.5
		4	9500	640	6	2
		5	7600	640	7.5	2.5
		6	6400	680	9	3
		7	5500	730	10.5	3.5
		8	4800	760	12	4
		9	4200	760	13.5	4.5
		10	3800	760	15	5
		12	3200	700	18	6
		14	2700	650	21	7
		16	2400	620	24	8
		18	2100	590	27	9
		20	1900	560	30	10
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	3	11000	450	4.5	1.5
		4	8000	430	6	2
		5	6400	440	7.5	2.5
		6	5300	480	9	3
		7	4500	500	10.5	3.5
		8	4000	570	12	4
S		9	3500	560	13.5	4.5
		10	3200	570	15	5
		12	2700	540	18	6
		14	2300	510	21	7
		16	2000	500	24	8
		18	1800	500	27	9
		20	1600	510	30	10

VQSVR

SHOULDER MILLING

HIGH EFFICIENCY CUTTING CONDITIONS

	Material	DC	n	Vf	ap	ae
M	Hardened stainless steels, Cobalt chromium alloy	3	8000	330	4.5	0.9
		4	6000	330	6	1.2
		5	4800	330	7.5	1.5
		6	4000	360	9	1.8
		7	3400	380	10.5	2.1
		8	3000	430	12	2.4
		9	2700	430	13.5	2.7
		10	2400	430	15	3
		12	2000	400	18	3.6
		14	1700	370	21	4.2
		16	1500	380	24	4.8
		18	1300	360	27	5.4
		20	1200	380	30	6
N	Copper, Copper alloy	3	19000	1100	4.5	1.5
		4	14000	1100	6	2
		5	11000	1100	7.5	2.5
		6	9500	1100	9	3
		7	8200	1100	10.5	3.5
		8	7200	1300	12	4
		9	6400	1300	13.5	4.5
		10	5700	1200	15	5
		12	4800	1200	18	6
		14	4100	1100	21	7
		16	3600	1000	24	8
		18	3200	960	27	9
		20	2900	920	30	10



VQSVR

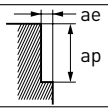
GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap	ae
P	Carbon steel, Alloy steel, Mild steel	3	13000	620	4.5	1.5
		4	9500	610	6	2
		5	7600	610	7.5	2.5
		6	6400	610	9	3
		7	5500	620	10.5	3.5
		8	4800	670	12	4
		9	4200	670	13.5	4.5
		10	3800	670	15	5
		12	3200	610	18	6
		14	2700	560	21	7
		16	2400	540	24	8
		18	2100	500	27	9
		20	1900	480	30	10
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	3	11000	430	4.5	1.5
		4	8000	430	6	2
		5	6400	430	7.5	2.5
		6	5300	450	9	3
		7	4500	480	10.5	3.5
		8	4000	510	12	4
		9	3500	500	13.5	4.5
		10	3200	510	15	5
		12	2700	470	18	6
		14	2300	440	21	7
		16	2000	410	24	8
		18	1800	400	27	9
		20	1600	380	30	10
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	3	8500	280	4.5	1.5
		4	6400	280	6	2
		5	5100	280	7.5	2.5
		6	4200	300	9	3
		7	3600	320	10.5	3.5
		8	3200	360	12	4
S		9	2800	360	13.5	4.5
		10	2500	360	15	5
		12	2100	340	18	6
		14	1800	320	21	7
		16	1600	320	24	8
		18	1400	310	27	9
		20	1300	330	30	10

VQSVR

GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap	ae
M	Hardened stainless steels, Cobalt chromium alloy	3	7400	240	4.5	0.9
		4	5600	240	6	1.2
		5	4500	250	7.5	1.5
		6	3700	270	9	1.8
		7	3200	290	10.5	2.1
		8	2800	320	12	2.4
		9	2500	320	13.5	2.7
		10	2200	310	15	3
		12	1900	300	18	3.6
		14	1600	280	21	4.2
		16	1400	280	24	4.8
		18	1200	270	27	5.4
		20	1100	280	30	6
N	Copper, Copper alloy	3	15000	720	4.5	1.5
		4	11000	700	6	2
		5	8900	720	7.5	2.5
		6	7400	710	9	3
		7	6400	720	10.5	3.5
		8	5600	780	12	4
		9	5000	800	13.5	4.5
		10	4500	790	15	5
		12	3700	710	18	6
		14	3200	670	21	7
		16	2800	630	24	8
		18	2500	600	27	9
		20	2200	560	30	10



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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.

VQSVR

SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

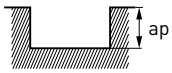
	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	3	13000	720	3
		4	9500	720	4
		5	7600	720	5
		6	6400	720	6
		7	5500	770	7
		8	4800	800	8
		9	4200	810	9
		10	3800	800	10
		12	3200	750	12
		14	2700	670	14
		16	2400	620	16
		18	2100	570	18
		20	1900	540	20
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	3	11000	440	3
		4	8000	450	4
		5	6400	460	5
		6	5300	450	6
		7	4500	470	7
		8	4000	480	8
		9	3500	490	9
		10	3200	520	10
		12	2700	480	12
		14	2300	420	14
		16	2000	380	16
		18	1800	380	18
		20	1600	350	20
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	3	8500	340	3
		4	6400	340	4
		5	5100	300	5
		6	4200	310	6
		7	3600	330	7
		8	3200	350	8
S		9	2800	350	9
		10	2500	340	10
		12	2100	340	12
		14	1800	300	14
		16	1600	290	16
		18	1400	260	18
		20	1300	260	20

VQSVR

SLOTTING

HIGH EFFICIENCY CUTTING CONDITIONS

	Material	DC	n	Vf	ap
M	Hardened stainless steels, Cobalt chromium alloy	3	6400	250	1.5
		4	4800	250	2
		5	3800	230	2.5
		6	3200	240	3
		7	2700	250	3.5
		8	2400	260	4
		9	2100	260	4.5
		10	1900	260	5
		12	1600	260	6
		14	1400	240	7
		16	1200	220	8
		18	1100	210	9
		20	950	190	10
N	Copper, Copper alloy	3	16000	890	3
		4	12000	910	4
		5	9500	900	5
		6	8000	900	6
		7	6800	950	7
		8	6000	1000	8
		9	5300	1000	9
		10	4800	1000	10
		12	4000	940	12
		14	3400	840	14
		16	3000	780	16
		18	2700	730	18
		20	2400	680	20



VQSVR

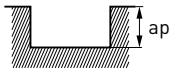
GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap
P	Carbon steel, Alloy steel, Mild steel	3	11000	490	3
		4	8000	490	4
		5	6400	490	5
		6	5300	480	6
		7	4500	500	7
		8	4000	530	8
		9	3500	540	9
		10	3200	540	10
		12	2700	510	12
		14	2300	460	14
		16	2000	410	16
		18	1800	390	18
		20	1600	360	20
	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel	3	8500	300	3
		4	6400	310	4
		5	5100	310	5
		6	4200	300	6
		7	3600	320	7
		8	3200	330	8
		9	2800	330	9
		10	2500	330	10
		12	2100	320	12
		14	1800	300	14
		16	1600	290	16
		18	1400	260	18
		20	1300	260	20
M	Austenitic, Ferritic and martensitic stainless steels, Titanium alloys	3	6400	200	3
		4	4800	200	4
		5	3800	180	5
		6	3200	190	6
		7	2700	200	7
		8	2400	210	8
S		9	2100	210	9
		10	1900	210	10
		12	1600	210	12
		14	1400	190	14
		16	1200	170	16
		18	1100	170	18
		20	950	150	20

VQSVR

GENERAL PURPOSE CUTTING CONDITIONS

	Material	DC	n	Vf	ap
M	Hardened stainless steels, Cobalt chromium alloy	3	5300	170	1.5
		4	4000	170	2
		5	3200	150	2.5
		6	2700	160	3
		7	2300	170	3.5
		8	2000	180	4
		9	1800	180	4.5
		10	1600	180	5
		12	1300	170	6
		14	1100	150	7
		16	990	140	8
		18	880	130	9
		20	800	130	10
N	Copper, Copper alloy	3	13000	580	3
		4	9500	580	4
		5	7600	580	5
		6	6400	580	6
		7	5500	620	7
		8	4800	640	8
		9	4200	650	9
		10	3800	640	10
		12	3200	600	12
		14	2700	540	14
		16	2400	500	16
		18	2100	460	18
		20	1900	430	20



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 mechanical contact type or a laser 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.

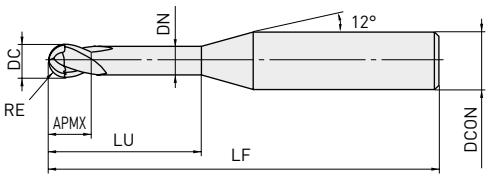
VQ4SVB

45°

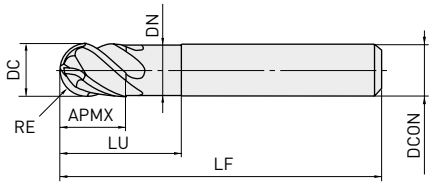
BALL NOSE, SHORT CUT LENGTH, 4 FLUTE, VARIABLE CURVE

P M N S

1



2



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

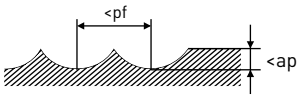
78 Vc

VQ4SVB

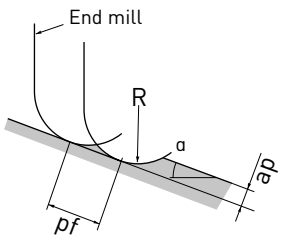
RECOMMENDED CUTTING CONDITIONS

SHOULDER MILLING (SLOTTING)

	Material	RE	α≤15°		α>15°		ap	pf
			n	Vf	n	Vf		
P	Carbon steel, Alloy steel, Mild steel, Pre-hardened steel	R 1	40000	8000	40000	8000	0.1	0.5
		R 1.5	32000	7700	32000	7700	0.2	0.7
		R 2	24000	5800	24000	5800	0.3	1
		R 2.5	19000	5300	19000	5300	0.4	1.2
		R 3	16000	4800	16000	4800	0.5	1.5
		R 4	12000	4300	12000	4300	0.8	2
		R 5	9600	4100	9600	4100	1	2.5
		R 6	8000	4000	8000	4000	1.2	3
M / S	Austenitic stainless steel, Titanium alloy, Hardened stainless steels, Cobalt chromium alloy, Ferritic and martensitic stainless steels	R 1	36000	6500	24000	2900	0.1	0.5
		R 1.5	24000	4800	16000	1900	0.2	0.7
		R 2	18000	4000	12000	1700	0.3	1
		R 2.5	14400	3500	9600	1500	0.4	1.2
		R 3	12000	3200	8000	1400	0.5	1.5
		R 4	9000	3200	6000	1400	0.8	2
		R 5	7200	3000	4800	1300	1	2.5
		R 6	6000	3000	4000	1300	1.2	3
N	Copper, Copper alloy	R 1	40000	8000	38000	4500	0.1	0.5
		R 1.5	38000	9100	25000	3800	0.2	0.7
		R 2	29000	7000	19000	3300	0.3	1
		R 2.5	23000	6400	15000	3100	0.4	1.2
		R 3	19000	5700	13000	2600	0.5	1.5
		R 4	14000	5000	9600	2300	0.8	2
		R 5	12000	5100	7700	2200	1	2.5
		R 6	9600	4800	6400	2200	1.2	3
S	Heat resistant alloys	R 1	9600	960	6400	510	0.08	0.2
		R 1.5	6400	640	4200	340	0.1	0.3
		R 2	4800	580	3200	260	0.1	0.4
		R 2.5	3800	530	2500	250	0.2	0.5
		R 3	3200	500	2100	210	0.2	0.6
		R 4	2400	430	1600	190	0.4	0.8
		R 5	2000	420	1300	180	0.5	1
		R 6	1700	350	1100	150	0.6	1.2



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 mechanical contact type or a laser 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.



NEW

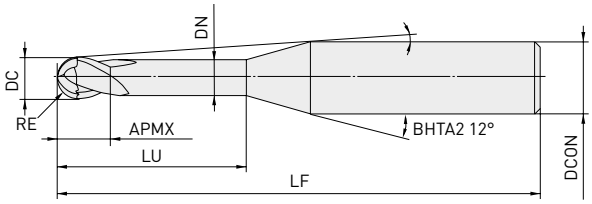
VQ2XLB

30°

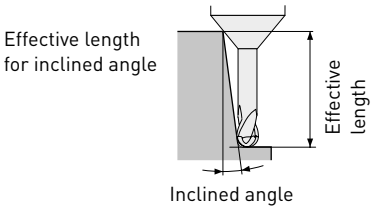
DC≤6

BALL NOSE, SHORT CUT LENGTH, 2 FLUTE, LONG NECK

S



0.5≤RE≤1.5	±0.005
4≤DCON≤6	0 -0.005



- SMART MIRACLE coating providing better wear resistance when machining difficult-to-cut materials.

Order number	Stock	DC	RE	APMX	LF	LU	DN	BHTA2	B2	DCON	ZEFP
VQ2XLBR0050N080	●	1	0.5	0.75	50	8	0.94	15°	6.4	4	2
VQ2XLBR0050N100	●	1	0.5	0.75	50	10	0.94	15°	5.6	4	
VQ2XLBR0050N080S06	●	1	0.5	0.75	50	8	0.94	15°	8.3	6	
VQ2XLBR0050N100S06	●	1	0.5	0.75	55	10	0.94	15°	7.5	6	
VQ2XLBR0050N120S06	●	1	0.5	0.75	55	12	0.94	15°	6.8	6	
VQ2XLBR0075N100S06	●	1.5	0.75	1.13	55	10	1.44	15°	7.2	6	
VQ2XLBR0075N120S06	●	1.5	0.75	1.13	55	12	1.44	15°	6.5	6	
VQ2XLBR0100N100	●	2	1	1.5	50	10	1.9	15°	4.5	4	
VQ2XLBR0100N100S06	●	2	1	1.5	55	10	1.9	15°	6.9	6	
VQ2XLBR0100N120	●	2	1	1.5	50	12	1.9	15°	3.9	4	
VQ2XLBR0100N120S06	●	2	1	1.5	55	12	1.9	15°	6.1	6	
VQ2XLBR0150N120	●	3	1.5	2.3	55	12	2.9	15°	5.3	6	
VQ2XLBR0150N140	●	3	1.5	2.3	60	14	2.9	15°	4.7	6	
VQ2XLBR0150N160	●	3	1.5	2.3	60	16	2.9	15°	4.3	6	

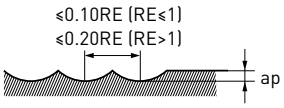
80 Vc

NEW

VQ2XLB

RECOMMENDED CUTTING CONDITIONS

	Material	RE	LU	n	Vc	Vf	ap	ae
S	Titanium Alloys	0.5	8	32000	100	2500	0.05	0.1
		0.5	10	24000	75	1500	0.05	0.1
		0.5	12	24000	75	1500	0.03	0.1
		0.75	10	21000	100	2100	0.13	0.3
		0.75	12	16000	75	1500	0.13	0.3
		1	10	16000	100	1800	0.20	0.5
		1	12	16000	100	1800	0.20	0.5
		1.5	12	10000	100	1600	0.30	0.8
		1.5	14	10000	100	1600	0.30	0.8
		1.5	16	10000	100	1600	0.30	0.8
	Cobalt Chromium Alloys	0.5	8	25000	80	2000	0.05	0.1
		0.5	10	19000	60	1500	0.05	0.1
		0.5	12	19000	60	1500	0.03	0.1
		0.75	10	17000	80	1700	0.08	0.1
		0.75	12	13000	60	1200	0.08	0.1
		1	10	13000	80	1500	0.2	0.5
		1	12	13000	80	1500	0.2	0.5
		1.5	12	8500	80	1300	0.3	0.8
		1.5	14	8500	80	1300	0.3	0.8
		1.5	16	8500	80	1300	0.3	0.8
	Pure Titanium	0.5	8	27000	80	1600	0.08	0.1
		0.5	10	19000	60	1200	0.08	0.1
		0.5	12	19000	60	1200	0.04	0.1
		0.75	10	25000	120	2000	0.13	0.2
		0.75	12	21000	100	1600	0.13	0.2
		1	10	32000	200	2500	0.32	0.8
		1	12	29000	180	1700	0.32	0.8
		1.5	12	21000	200	1600	0.48	1.2
		1.5	14	21000	200	1600	0.48	1.2
		1.5	16	21000	200	1600	0.48	1.2



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 mechanical contact type or a laser tool setter.
2. When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
3. If the depth of cut is smaller, the revolution and the feed rate can be increased.

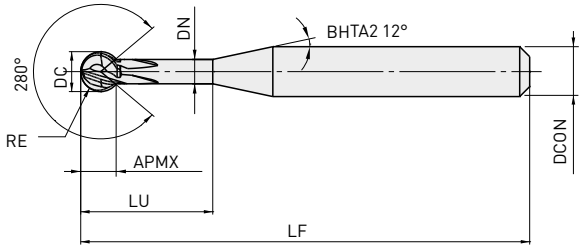
NEW

VQ4WB

UWC VQ 30° DC

MULTI-FUNCTIONAL LOLLIPOP, SHORT CUT LENGTH, 4 FLUTE

P M N S



0.5≤RE≤3
±0.01

4≤DCON≤6
0 -0.008

- Multi-functional ball end mill with a lollipop geometry for 5-axis machining.
- Optimal for back deburring, undercutting and inner curved surface machining.

Order number	Stock	DC	RE	APMX	LF	LU	DN	DCON	ZEFP
VQ4WBR0050N06E280	●	1	0.5	0.88	50	6	0.62	4	4
VQ4WBR0065N08E280	●	1.3	0.65	1.15	50	8	0.81	4	4
VQ4WBR0090N06E280	●	1.8	0.9	1.59	50	6	1.13	4	4
VQ4WBR0100N06E280	●	2	1	1.77	60	6	1.26	6	4
VQ4WBR0140N16E280	●	2.8	1.4	2.47	60	16	1.77	6	4
VQ4WBR0150N08E280	●	3	1.5	2.65	60	8	1.9	6	4
VQ4WBR0190N12E280	●	3.8	1.9	3.36	60	12	2.37	6	4
VQ4WBR0200N12E280	●	4	2	3.53	60	12	2.54	6	4
VQ4WBR0240N16E280	●	4.8	2.4	4.24	70	16	3.06	6	4
VQ4WBR0250N12E280	●	5	2.5	4.42	80	12	3.19	6	4
VQ4WBR0300N12E280	●	6	3	5.3	80	12	3.83	6	4

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 mechanical contact type or a laser tool setter.

82 Vc

Special Orders
For non standard products not shown above, please contact our sales department.

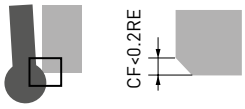
NEW

VQ4WB

RECOMMENDED CUTTING CONDITIONS

CHAMFERING (DEBURRING)

	Material	DC	RE	n	Vf	Max. CF
P	Milld steels, Carbon steels, Copper alloys, Pre-hardened steels (–45HRC)	1.0	0.5	19000	300	0.10
		1.3	0.65	15000	420	0.13
		1.8	0.9	11000	570	0.18
		2.0	1.0	9500	610	0.20
		2.8	1.4	6800	760	0.28
N		3.0	1.5	6400	770	0.30
		3.8	1.9	5000	840	0.38
		4.0	2.0	4800	880	0.40
		4.8	2.4	4000	960	0.48
		5.0	2.5	3800	970	0.50
		6.0	3.0	3200	1000	0.60
M	Austentic, Ferritic and martensitic stainless steels, Precipitation hardening stainless steels, Cobalt chrome alloys, Titanium alloys	1.0	0.5	14000	220	0.10
		1.3	0.65	11000	310	0.13
		1.8	0.9	8000	420	0.18
		2.0	1.0	7200	460	0.20
		2.8	1.4	5100	570	0.28
S		3.0	1.5	4800	580	0.30
		3.8	1.9	3800	640	0.38
		4.0	2.0	3600	660	0.40
		4.8	2.4	3000	720	0.48
		5.0	2.5	2900	740	0.50
		6.0	3.0	2400	770	0.60



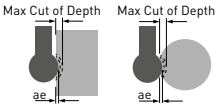
INTERNAL PROFILE / UNDERCUT

	Material	DC	RE	n	Vf	ae
P	Mild steels, Carbon steels, Copper alloys, Pre-hardened steels (–45HRC)	2.0	1.0	9500	460	0.03
		3.0	1.5	6400	560	0.10
N		4.0	2.0	4800	650	0.14
		5.0	2.5	3800	730	0.18
		6.0	3.0	3200	770	0.22
M	Austentic, Ferritic and martensitic stainless steels, Precipitation hardening stainless steels, Cobalt chrome alloys, Titanium alloys	2.0	1.0	7200	290	0.03
		3.0	1.5	4800	350	0.10
S		4.0	2.0	3600	390	0.14
		5.0	2.5	2900	440	0.18
		6.0	3.0	2400	460	0.22

VQ4WB

RADIUSED SHAPE SLOTTING

	Material	DC	RE	n	Vf	ae	Max. ae
P	Milld steels, Carbon steels, Copper alloys, Pre-hardened steels (–45HRC)	2.0	1.0	9500	300	0.03	0.06
		3.0	1.5	6400	380	0.10	0.20
N		4.0	2.0	4800	440	0.14	0.28
		5.0	2.5	3800	490	0.18	0.54
		6.0	3.0	3200	510	0.22	0.88
M	Austentic, Ferritic and martensitic stainless steels, Precipitation hardening stainless steels, Cobalt chrome alloys, Titanium alloys	2.0	1.0	7200	140	0.03	0.06
		3.0	1.5	4800	190	0.10	0.20
S		4.0	2.0	3600	230	0.14	0.28
		5.0	2.5	2900	260	0.18	0.54
		6.0	3.0	2400	270	0.22	0.88

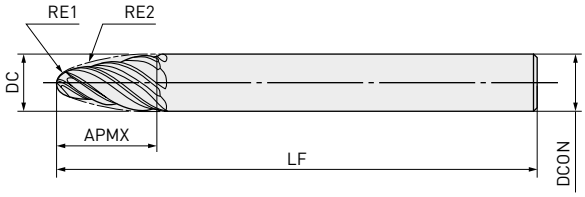


1. SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
2. If the depth of cut is smaller than this table, feed rate can be increased.
3. If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.
4. For sizes RE 0.5, 0.65, 0.9, 1.4, 1.9 and RE 2.4 which have long neck lengths, internal profile milling and round shape slotting are not recommended.
5. The maximum allowed depth of cut (Max ae) avoids interference between the workpiece and tool shank. It is recommended to machine up to the Max ae in 2-4 passes.

VQT6UR

CONICAL TAPER BARREL, MEDIUM CUT LENGTH, 6 FLUTE

P M N S



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

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

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 mechanical contact type or a laser tool setter.

85 Vc

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

VQT6UR

RECOMMENDED CUTTING CONDITIONS

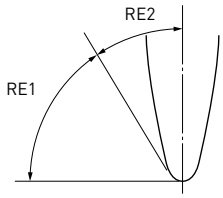
EFFECTIVE ANGLE

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

RE2

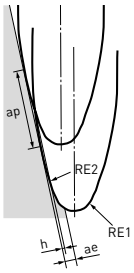
SIDE MILLING WITH THE USE OF THE TANGENTIAL FORM RADIUS

Order number	Nose radius		Tangential form radius		Effective angle
	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°	



	Material	DC	RE2	n	Vf	ap	ae
P	Mild steels (≤180HB) Carbon steels, Cast irons (180–280HB)	8	75	8000	2400	0.78	0.005—0.3
		10	85	6400	1900	0.83	
		10	75	6400	1900	0.78	
		12	100	5300	1600	0.89	
M S	Austentic stainless steels (≤200HB) Titanium alloys	8	75	3200	770	0.78	0.005—0.3
		10	85	2500	600	0.83	
		10	75	2500	600	0.78	
		12	100	2100	500	0.89	
N	Aluminium alloys (Si < 5%)	8	75	16000	4800	0.78	0.005—0.3
		10	85	13000	3900	0.83	
		10	75	13000	3900	0.78	
		12	100	11000	3300	0.89	

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 mechanical 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 to the tool contact area.



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

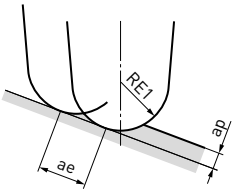
VQT6UR

RE1

SIDE MILLING WITH THE USE OF THE NOSE RADIUS

	Material	DC	RE2	n	Vf	ap	ae
P	Mild steels (≤180HB) Carbon steels, Cast irons (180–280HB)	8	2	16000	2400	0.4	1
		10	2	16000	2400	0.4	1
		10	3	11000	1700	0.6	1.5
		12	4	8000	1200	0.8	2
M	Austentic stainless steels (≤200HB) Titanium alloys	8	2	6400	580	0.4	1
		10	2	6400	580	0.4	1
S		10	3	4200	380	0.6	1.5
		12	4	3200	290	0.8	2
N	Aluminium alloys (Si < 5%)	8	2	32000	4800	0.4	1
		10	2	32000	4800	0.4	1
		10	3	21000	3200	0.6	1.5
		12	4	16000	2400	0.8	2

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 mechanical 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 to the tool contact area.



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