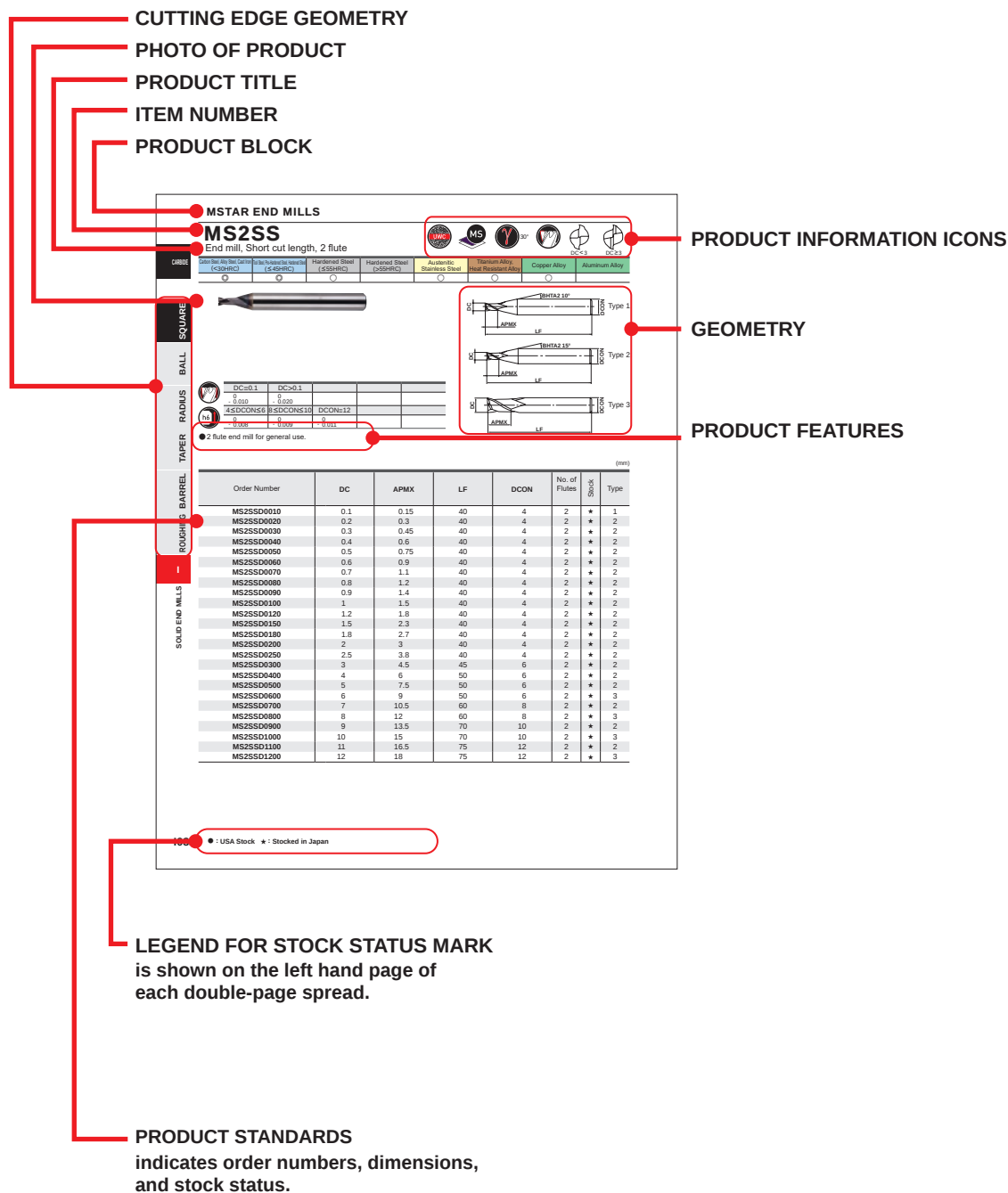


HOW TO READ THE STANDARD OF SOLID END MILLS

●How this section page is organized

①Organized according to cutting mode for milling. (Refer to END MILL LIST.)



●To Order: Please specify product title and order number.

MILLING

SOLID CARBIDE END MILLS

IDENTIFICATION	I002
SYMBOL DESCRIPTIONS	I003
COATING TECHNOLOGY	I004
TOOL NAVI	I006
END MILLS SELECTION CHART	I024

SOLID ENDMILL STANDARD

MSTAR END MILLS (MS Type)	I032
MS PLUS END MILLS (MP Type)	I086
MIRACLE END MILLS (VC Type)	I113
SMART MIRACLE END MILLS (VQ Type)	I124
IMPACT MIRACLE END MILLS (VF Type)	I183
IMPACT MIRACLE REVOLUTION END MILLS (VFR Type) ...	I246
DIAMOND COATED END MILLS (DFC Type)	I252
DIAMOND COATED END MILLS (DF Type)	I254
DIAMOND COATED END MILLS (DC Type)	I272
CBN END MILLS	I276
CERAMIC END MILLS (CE Type)	I280
UNCOATED CARBIDE END MILLS	I282

★Arranged by Alphabetical order

I282	C2MHA	I060	MS4SC	I160	VQ4SVB(INCH)
I284	C4LATB	I070	MS4XL (INCH)	I158	VQ4SVB
I276	CBN2XLB	I066	MS4XL	I175	VQ6MHVCH
I278	CBN2XLRB	I053	MSMHD	I176	VQ6MHVRBCH
I280	CE4SRB	I058	MSMHZD (INCH)	I150	VQJHV(INCH)
I281	CE6SRB	I056	MSMHZD	I148	VQJHV
I272	DC2SB	I052	MSSH	I145	VQMHV(INCH)
I274	DC2XLB	I122	VC2C	I141	VQMHV
I258	DF2MB	I120	VC4JRB	I167	VQMHVRB(INCH)
I260	DF2XLB	I113	VCLD	I162	VQMHVRB
I264	DF2XLB	I114	VCPSRB	I172	VQMHVRBF(INCH)
I266	DF3XB	I118	VCPSRB (TAPER NECK)	I170	VQMHVRBF
I254	DF4JC	I186	VF2MV	I130	VQMHZV(INCH)
I255	DF4XL	I203	VF2SB	I124	VQMHZV
I252	DFC4JC	I202	VF2WB	I138	VQMHZVOH(INCH)
I253	DFCJRT	I183	VF2XL	I134	VQMHZVOH
I268	DFPSRB	I212	VF2XLB (INCH)	I155	VQSVR
I099	MP2MB (INCH)	I206	VF2XLB	I178	VQT5MVRB
I096	MP2MB	I205	VF2XLBS	I180	VQT6UR
I095	MP2SB	I214	VF3XB	I152	VQXL
I102	MP2SDB	I220	VF4MB		
I094	MP2SSB	I188	VF4MV		
I104	MP2XLB	I189	VF6MHV		
I086	MP3MC	I242	VF6MHVRB		
I088	MP4MC	I199	VF6SVRCH		
I092	MP4MRB	I190	VF8MHVCH		
I090	MP4JC	I244	VF8MHVRBCH		
I072	MS2ES	I222	VFFDRB		
I038	MS2JS	I230	VFHVRB (INCH)		
I040	MS2LS	I224	VFHVRB		
I036	MS2MD	I232	VFHVRB (TAPER NECK)		
I080	MS2MRB	I194	VFMD (INCH)		
I033	MS2MS	I192	VFMD		
I032	MS2SS	I238	VFMDRB		
I050	MS2XL (INCH)	I200	VFMFPR		
I042	MS2XL	I240	VFMHVRBCH		
I046	MS2XL6	I248	VFR2SB		
I078	MS2XLB	I250	VFR2SBF		
I074	MS3ES	I246	VFR2SSB		
I076	MS4EC	I191	VFS		
I064	MS4JC	I236	VFSDB		
I062	MS4MC	I196	VFSFPR		
I083	MS4MRB	I198	VFSFPRCH		



IDENTIFICATION

ORDER NUMBER OF END MILLS

VQ **4** **S** **VB** **R0100** *******

End Mill Names	Number of Flutes	Flute Length	Features	Dimensions	Others
VQ : SMART MIRACLE end mills	1 : 1flute	ES : Extra short	S : General use	D**** : Diameter	S** : Shank diameter
VFR : IMPACT MIRACLE REVOLUTION end mills	2 : 2flute	S : Short	U : For stainless steel	ex.	N*** : Neck length
VF : IMPACT MIRACLE end mills	3 : 3flute	M : Medium	K : For keyway	D0050 → ϕ 0.5	T**** : Taper angle one side
MP : MS plus end mills	4 : 4flute	J : Semi long	A : For light alloy	D0500 → ϕ 5	L** : Flute length
MS : Mstar end mills	5 : 5flute	L : Long	C : Center cut		A*** : Overall Length
MS : Mstar end mills	6 : 6flute	XL : Long neck	D : For deep cut	R**** : Radius of ball nose	
VC : Miracle end mills	8 : 8flute	X : Taper neck	V : Irregular spiral helix angle	ex.	
DFC : Diamond coated end mills	...	SX : Extra long	B : Ball nose	R0050 → R0.5	
DF : Diamond coated end mills		MX : Extra long	VB : Irregular spiral helix angle, Ball nose	R0500 → R5	
DC : Diamond coated end mills			R : Roughing		
CBN : CBN end mills			FPR : Fine roughing		
CE : Ceramic end mills			H : High helix		
C : Carbide end mills			T : Taper		
VQT : SMART MIRACLE end mills (For Titanium alloy cutting)			TB : Taper ball nose		
			RB : Corner radius		
			CH : Coolant hole		
			UR : Multi step radius		

★Other types are available by special order.

SYMBOL DESCRIPTIONS

Tool Material



Ultra Micro Grain Carbide

Ultra micro grain carbide is used as the substrate material.



Cubic Boron Nitride

Mitsubishi's original CBN is used.



Ceramic

Ceramic is used as the substrate material.

Tolerances



Outside Diameter Tolerance

Indicates diameter tolerance of end mill.



R Tolerance

Indicates the radial tolerance of a ball nose end mill.



R Tolerance

Indicates the radial tolerance of an end mill with a corner radius.



Tolerance of Taper Angle

Indicates the tolerance of the taper angle.



Tolerance of Point Angle

Indicates the tolerance of the point angle.



Shank Diameter Tolerance

Indicates the shank diameter tolerance of end mill.

Angle, Coolant hole, Sharp corner edge and Gash land



Helix Angle

Indicates the helix angle of the end mill.



End Cutting Edge with Coolant Hole



Peripheral Cutting Edge with Coolant Hole



Sharp Corner Edge

Indicates the end mill has a sharp corner edge.



Gash Land

Indicates the end mill cutting edge has a gash land.

Coating



SMART MIRACLE Coating

(Al, Cr)N coating optimum for difficult-to-cut materials.



IMPACT MIRACLE REVOLUTION Coating

A coating which adds the excellent high oxidation temperature of (AL, Cr, Si) N-based films to the nano crystal technology of VF.



IMPACT MIRACLE Coating

Single phase nano crystal coating technology for higher film hardness and heat resistance.



MS PLUS Coating

Offers higher versatility for carbon steel, alloy steel and hardened steel.



(Al,Ti)N Coating

(Al,Ti)N offers higher versatility.



MIRACLE Coating

The original Miracle (Al, Ti)N coating also suitable for dry cutting of carbon steels and hardened steels.



Diamond Coating

Suitable for CFRP



Diamond Coating

High performance coating for hard brittle materials excelling in film adhesion to the substrate.



Diamond Coating

Suitable for graphite machining.

Work Application Range

1st Recommendation



2nd Recommendation



COATING TECHNOLOGY



IMPACT MIRACLE REVOLUTION Coating

The combination of the (Al, Cr, Si) N coating (newly-developed), which has a high oxidation temperature and high lubricity, together with the (Al, Ti, Si) N coating, which has better wear resistance and high adhesion, allows hardened steel with even greater strength to be maintained.



IMPACT MIRACLE Coating

For higher hardness, higher speed and longer tool life!

In comparison with the conventional coating single-phase nano crystal coating technology offers higher coating hardness and heat resistance. When machining hardened steels it can be seen that the IMPACT MIRACLE coating offers a lower friction coefficient and as such prevents abnormal damage such as chipping.

Properties of IMPACT MIRACLE COATING

	IMPACT MIRACLE Single-phase nano coating (Al, Ti, Si)N	(Al, Ti, Si)N	(Al, Ti)N
Hardness (HV)	3700	3200	2800
Oxidation Temperature (°F)	2370	2010	1540
Adhesion (N) ¹⁾	100	80	80
Wear Coefficient ²⁾	0.48	0.53	0.58

1) Adhesion : Measured by critical load scratch test.

2) Coefficient of friction : Measured by ball-on-disk method.
(Counter gear : AISI D2 60HRC)



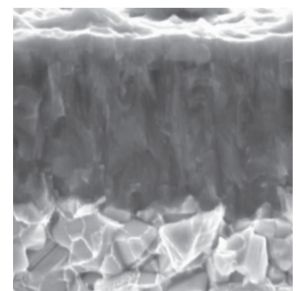
MS plus Coating

Suitable coating for a broad range of work materials such as carbon steel, alloy steel and hardened steel of approx. 50HRC.

Our original coating technology enables a multilayer of (Al,Ti)N and (Al,Cr)N. It allows machining of a wide range of work materials.

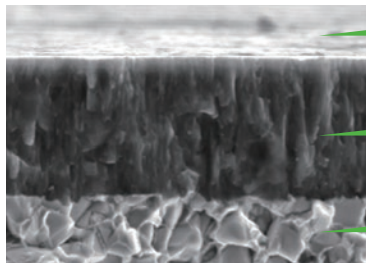
Properties of MS plus coating

	(Al, Ti, Cr)N multilayer	(Al, Ti)N	(Al, Cr)N
Hardness (HV)	3200	2800	3100
Oxidation Temperature (°F)	2012	1472	2012
Adhesion (N)	100	80	80



VQ SMART MIRACLE Coating

Newly-developed (Al,Cr)N coating with improved wear resistance. The smoothening treatment of the coating layer reduces the cutting resistance and improves chip discharge significantly. This next-generation coating offers longer tool life and higher efficiency in machining difficult-to-cut materials.



Smoothed Surface "Zero- μ Surface"

Newly Developed (Al,Cr)N Coating

Super Fine Grade Substrate



SMART MIRACLE Coating

ZERO- μ Surface

The original surface treatment technology offers smooth coating layer. A good balance of smooth surface and sharp edge allows smooth chip discharge and reduces the cutting resistance. Machining efficiency and tool life is improved.



DC Diamond Coating (DC)

Proprietary CVD diamond coating produces excellent wear resistance and smooth hole surface.

The newly developed CVD diamond coated carbide material achieves outstanding abrasion resistance and smoothness due to a proprietary fine multilayer diamond crystal control technology. Suitable for cutting hard brittle materials such as cemented carbide.

DF Diamond Coating (DF)

Diamond coating for non-ferrous and new non-metal materials.

Owing to Mitsubishi's unique plasma chemical vapor deposition (CVD) coating technology, great combination of coating hardness similar to that of natural diamond has been combined with a good adhesion to carbide substrates. DF end mill series suitable for graphite machining.

VC MIRACLE Coating (Al,Ti)N

MIRACLE coating for high speed milling.

Miracle coating is produced by adding Al to the existing TiN coating.

This coating layer consists of a compound solid solution of (Al,Ti)N.

This results in improving the heat resistance during cutting, and thus delivers high performance in high hardness material machining and high speed dry cutting. It also has the high adhesion strength for the cemented carbide substrate, and extends the tool life significantly compared to conventional products.

TOOL NAVI

■ HOW TO USE TOOL NAVI

3 steps provide the correct tool and cutting data.

STEP1 Choose work material, end mill type and cutting length.

INDEX		Type
Work Material	Carbon Steel Alloy Steel Cast Iron	P
	Square End Mill	
	Short.....	I008
	Medium.....	I008
	Semi long.....	I009
	Long neck.....	I010
	Radius End Mills	
	Short / Medium.....	I010
	Long neck / Taper neck.....	I011
	Ball Nose End Mills	
	Short / Medium.....	I011
	Long neck.....	I012
	Taper neck.....	I012
	Square End Mill	
	Medium.....	I013
	Long neck.....	I013
	Radius End Mills	
	Short / Medium.....	I013
	Long neck / Taper neck.....	I014

STEP2 Choose end mill.

SOLID END MILLS									
TOOL NAVI									
Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
M									
S									
Square End Mill									
Medium (ap-3.5xDC)									
VQMHZV			METRIC DC 1-20 INCH DC.0625 ~5000	1.8 ~2.5xDC	-	3	F R	M S P N	METRIC I124 INCH I130
VQMHZVOH			METRIC DC 6-16 INCH DC.2500 ~5000	1.9 ~2.4xDC	-	3	F R	M S P N	METRIC I134 INCH I138
VQMHV			METRIC DC 1-25 INCH DC.1250 ~5000	2 ~2.8xDC	-	4	F R	M S P N	METRIC I141 INCH I145
VQSVR			METRIC DC 3-20 INCH DC.1250 ~5000	1.8 ~2.4xDC	-	3	F R	M S P N	I155

Recommendation

*1 Finish
*2 Rough

1st recommendation
2nd recommendation

Page

STEP3 Choose size and cutting condition.

Size

MS PLUS END MILLS									
MP2SSB									
Ball nose, Short cut length, 2 flute, Short shank									
Order Number	RE	DC	APRFL	LF	DCON	No. of Flutes	Stock	Type	
MP2SSB0020	0.1	0.2	0.2	40	4	2	1	1	
MP2SSB0030	0.2	0.4	0.4	40	4	2	1	1	
MP2SSB0040	0.3	0.6	0.6	40	4	2	1	1	
MP2SSB0050	0.4	0.8	0.8	40	4	2	1	1	
MP2SSB0060	0.5	1	1	40	4	2	1	1	
MP2SSB0070	0.6	1.2	1.2	40	4	2	1	1	
MP2SSB0080	0.75	1.5	1.5	40	4	2	1	1	
MP2SSB0090	0.75	1.5	1.5	40	4	2	1	1	
MP2SSB0100	1	2	2	45	5	2	1	1	
MP2SSB0120	1.5	3	3	45	5	2	1	1	
MP2SSB0150	2	4	4	45	5	2	1	1	
MP2SSB0200	3	6	6	50	6	2	1	1	
MP2SSB0250	4	8	8	60	8	2	1	1	
MP2SSB0300	5	10	10	70	10	2	1	1	
MP2SSB0400	6	12	12	75	12	2	1	1	

Cutting conditions

RECOMMENDED CUTTING CONDITIONS									
Ball nose, Short cut length, 2 flute, Short shank MP2SSB									
Ball nose, Short cut length, 2 flute MP2SB									
Work	Material	Feed	Spindle Speed	Depth of Cut	Feed	Spindle Speed	Depth of Cut	Feed	Spindle Speed
RE-1	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-2	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-3	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-4	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-5	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-6	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-7	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-8	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-9	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-10	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-11	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-12	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-13	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-14	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-15	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-16	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-17	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-18	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-19	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-20	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-21	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-22	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-23	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-24	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-25	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-26	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-27	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-28	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-29	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000
RE-30	Aluminum	0.05	1000	0.05	0.05	1000	0.05	0.05	1000

INDEX

Carbon Steel Alloy Steel Cast Iron	P	Square End Mill Short I008 Medium I008 Semi long I009 Long neck I010 Radius End Mills Short / Medium I010 Long neck / Taper neck I011 Ball Nose End Mills Short / Medium I011 Long neck I012 Taper neck I012
Hardened Steel	H	Square End Mill Medium I013 Long neck I013 Radius End Mills Short / Medium I013 Long neck / Taper neck I014 Ball Nose End Mills Short / Medium I014 Long neck / Taper neck I015
Austenitic Stainless Steel	M	Square End Mill Medium I016 Semi long I017 Long neck I017
Ti Alloy Heat Resistant Alloy	S	Radius End Mills Short / Medium I017 Ball Nose End Mills Short / Medium I018 Long neck I018
Ti Alloy Heat Resistant Alloy	S	Ceramic Radius End Mills Short I019 Barrel End Mills Medium I019
Copper Alloy Aluminum Alloy	N	Square End Mill Medium I020 Ball Nose End Mills Short / Medium I020 Long neck I020 Tapered flute I020
Graphite FRP	G	Square End Mill Semi long I021 Long neck I021 Radius End Mills Long neck I021 Ball Nose End Mills Short / Medium I021 Long neck I022 Taper neck I022

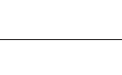
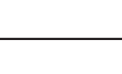
TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
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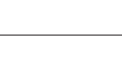
P

Square End Mill

Short (ap-1.5xDC)

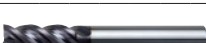
MS2ES		   	METRIC DC 3-12	0.5 -1xDC	-	2	 	    	I072
MS2SS		    DC<3 DC≥3	METRIC DC 0.1-12	1.5xDC	-	2	 	    	I032
MS3ES		   	METRIC DC 3-12	0.5 -1xDC	-	3	 	    	I074
MS4EC		   	METRIC DC 3-14	0.5 -1xDC	-	4	 	    	I076
MS4SC		   	METRIC DC 1-12	1.5xDC	-	4	 	    	I060
MSSH D		   	METRIC DC 3-20	1.5xDC	-	4	 	    	I052

Medium (ap-3xDC)

MP3MC		   	INCH DC.0312 -.5000	0.1 -1xDC	-	3	 	   	I086
MP4MC		   	INCH DC.0312 -.5000	0.1 -1xDC	-	4	 	   	I088
MP4JC		   	INCH DC.0625 -.5000	2.5xDC	-	4	 	   	I090

★ ap : Depth of Cut

★ DC : Cutting Diameter

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
MS2MS	MS	 	METRIC DC 0.2–20	2xDC	–	2	F  R 	P H M S N	I033
MS2JS	MS	 	METRIC DC 0.1–12	3xDC	–	2	F  R 	P H M S N	I038
VQMHZV	VO	 	METRIC DC 1–20 INCH DC.0625 –.5000	1.6 –2.5xDC	–	3	F  R 	P M S N	METRIC I124 INCH I130
MSMHZD	MS	 	METRIC DC 1–20 INCH DC.0625 –.7500	1.6 –2.5xDC	–	3	F  R 	P H M S N	METRIC I056 INCH I058
VQMHV	VO	 	METRIC DC 1–25 INCH DC.1250 –.5000	2 –2.8xDC	–	4	F  R 	P M S N	METRIC I141 INCH I145
MSMHD	MS	 	METRIC DC 2–25	2 –3.1xDC	–	4	F  R 	P H M S N	I053
VQSVR	VO	 	METRIC DC 3–20	1.8 –2.4xDC	–	3 4	F  R 	P M S N	I155
Semi long (ap=4xDC)									
MS2LS	MS	 	METRIC DC 0.2–12	4xDC	–	2	F  R 	P H M S N	I040
VQJHV	VO	 	METRIC DC 1–20 INCH DC.1250 –.5000	3.3 –4xDC	–	4	F  R 	P M S N	METRIC I148 INCH I150
MS4JC	MS	 	METRIC DC 1–12	4xDC	–	4	F  R 	P H M S N	I064

TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
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P

Square End Mill

Long neck (ap-30xDC)

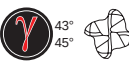
VQXL		   	METRIC DC 0.2-1.0	1.4 -1.67xDC	2.5 -6xDC	3 4	F  R 	P M S N	I152
VF2XL		   	METRIC DC 0.1-3	1.5 -1.7xDC	2.5 -12.5xDC	2	F  R 	H P	I183
MS2XL		   	METRIC DC 0.2-6 INCH DC.0156 -.2500	1.3 -1.6xDC	2.5 -30xDC	2	F  R 	P H M S N	METRIC I042 INCH I050
MS2XL6		   	METRIC DC 0.3-2.5	1.5 -2.7xDC	2.5 -5xDC	2	F  R 	P H M S N	I046
MS4XL		   	METRIC DC 1-10 INCH DC.0625 -.2500	1xDC	2.7 -16.2xDC	4	F  R 	P H M S N	METRIC I066 INCH I070

Radius End Mills

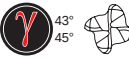
Short / Medium (ap-2.8xDC)

MP4MRB		   	INCH DC.1250 -.5000	0.1 -1.5xDC	-	4	F  R 	P H M S	I092
MS2MRB		   	METRIC DC 1-12	2xDC	-	2	F  R 	P H M S N	I080
VQMHVRB		    	METRIC DC 2-20 INCH DC.1250 -.5000	2 -2.8xDC	-	4	F  R 	P M S N	METRIC I162 INCH I167

- ★ ap : Depth of Cut
 ★ DC : Cutting Diameter
 ★ RE : Ball Nose End Mill Radius

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
MS4MRB	MS	 	METRIC DC 3-20	1.9 -2.8xDC	-	4	F  R 	P H M S N	I083
VFHVRB	VF	 	METRIC DC 1-16 INCH DC.1250 -.5000	1 -1.6xDC	-	4	F  R 	P H M S	METRIC I224 INCH I230
VCPSRB [High precision]	VC	 	METRIC DC 0.6-12	1xDC	-	2 4	F  R 	P H M S	I114

Long neck (ap-12xDC) / Taper neck (ap-50xDC)

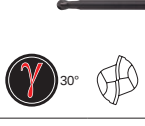
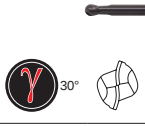
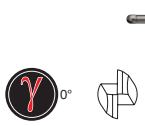
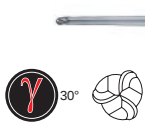
VFHVRB	VF	 	METRIC DC 1-12	1 -1.6xDC	2.6 -50xDC	4	F  R 	P H M S	I232
CBN2XLRB		 	METRIC DC 0.5-2	0.6xDC	3 -6xDC	2	F  R 	P H	I278

Ball Nose End Mills

Short / Medium (ap-3xDC)

MP2SSB	MS+	 	METRIC RE 0.1-6	1xDC	-	2	F  R 	P H M S N	I094
MP2SB	MS+	 	METRIC RE 0.1-6	1.5 -1.7xDC	-	2	F  R 	P H M S N	I095
MP2MB	MS+	 	METRIC RE 0.25-6 INCH RE.0156 -.2500	1.8 -3xDC	-	2	F  R 	P H M S N	METRIC I096 INCH I099
MP2SDB	MS+	 	METRIC RE 0.5-6	1 -2xDC	-	2	F  R 	P H	I102

TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
P									
Ball Nose End Mills									
Short / Medium (ap-3xDC)									
VQ4SVB			METRIC RE 1-6 INCH RE.0625 -.2500	1.5xDC	-	4			METRIC I158 INCH I160
Long neck (ap-20xDC)									
MP2XLB			METRIC RE 0.05-3	0.7 -1xDC	1.2 -20xDC	2			I104
MS2XLB			INCH RE.0078 -.1250	1xDC	2 -20xDC	2			I078
VF2XLB			METRIC RE 0.1-3 INCH RE.0156 -.1250	0.8xDC	2.5 -20xDC	2			METRIC I206 INCH I212
VF2XLBS			METRIC RE 0.2-1	0.8xDC	2.5 -12xDC	2			I205
VF2WB			METRIC RE 1-3	-	2 -3xDC	2			I202
CBN2XLB			METRIC RE 0.2-1	0.6 -0.8xDC	0.85 -4xDC	2			I276
Taper neck (ap-70xDC)									
VF3XB			METRIC RE 0.4-2.5	0.6 -0.9xDC	6.7 -70xDC	3			I214

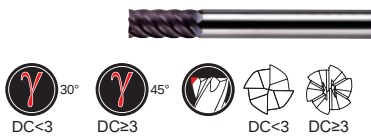
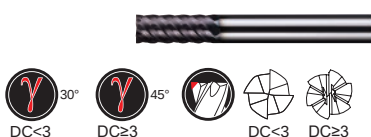
★ ap : Depth of Cut
 ★ DC : Cutting Diameter
 ★ RE : Ball Nose End Mill Radius

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
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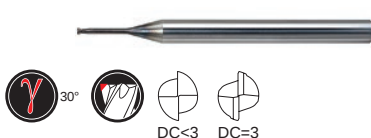
H

Square End Mill

Medium (ap=3.5xDC)

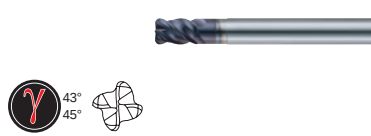
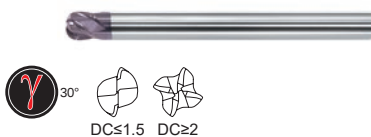
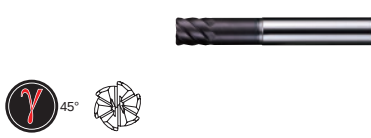
VFSD			METRIC DC 1-12	2xDC	-	4 6	F  R 	 	I191
VFMD			METRIC DC 1-25 INCH DC.0313 -.5000	2 ~3.5xDC	-	4 6	F  R 	 	METRIC I192 INCH I194
VF2MV			METRIC DC 0.5-6	2.5xDC	-	2	F  R 	 	I186
VF4MV			METRIC DC 6-20	2.5xDC	-	4	F  R 	 	I188

Long neck (ap=12.5xDC)

VF2XL			METRIC DC 0.1-3	1.5 ~1.7xDC	2.5 ~12.5xDC	2	F  R 	 	I183
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Radius End Mills

Short / Medium (ap=3.3xDC)

VFHVRB			METRIC DC 1-16 INCH DC.1250 -.5000	1 ~1.6xDC	-	4	F  R 	   	METRIC I224 INCH I230
VCPSRB [High precision]			METRIC DC 0.6-12	1xDC	-	2 4	F  R 	   	I114
VFSDB			METRIC DC 3-12	1xDC	-	6	F  R 	 	I236

TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
H									

Radius End Mills

Short / Medium (ap-3.3xDC)

VFMDRB		  	METRIC DC 3-20	2.2 -3.3xDC	-	6	F  R 	 	I238
VFFDRB		   DC≤6 DC≥8	METRIC DC 3-12	0.06DC	-	4 6	F  R 	 	I222

Long neck (ap-6xDC) / Taper neck (ap-50xDC)

VFHVRB		  	METRIC DC 1-12	1 -1.6xDC	2.6 -50xDC	4	F  R 	   	I232
CBN2XLRB		  	METRIC DC 0.5-2	0.6xDC	3 -6xDC	2	F  R 	 	I278

Ball Nose End Mills

Short / Medium (ap-3xDC)

 VFR2SSB		  	METRIC RE 0.5-6	1xDC	-	2	F  R 	 	I246
VFR2SB		   RE < 0.3 RE ≥ 0.3	METRIC RE 0.1-10	1 -2xDC	-	2	F  R 	 	I248
VFR2SBF		  	METRIC RE 0.5-3	1 -2xDC	-	2	F  R 	 	I250
MP2SSB		  	METRIC RE 0.1-6	1xDC	-	2	F  R 	    	I094

- * ap : Depth of Cut
- * DC : Cutting Diameter
- * RE : Ball Nose End Mill Radius

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
MP2SB	MS ⁺	  	METRIC RE 0.1-6	1.5 -1.7xDC	-	2			I095
MP2MB	MS ⁺	  	METRIC RE 0.25-6 INCH RE.0156 -.2500	1.8 -3xDC	-	2			METRIC I096 INCH I099
MP2SDB	MS ⁺	  	METRIC RE 0.5-6	1 -2xDC	-	2			I102
VF2SB	VF	  	INCH RE.0156 -.2500	1 -2xDC	-	2			I203
VF4MB	VF	  	METRIC RE 0.5-6	1.8 -3xDC	-	4			I220

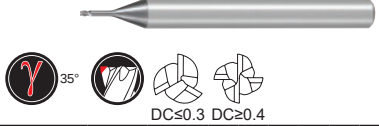
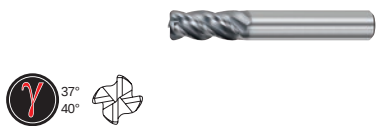
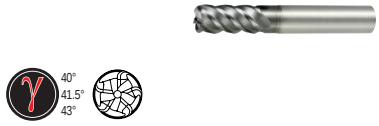
Long neck (ap-20xDC) / Taper neck (ap-70xDC)

MP2XLB	MS ⁺	  	METRIC RE 0.05-3	0.7 -1xDC	1.2 -20xDC	2			I104
VF2XLB	VF	  	METRIC RE 0.1-3 INCH RE.0156 -.1250	0.8xDC	2.5 -20xDC	2			METRIC I206 INCH I212
VF2XLBS	VF	  	METRIC RE 0.2-1	0.8xDC	2.5 -12xDC	2			I205
VF3XB	VF	  	METRIC RE 0.4-2.5	0.6 -0.9xDC	6.6 -70xDC	3			I214
CBN2XLB	CBN	  	METRIC RE 0.2-1	0.6 -0.8xDC	0.85 -4xDC	2			I276

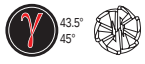
TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
M									
S									
Square End Mill									
Medium (ap~3.5xDC)									
VQMHZV			METRIC DC 1-20 INCH DC.0625 ~.5000	1.6 ~2.5xDC	-	3	F R	M S P N	METRIC I124 INCH I130
VQMHZVOH			METRIC DC 6-16 INCH DC.2500 ~.5000	1.9 ~2.4xDC	-	3	F R	M S P N	METRIC I134 INCH I138
VQMHV			METRIC DC 1-25 INCH DC.1250 ~.5000	2 ~2.8xDC	-	4	F R	M S P N	METRIC I141 INCH I145
VQSVR			METRIC DC 3-20	1.8 ~2.4xDC	-	3 4	F R	M S P N	I155
VF6MHV			METRIC DC 6-20	1.9 ~2.4xDC	-	6	F R	M S P	I189
VQ6MHVCH			METRIC DC 10-20	1.9 ~2.2xDC	-	6	F R	M S P N	I175
VF8MHVCH			METRIC DC 16,20	1.9 ~2xDC	-	8	F R	M S P	I190
VFSFPRCH			METRIC DC 16,20	1.9 ~2.1xDC	-	4	F R	M S P	I198

★ ap : Depth of Cut
★ DC : Cutting Diameter

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
VF6SVRCH			METRIC DC 16,20	1.9 ~2.1xDC	-	6	F  R 	M S P	I199
VFMFPR			METRIC DC 5-20	2.8 ~3.5xDC	-	4	F  R 	M S P	I200
Semi long (ap-4xDC)									
VQJHV			METRIC DC 1-20 INCH DC.1250 ~.5000	3.3 ~4xDC	-	4	F  R 	M S P N	METRIC I148 INCH I150
Long neck (ap-6xDC)									
VQXL			METRIC DC 0.2-1.0	1.4 ~1.67xDC	2.5 ~6xDC	3 4	F  R 	M S P N	I152
Radius End Mills									
Short / Medium (ap~2.8xDC)									
VQMHRB			METRIC DC 2-20 INCH DC.1250 ~.5000	2 ~2.8xDC	-	4	F  R 	M S P N	METRIC I162 INCH I167
VQMHRBF			METRIC DC 6-16 INCH DC.2500 ~.5000	2.2 ~2.4xDC	-	4	F  R 	M S P N	METRIC I170 INCH I172
VFMHVRBCH			METRIC DC 16,20	2.2 ~2.3xDC	-	4	F  R 	M S P	I240
NEW VQT5MVRB			METRIC DC 16-25	2.2 ~2.3xDC	-	5	F  R 	M S	I178
VF6MHVRB			METRIC DC 6-20	1.9 ~2.4xDC	-	6	F  R 	M S P	I242

TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
M									
S									
Radius End Mills									
Short / Medium (ap-2.8xDC)									
NEW VQ6MHVRBCH		 	METRIC DC 10-20	1.9 -2.2xDC	-	6	F  R 	M S P N	I176
Short / Medium (ap-3xDC)									
VF8MHVRBCH		 	METRIC DC 16,20	1.9 -2xDC	-	8	F  R 	M S P	I244
Ball Nose End Mills									
Short / Medium (ap-1.5xDC)									
VQ4SVB		 	METRIC RE 1-6 INCH RE.0625 -.2500	1.5xDC	-	4	F  R 	M S P N	METRIC I158 INCH I160
Long neck (ap-3xDC)									
VF2WB		 	METRIC RE 1-3	-	2 -3xDC	2	F  R 	M S P H	I202

- ★ ap : Depth of Cut
 ★ DC : Cutting Diameter
 ★ RE : Ball Nose End Mill Radius

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
S									
Ceramic Radius End Mills									
Short (ap=0.75xDC)									
CE4SRB			 METRIC DC 6-12	0.75xDC	-	4	F  R 		I280
CE6SRB			 METRIC DC 6-12	0.75xDC	-	6	F  R 		I281
Barrel End Mills									
Medium (ap=2.6xDC)									
 VQT6UR			 METRIC DC 8-12	2 -2.6xDC	-	6	F  R 	  	I180

TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
N									
Square End Mill									
Medium (ap=3.2xDC)									
C2MHA		  	METRIC DC 3-25	1.5 ~3xDC	-	2	F  R 	N	I282
Ball Nose End Mills									
Short / Medium (ap=3xDC)									
DC2SB		 	METRIC RE 0.1-3	0.6 ~0.7xDC	-	2	F  R 	N For hard brittle materials	I272
Long neck (ap=20xDC)									
DC2XLB		 	METRIC RE 0.1-3	0.6xDC	1.7 ~5xDC	2	F  R 	N For hard brittle materials	I274
Tapered flute (ap=20xDC)									
C4LATB		 	METRIC RE 0.5-2	6.7 ~20xDC	-	4	F  R 	N	I284

- ★ ap : Depth of Cut
 ★ DC : Cutting Diameter
 ★ RE : Ball Nose End Mill Radius

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
G									
Square End Mill									
Semi long (ap-4xDC)									
DF4JC		  	METRIC DC 3-12	3 -4xDC	-	4	F  R 	G N	I254
DFC4JC		  	METRIC DC 6-12	2.5 -3.8xDC	-	4	F  R 	G For CFRP	I252
DFCJRT		 	METRIC DC 6-12	2.5 -3.8xDC	-	10 12	F  R 	G For CFRP	I253
Long neck (ap-10.7xDC)									
DF4XL		   	METRIC DC 1-12	1.5xDC	2.5 -10.7xDC	4	F  R 	G N	I255
Radius End Mills									
Long neck (ap-30xDC)									
DFPSRB		   	METRIC DC 0.5-12	1.3 -1.5xDC	3.3 -30xDC	2 4	F  R 	G N	I268
Ball Nose End Mills									
Short / Medium (ap-5xDC)									
DF2MB		  	METRIC RE 3-6	4.6 -5xDC	-	2	F  R 	G N	I258

TOOL NAVI

Product Name	Coating or Substrate	End Mills	Size Range	ap	Neck Length	Flutes	Finish / Rough	Work Materials Upper : 1st Recommendation Under : 2nd Recommendation	Page
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G

Ball Nose End Mills

Long neck (ap-40xDC)

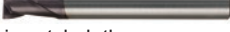
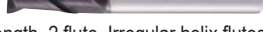
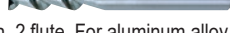
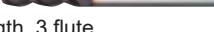
DF2XLB			METRIC RE 0.1-3	1.2 -1.5xDC	2.5 -40xDC	2	F     R    	 	I260
NEW DF2XLBF			METRIC RE 0.3-1.5	0.8 -1.5xDC	5 -20xDC	2	F     R    	 	I264

Taper neck (ap-50xDC)

DF3XB			METRIC RE 0.5-2	1.5xDC	20 -50xDC	3	F     R    	 	I266
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- * ap : Depth of Cut
- * DC : Cutting Diameter
- * RE : Ball Nose End Mill Radius

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material					Copper Alloy	Aluminum Alloy	Page		
							P	H	M	S	N					
							Carbon Steel, Alloy Steel, Cast Iron	Tool steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel(-55HRC)	Hardened Steel(55HRC-)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy				
SQUARE																
2	General Use		MS	MS2SS		METRIC DC 0.1–12	⊙	⊙	○		○	○	○		I032	
			MS	MS2MS		METRIC DC 0.2–20	⊙	⊙	○		○	○	○		I033	
			MS	MS2MD		METRIC DC 1–12	⊙	⊙	○		○	○			I036	
			MS	MS2JS		METRIC DC 0.1–12	⊙	⊙	○		○	○	○		I038	
			MS	MS2LS		METRIC DC 0.2–12	⊙	⊙	○		○	○	○		I040	
	For Swiss Style Lathes		MS	MS2ES		METRIC DC 3–12	⊙	⊙	○		○	○	○		I072	
	For Hardened Steel		VF	VF2MV		METRIC DC 0.5–6		○	⊙	⊙					I186	
	For Aluminum Alloy		UWC	C2MHA		METRIC DC 3–25								⊙	I282	
	3	General Use		MS	MSMHZD		METRIC DC 1–20 INCH DC .0625–.7500	⊙	⊙	○		○	○	○		METRIC I056 INCH I058
				MS+	MP3MC		INCH DC .0312–.5000	⊙	⊙	○		○	○			I086
For Swiss Style Lathes			MS	MS3ES		METRIC DC 3–12	⊙	⊙	○		○	○	○		I074	
For Difficult-to-cut Materials			VQ	VQMHZV		METRIC DC 1–20 INCH DC .0625–.5000	⊙	⊙			⊙	⊙	○		METRIC I124 INCH I130	
			VQ	VQMHZVOH		METRIC DC 6–16 INCH DC .2500–.5000	⊙	⊙			⊙	⊙	○		METRIC I134 INCH I138	
4	General Use		MS	MS4SC		METRIC DC 1–12	⊙	⊙	○		○	○	○		I060	
			MS	MS4MC		METRIC DC 1–20	⊙	⊙	○		○	○	○		I062	

★ DC : Cutting Diameter

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material								Page
							P	H	M	S	N				
							Carbon Steel, Alloy Steel, Cast Iron	Tool steel, Pre-hardened Steel, Hardened Steel	Hardened Steel (<55HRC)	Hardened Steel (55HRC-)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy	
4	General Use		MS4JC		METRIC DC 1–12	⊙	⊙	○		○	○		I064		
				MP4MC		INCH DC .0312–.5000	⊙	⊙	○		○	○		I088	
				MP4JC		INCH DC .0625–.5000	⊙	⊙	○		○	○		I090	
				MSSHD		METRIC DC 3–20	⊙	⊙	○		○	○		I052	
				MSMHD		METRIC DC 2–25	⊙	⊙	○		○	○		I053	
			MS4EC		METRIC DC 3–14	⊙	⊙	○		○	○		I076		
		For Hardened Steel		VF4MV		METRIC DC 6–20		○	⊙	⊙				I188	
			For Difficult-to-cut Materials		VQMHV		METRIC DC 1–25 INCH DC .1250–.5000	⊙	⊙			⊙	⊙	○	METRIC I141 INCH I145
				VQJHV		METRIC DC 1–20 INCH DC .1250–.5000	⊙	⊙			⊙	⊙	○	METRIC I148 INCH I150	
	For CFRP		DFC4JC		METRIC DC 6–12	CFRP : ⊙							I252		
	For Graphite		DF4JC		METRIC DC 3–12	Graphite : ⊙ GFRP/CFRP : ○ Machineable Ceramics : ○						⊙	○	I254	
	4 6	For Hardened Steel		VFSD		METRIC DC 1–12		○	⊙	⊙				I191	
				VFMD		METRIC DC 1–25 INCH DC .0313–.5000		○	⊙	⊙				METRIC I192 INCH I194	
				VCLD		METRIC DC 6–25		○	⊙	⊙				I113	
		For Difficult-to-cut Materials		VF6MHV		METRIC DC 6–20	○	○			⊙	⊙		I189	
			NEW VQ6MHVCH		METRIC DC 10–20	○	○			⊙	⊙	○	I175		

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page		
							P	H	M	S	N				
							Carbon Steel, Alloy Steel, Cast Iron	Ti6Al4V, Pre-Hardened Steel, Hardened Steel	Hardened Steel (55HRC)	Hardened Steel (55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy	
SQUARE															
8	For Difficult-to-cut Materials	VF	VF8MHVCH	End mill, Medium cut length, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16,20		○	○			◎	◎			I190
10 12	For CFRP	DFC	DFCJRT	End mill with cross-nick, For CFRP	METRIC DC 6-12	CFRP : ◎								I253	
LONG NECK SQUARE															
3 4	For Difficult-to-cut Materials	VQ	VQXL	End mill, Short cut length, 3-4 flute, Long neck	METRIC DC 0.2-1		◎	◎			◎	◎	○		I152
2	For Deep Slotting	MS	MS2XL	End mill, Short cut length, 2 flute, Long neck	METRIC DC 0.2-6 INCH DC .0156-.2500		◎	◎	○		○	○	○		METRIC I042 INCH I050
		MS	MS2XL6	End mill, Short cut length, 2 flute, 6mm shank	METRIC DC 0.3-2.5		◎	◎	○		○	○	○		I046
4	For Deep Slotting	VF	VF2XL	End mill, 2 flute, Long neck	METRIC DC 0.1-3		○	◎	◎	◎					I183
	General Use	MS	MS4XL	End mill, Short cut length, 4 flute, Long neck	METRIC DC 1-10 INCH DC .0625-.2500		◎	◎	○		○	○	○		METRIC I066 INCH I070
	For Graphite	DF	DF4XL	End mill, Long neck, 4 flute, For graphite	METRIC DC 1-12	Graphite : ◎ GFRP/CFRP : ○ Machineable Ceramics : ○						◎	○	I255	
BALL															
2	General Use	MS+	MP2SSB	Ball nose, Short cut length, 2 flute, Short shank	METRIC RE 0.1-6		◎	◎	◎		○	○	○		I094
		MS+	MP2SB	Ball nose, Short cut length, 2 flute	METRIC RE 0.1-6		◎	◎	◎		○	○	○		I095
		MS+	MP2MB	Ball nose, Medium cutting length, 2 flute	METRIC RE 0.25-6 INCH RE .0156-.2500		◎	◎	◎		○	○	○		METRIC I096 INCH I099
		MS+	MP2SDB	Ball nose, Short cut length, 2 flute, High strength	METRIC RE 0.5-6		○	◎	◎						I102
	For Hardened Steel	VFR	NEW VFR2SSB	Ball nose, Short cut length, 2 flute, Short shank	METRIC RE 0.5-6			○	◎	◎					I246

★ DC : Cutting Diameter

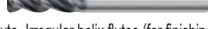
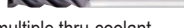
★ RE : Ball Nose End Mill Radius

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material					Page			
							P	H	M	S	N				
							Carbon Steel, Alloy Steel, Cast Iron	Tool steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel (-55HRC)	Hardened Steel (55HRC+)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy	
2	For Hardened Steel		VFR2SB		Ball nose, Short cut length, 2 flute	METRIC RE 0.1–10		○	◎	◎					I248
			VFR2SBF		Ball nose, Short cut length, 2 flute, For Mirror finish cutting	METRIC RE 0.5–3		○	◎	◎					I250
			VF2SB		Ball nose, Short cut length, 2 flute, For hardened materials	INCH RE .0156–.2500	○	◎	◎	◎	○	○			I203
	For Hard Brittle Materials		DC2SB		Ball nose, Short cut length, 2 flute, For hard brittle materials	METRIC RE 0.1–3	Cemented Carbide : ◎ Alumina / Zirconia : ◎ Silicon Carbide / Nitride : ◎ Quartz Glass : ◎							I272	
	For Graphite		DF2MB		Ball nose, Medium cut length, 2 flute, For graphite	METRIC RE 3–6	Graphite : ◎ GFRP/CFRP : ◎ Machineable Ceramics : ◎					◎	○	I258	
4	For Hardened Steel		VF4MB		Ball nose, Medium cut length, 4 flute	METRIC RE 0.5–6		○	◎	◎					I220
	For Difficult-to-cut Materials		VQ4SVB		Ball nose, Medium cutting length, 4 flute	METRIC RE 1–6 INCH RE .0625–.2500	◎	◎			◎	◎	○		METRIC I158 INCH I160

LONG NECK BALL

2	General Use		MS+	MP2XLB		METRIC RE 0.05–3	○	○	○		○	○	○		I104
	For Hardened Steel		CBN	CBN2XLB		METRIC RE 0.2–1		○	○	○					I276
	For Profiling of Special Geometry		VF	VF2WB		METRIC RE 1–3	○	○	○		○	○			I202
	For Deep Slotting of Hardened Steel		VF	VF2XLBS		METRIC RE 0.2–1	○	○	○	○					I205
			VF	VF2XLB		METRIC RE 0.1–3 INCH RE .0156–.1250	○	○	○	○					METRIC I206 INCH I212
	For Hard Brittle Materials		DC	DC2XLB		METRIC RE 0.1–3	Cemented Carbide : ○ Alumina / Zirconia : ○ Silicon Carbide / Nitride : ○ Quartz Glass : ○								I274
	For Graphite		DF	DF2XLB		METRIC RE 0.1–3	Graphite : ○ GFRP/CFRP : ○ Machineable Ceramics : ○					○	○		I260
			NEW	DF	DF2XLBFB	METRIC RE 0.3–1.5	Graphite : ○ Zirconia : ○ Rigid Composite Resin : ○ Machineable Ceramics : ○					○	○		I264
For Deep Slotting		MS	MS	MS2XLB		INCH RE .0078–.1250	○	○	○		○	○			I078

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material					Copper Alloy	Aluminum Alloy	Page	
							P	H	M	S	N				
							Carbon Steel, Alloy Steel, Cast Iron	Tool steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel (55HRC-)	Hardened Steel (55HRC-)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy			
TAPER NECK BALL															
3	For Deep Slotting	Hardened Steel	VF	VF3XB		METRIC RE 0.4–2.5	☐	☒	☒	☒					I214
	For Graphite		DF	DF3XB		METRIC RE 0.5–2	Graphite : ☒ GFRP/CFRP : ☐ Machineable Ceramics : ☐					☒	☐	I266	
RADIUS															
2	General Use	MS	MS2MRB		Corner radius, Medium cut length, 2 flute	METRIC DC 1–12	☒	☒	☐	☐	☐	☐			I080
2 4	For High-Precision Machining	VC	VCPSRB		Corner radius, Short cut length, 2–4 flute, High precision	METRIC DC 0.6–12	☐	☐	☒	☐	☐	☐			I114
4	For High Efficiency Machining	VF	VFHVRB		4 flute, Corner radius, Short cut length, Irregular helix flutes	METRIC DC 1–16 INCH DC .1250–.5000	☒	☒	☒	☐	☐	☐			METRIC I224 INCH I230
	General Use	MS+	MP4MRB		Corner radius, Medium cut length, 4 flute	INCH DC .1250–.5000	☒	☒	☐	☐	☐	☐			I092
		MS	MS4MRB		Corner radius, Medium cut length, 4 flute	METRIC DC 3–20	☒	☒	☐	☐	☐	☐			I083
		VC	VC4JRB		Corner radius, Semi long cut length, 4 flute	METRIC DC 3–20	☐	☒	☐	☐	☐	☐			I120
	For Difficult-to-cut Materials	VQ	VQMHRB		Corner radius, Medium cutting length, 4 flute, Irregular helix flutes	METRIC DC 2–20 INCH DC .1250–.5000	☒	☒		☒	☒	☐			METRIC I162 INCH I167
		VQ	VQMHRBF		Corner radius, Medium cutting length, 4 flute, Irregular helix flutes (for finishing)	METRIC DC 6–16 INCH DC .2500–.5000	☒	☒		☒	☒	☐			METRIC I170 INCH I172
		VF	VFMHVRBCH		Corner radius, Medium cut length, 4 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16-20	☐	☐		☒	☒				I240
	4 6	For Hardened Steel	VF	VFFDRB		Multi-task corner radius end mill for impact miracle high speed cutting	METRIC DC 3–12		☐	☒	☒				I222
6	For Hardened Steel	VF	VFSDRB		Corner radius, Short cut length, 6 flute	METRIC DC 3–12		☐	☒	☒				I236	
		VF	VFMDRB		Corner radius, Medium cut length, 6 flute, For hardened materials	METRIC DC 3–20		☐	☒	☒				I238	

★ DC : Cutting Diameter

★ RE : Ball Nose End Mill Radius

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page	
							P	H	M	S	N			
							Carbon Steel, Alloy Steel, Cast Iron Tool steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel(-55HRC)	Hardened Steel(55HRC-)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy		Aluminum Alloy
	6	For Difficult-to-cut Materials		VF6MHVRB	 Corner radius, Medium cut length, 6 flute, Irregular helix flutes	METRIC DC 6–20	○	○			◎	◎		I242
				 VQ6MHVRBCH	 Corner radius, Medium cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 10–20	○	○			◎	◎	○	I176
				 VQT5MVRB	 Corner radius, Medium cut length, 5 flute, Irregular helix flutes, With coolant hole	METRIC DC 16,20,25					◎	◎		I178
				VF8MHVRBCH	 Corner radius, Medium cut length, 8 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16,20	○	○			◎	◎		I244
	4	For Heat Resistant Alloy		CE4SRB	 Corner radius, short cut length, 4 flute	METRIC DC 6–12						◎		I280
				CE6SRB	 Corner radius, short cut length, 6 flute	METRIC DC 6–12						◎		I281

END MILLS SELECTION CHART

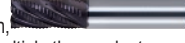
Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material					Copper Alloy	Aluminum Alloy	Page	
							P	H	M	S	N				
							Carbon Steel, Alloy Steel, Cast Iron	Tool steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel(-55HRC)	Hardened Steel(55HRC-)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy			
LONG NECK CORNER RADIUS															
2	For Hardened Steel		CBN	CBN2XLRB	 Corner radius, Medium cut length, 2 flute, Long neck	METRIC DC 0.5–2	☐	☐	☐						I278
2 4	For Graphite		DF	DFPSRB	 Corner radius, Short cut length, 2–4 flute, High precision, For graphite	METRIC DC 0.5–12	Graphite : ☒	GFRP/CFRP : ☐	Machineable Ceramics : ☐			☒	☐		I268
TAPER NECK RADIUS															
2 4	For High-Precision Machining		VC	VCPSRB	 Corner radius, Short cut length, 2–4 flute, High precision	METRIC DC 1.5–12	☐	☒	☒	☐	☐	☐			I118
4	For High Efficiency Machining		VF	VFHVRB	 4 flute, Corner radius, Short cut length, Irregular helix flutes	METRIC DC 1–12	☒	☒	☒	☐	☐	☐			I232
TAPER BALL															
4	For Aluminum Alloy		UWC	C4LATB	 Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers	METRIC RE 0.5–2								☒	I284
BARREL END MILL															
6	For Barrel		NEW	VQ	VQT6UR	 Barrel, Medium cut length, 6 flute	METRIC DC 8–12					☐	☒	☐	I180

★ DC : Cutting Diameter

★ RE : Ball Nose End Mill Radius

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P	H	M	S	N		
							Carbon Steel, Alloy Steel, Cast Iron Tool steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel (≤55HRC)	Hardened Steel (55HRC+)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	

ROUGHING

3 4	For Difficult-to-cut Materials		VQSVR		METRIC DC 3–20								I155
			VFSFPR		METRIC DC 3–20								I196
4			VFMFPR		METRIC DC 5–20								I200
			VFSFPRCH		METRIC DC 16,20								I198
6			VF6SVRCH		METRIC DC 16,20								I199

CHAMFER CUTTER

2	For Chamfering		VC2C		METRIC DC 2–12								I122
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MSTAR END MILLS

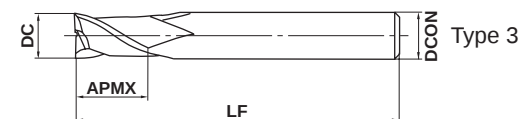
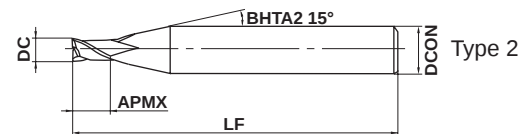
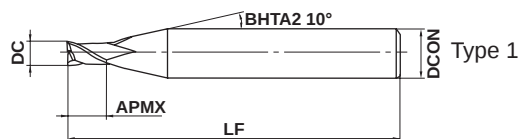
MS2SS

End mill, Short cut length, 2 flute



CARBIDE

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



DC=0.1	DC>0.1			
0 - 0.010	0 - 0.020			
4≤DCON≤6	8≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 2 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2SSD0010	0.1	0.15	40	4	2	★	1
MS2SSD0020	0.2	0.3	40	4	2	★	2
MS2SSD0030	0.3	0.45	40	4	2	★	2
MS2SSD0040	0.4	0.6	40	4	2	★	2
MS2SSD0050	0.5	0.75	40	4	2	★	2
MS2SSD0060	0.6	0.9	40	4	2	★	2
MS2SSD0070	0.7	1.1	40	4	2	★	2
MS2SSD0080	0.8	1.2	40	4	2	★	2
MS2SSD0090	0.9	1.4	40	4	2	★	2
MS2SSD0100	1	1.5	40	4	2	★	2
MS2SSD0120	1.2	1.8	40	4	2	★	2
MS2SSD0150	1.5	2.3	40	4	2	★	2
MS2SSD0180	1.8	2.7	40	4	2	★	2
MS2SSD0200	2	3	40	4	2	★	2
MS2SSD0250	2.5	3.8	40	4	2	★	2
MS2SSD0300	3	4.5	45	6	2	★	2
MS2SSD0400	4	6	50	6	2	★	2
MS2SSD0500	5	7.5	50	6	2	★	2
MS2SSD0600	6	9	50	6	2	★	3
MS2SSD0700	7	10.5	60	8	2	★	2
MS2SSD0800	8	12	60	8	2	★	3
MS2SSD0900	9	13.5	70	10	2	★	2
MS2SSD1000	10	15	70	10	2	★	3
MS2SSD1100	11	16.5	75	12	2	★	2
MS2SSD1200	12	18	75	12	2	★	3

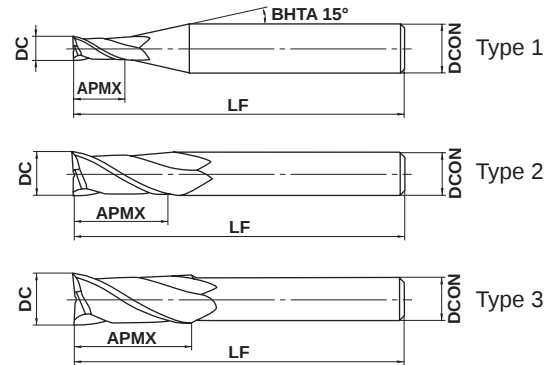
MS2MS

End mill, Medium cut length, 2 flute



CARBIDE

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



DC ≤ 12	DC > 12			
0 - 0.020	0 - 0.030			
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● 2 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2MSD0020	0.2	0.4	40	4	2	●	1
MS2MSD0030	0.3	0.6	40	4	2	●	1
MS2MSD0040	0.4	0.8	40	4	2	●	1
MS2MSD0050	0.5	1	40	4	2	●	1
MS2MSD0060	0.6	1.2	40	4	2	●	1
MS2MSD0070	0.7	1.4	40	4	2	●	1
MS2MSD0080	0.8	1.6	40	4	2	●	1
MS2MSD0090	0.9	1.8	40	4	2	●	1
MS2MSD0100	1	2	40	4	2	●	1
MS2MSD0110	1.1	2.2	40	4	2	●	1
MS2MSD0120	1.2	2.4	40	4	2	●	1
MS2MSD0130	1.3	2.6	40	4	2	●	1
MS2MSD0140	1.4	2.8	40	4	2	●	1
MS2MSD0150	1.5	3	40	4	2	●	1
MS2MSD0160	1.6	3.2	40	4	2	●	1
MS2MSD0170	1.7	3.4	40	4	2	●	1
MS2MSD0180	1.8	3.6	40	4	2	●	1
MS2MSD0190	1.9	3.8	40	4	2	●	1
MS2MSD0200	2	4	40	4	2	●	1
MS2MSD0210	2.1	4.2	40	4	2	●	1
MS2MSD0220	2.2	4.4	40	4	2	●	1
MS2MSD0230	2.3	4.6	40	4	2	●	1
MS2MSD0240	2.4	4.8	40	4	2	●	1
MS2MSD0250	2.5	5	40	4	2	●	1
MS2MSD0260	2.6	5.2	40	4	2	●	1
MS2MSD0270	2.7	5.4	40	4	2	●	1
MS2MSD0280	2.8	5.6	40	4	2	●	1
MS2MSD0290	2.9	5.8	40	4	2	●	1
MS2MSD0300	3	6	45	6	2	●	1
MS2MSD0310	3.1	6.2	45	6	2	★	1
MS2MSD0320	3.2	6.4	45	6	2	★	1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MSTAR END MILLS

MS2MS

End mill, Medium cut length, 2 flute

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2MSD0330	3.3	6.6	45	6	2	★	1
MS2MSD0340	3.4	6.8	45	6	2	★	1
MS2MSD0350	3.5	7	45	6	2	★	1
MS2MSD0360	3.6	7.2	45	6	2	★	1
MS2MSD0370	3.7	7.4	45	6	2	★	1
MS2MSD0380	3.8	7.6	45	6	2	★	1
MS2MSD0390	3.9	7.8	45	6	2	★	1
MS2MSD0400	4	8	50	6	2	●	1
MS2MSD0410	4.1	8.2	50	6	2	★	1
MS2MSD0420	4.2	8.4	50	6	2	★	1
MS2MSD0430	4.3	8.6	50	6	2	★	1
MS2MSD0440	4.4	8.8	50	6	2	★	1
MS2MSD0450	4.5	9	50	6	2	★	1
MS2MSD0460	4.6	9.2	50	6	2	★	1
MS2MSD0470	4.7	9.4	50	6	2	★	1
MS2MSD0480	4.8	9.6	50	6	2	★	1
MS2MSD0490	4.9	9.8	50	6	2	★	1
MS2MSD0500	5	10	50	6	2	●	1
MS2MSD0510	5.1	10.2	50	6	2	★	1
MS2MSD0520	5.2	10.4	50	6	2	★	1
MS2MSD0530	5.3	10.6	50	6	2	★	1
MS2MSD0540	5.4	10.8	50	6	2	★	1
MS2MSD0550	5.5	11	50	6	2	★	1
MS2MSD0560	5.6	11.2	50	6	2	★	1
MS2MSD0570	5.7	11.4	50	6	2	★	1
MS2MSD0580	5.8	11.6	50	6	2	★	1
MS2MSD0590	5.9	11.8	50	6	2	★	1
MS2MSD0600	6	12	50	6	2	●	2
MS2MSD0650	6.5	13	60	8	2	★	1
MS2MSD0700	7	14	60	8	2	★	1
MS2MSD0750	7.5	15	60	8	2	★	1
MS2MSD0800	8	16	60	8	2	●	2
MS2MSD0850	8.5	17	70	10	2	★	1
MS2MSD0900	9	18	70	10	2	★	1
MS2MSD0950	9.5	19	70	10	2	★	1
MS2MSD1000	10	20	70	10	2	●	2
MS2MSD1100	11	22	75	12	2	★	1
MS2MSD1200	12	24	75	12	2	●	2
MS2MSD1600	16	32	90	16	2	★	2
MS2MSD1800	18	36	90	16	2	★	3
MS2MSD2000	20	40	100	20	2	★	2

MS2SS

End mill, Short cut length, 2 flute

MS2MS

End mill, Medium cut length, 2 flute

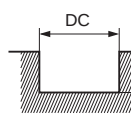
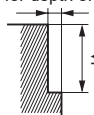
CARBIDE

RECOMMENDED CUTTING CONDITIONS

DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
0.1	40000	40	1.6	0.001	40000	40	1.6	0.001
0.2	40000	100	3.9	0.002	40000	100	3.9	0.002
0.3	40000	200	7.9	0.005	40000	200	7.9	0.005
0.4	40000	600	23.6	0.01	40000	600	23.6	0.01
0.5	40000	1000	39.4	0.015	40000	960	37.8	0.015
0.6	40000	1200	47.2	0.02	40000	1200	47.2	0.02
0.7	40000	1400	55.1	0.02	40000	1400	55.1	0.02
0.8	40000	1600	63.0	0.03	40000	1600	63.0	0.03
0.9	40000	1800	70.9	0.04	40000	1600	63.0	0.04
1	40000	2000	78.7	0.06	32000	1600	63.0	0.06
1.5	40000	3000	118.1	0.12	32000	1900	74.8	0.08
2	30000	3000	118.1	0.18	24000	1900	74.8	0.10
2.5	24000	2600	102.4	0.25	19000	1600	63.0	0.13
3	20000	2300	90.6	0.30	16000	1400	55.1	0.15
4	15000	2000	78.7	0.40	12000	1200	47.2	0.20
5	12000	1600	63.0	0.50	9000	900	35.4	0.25
6	10000	1400	55.1	0.60	7000	700	27.6	0.30
8	8000	1000	39.4	0.80	5600	550	21.7	0.40
10	6400	900	35.4	1.00	4500	500	19.7	0.50
12	5400	820	32.3	1.00	3800	450	17.7	0.50
16	2400	380	15.0	3.00	1200	100	3.9	0.80
20	1900	320	12.6	4.00	1000	80	3.1	1.00

Depth of cut

≤Please refer to the list above for depth of cut.



≤Please refer to the list above for depth of cut.

DC: Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.

Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MSTAR END MILLS

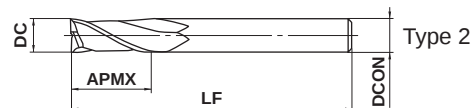
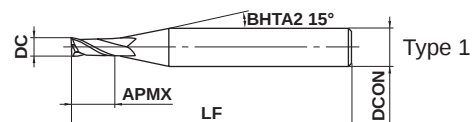
MS2MD

End mill, Medium cut length, 2 flute



CARBIDE

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



1 ≤ DC ≤ 12				
0 - 0.020				



4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.008	0 - 0.009	0 - 0.011		

● Strong edge type, 2 flute end mill with high resistance to corner fracturing.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2MDD0100	1	2.5	40	4	2	★	1
MS2MDD0150	1.5	3.8	40	4	2	★	1
MS2MDD0200	2	5	40	4	2	★	1
MS2MDD0250	2.5	6.3	40	4	2	★	1
MS2MDD0300	3	7.5	50	6	2	★	1
MS2MDD0400	4	10	50	6	2	★	1
MS2MDD0500	5	12.5	50	6	2	★	1
MS2MDD0600	6	15	50	6	2	★	2
MS2MDD0800	8	20	60	8	2	★	2
MS2MDD1000	10	25	70	10	2	★	2
MS2MDD1200	12	30	90	12	2	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel				Hardened steel (45-55HRC)			
	AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.				AISI H13 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
1	40000	2000	78.7	0.06	32000	1600	63.0	0.06
1.5	40000	3000	118.1	0.12	32000	1900	74.8	0.08
2	30000	3000	118.1	0.18	24000	1900	74.8	0.10
2.5	24000	2600	102.4	0.25	19000	1600	63.0	0.13
3	20000	2300	90.6	0.30	16000	1400	55.1	0.15
4	15000	2000	78.7	0.40	12000	1200	47.2	0.20
5	12000	1600	63.0	0.50	9000	900	35.4	0.25
6	10000	1400	55.1	0.60	7000	700	27.6	0.30
8	8000	1000	39.4	0.80	5600	550	21.7	0.40
10	6400	900	35.4	1.00	4500	500	19.7	0.50
12	5400	820	32.3	1.00	3800	450	17.7	0.50

Depth of cut

≤Please refer to the list above for depth of cut.

DC

≤1DC

DC

≤Please refer to the list above for depth of cut.

DC: Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

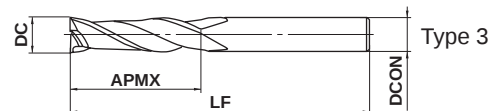
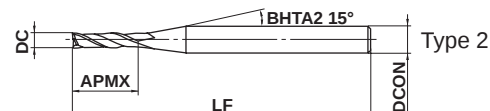
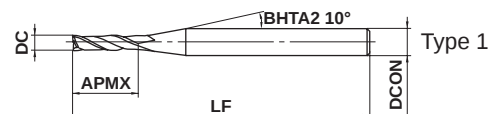
MS2JS

End mill, Semi long cut length, 2 flute



CARBIDE

Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○	○	○	○	○	○	○



DC=0.1	DC>0.1			
0 - 0.010	0 - 0.020			
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 2 flute end mill for general use.

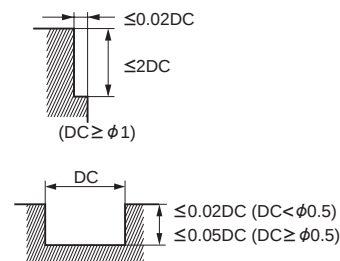
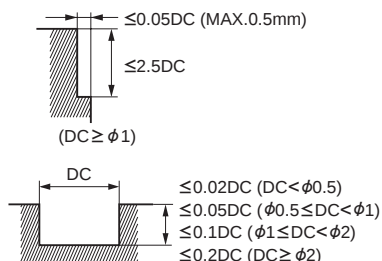
(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2JSD0010	0.1	0.3	40	4	2	●	1
MS2JSD0020	0.2	0.6	40	4	2	●	2
MS2JSD0030	0.3	0.9	40	4	2	●	2
MS2JSD0040	0.4	1.2	40	4	2	●	2
MS2JSD0050	0.5	1.5	40	4	2	●	2
MS2JSD0060	0.6	1.8	40	4	2	●	2
MS2JSD0070	0.7	2.1	40	4	2	●	2
MS2JSD0080	0.8	2.4	40	4	2	●	2
MS2JSD0090	0.9	2.7	40	4	2	●	2
MS2JSD0100	1	3	40	4	2	●	2
MS2JSD0120	1.2	3.6	40	4	2	●	2
MS2JSD0150	1.5	4.5	40	4	2	●	2
MS2JSD0180	1.8	5.4	40	4	2	●	2
MS2JSD0200	2	6	40	4	2	●	2
MS2JSD0250	2.5	7.5	40	4	2	●	2
MS2JSD0300	3	9	45	6	2	●	2
MS2JSD0400	4	12	50	6	2	●	2
MS2JSD0500	5	15	50	6	2	●	2
MS2JSD0600	6	18	50	6	2	●	3
MS2JSD0800	8	24	70	8	2	●	3
MS2JSD1000	10	30	90	10	2	●	3
MS2JSD1200	12	36	90	12	2	●	3

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
0.1	40000	— (40)	— (1.6)	40000	— (40)	— (1.6)	40000	— (35)	— (1.4)	40000	— (25)	— (1.0)
0.2	40000	— (45)	— (1.8)	40000	— (45)	— (1.8)	40000	— (35)	— (1.4)	32000	— (25)	— (1.0)
0.3	40000	— (55)	— (2.2)	32000	— (45)	— (1.8)	27000	— (35)	— (1.4)	21000	— (25)	— (1.0)
0.4	32000	— (60)	— (2.4)	24000	— (45)	— (1.8)	20000	— (35)	— (1.4)	16000	— (25)	— (1.0)
0.5	25000	— (60)	— (2.4)	19000	— (45)	— (1.8)	16000	— (35)	— (1.4)	13000	— (25)	— (1.0)
0.6	21000	— (60)	— (2.4)	16000	— (45)	— (1.8)	13000	— (35)	— (1.4)	11000	— (25)	— (1.0)
0.7	18000	— (60)	— (2.4)	14000	— (45)	— (1.8)	11000	— (35)	— (1.4)	9100	— (25)	— (1.0)
0.8	16000	— (60)	— (2.4)	12000	— (45)	— (1.8)	9900	— (35)	— (1.4)	8000	— (25)	— (1.0)
0.9	14000	— (60)	— (2.4)	11000	— (45)	— (1.8)	8800	— (35)	— (1.4)	7100	— (25)	— (1.0)
1	13000	60 (60)	2.4 (2.4)	9500	45 (45)	1.8 (1.8)	8000	35 (35)	1.4 (1.4)	6400	25 (25)	1.0 (1.0)
1.5	8500	60 (60)	2.4 (2.4)	6400	45 (45)	1.8 (1.8)	5300	35 (35)	1.4 (1.4)	4200	25 (25)	1.0 (1.0)
2	6400	60 (60)	2.4 (2.4)	4800	45 (45)	1.8 (1.8)	4000	35 (35)	1.4 (1.4)	3200	25 (25)	1.0 (1.0)
2.5	5100	60 (60)	2.4 (2.4)	3800	45 (45)	1.8 (1.8)	3200	40 (40)	1.6 (1.6)	2500	25 (25)	1.0 (1.0)
3	4200	65 (60)	2.6 (2.4)	3400	55 (45)	2.2 (1.8)	2600	40 (40)	1.6 (1.6)	2100	25 (25)	1.0 (1.0)
4	3400	80 (60)	3.1 (2.4)	2700	65 (45)	2.6 (1.8)	2100 (1600)	50 (30)	2.0 (1.2)	1700	35 (25)	1.4 (1.0)
5	2900	100 (60)	3.9 (2.4)	2300	80 (45)	3.1 (1.8)	1800 (1350)	60 (30)	2.4 (1.2)	1500	40 (25)	1.6 (1.0)
6	2500	120 (60)	4.7 (2.4)	2000	100 (50)	3.9 (2.0)	1500 (1100)	75 (30)	3.0 (1.2)	1300	50 (25)	2.0 (1.0)
8	1900	130 (60)	5.1 (2.4)	1500	100 (50)	3.9 (2.0)	1200 (900)	80 (30)	3.1 (1.2)	1000	50 (25)	2.0 (1.0)
10	1600	130 (60)	5.1 (2.4)	1300	100 (50)	3.9 (2.0)	950 (710)	75 (30)	3.0 (1.2)	800	50 (25)	2.0 (1.0)
12	1300	120 (60)	4.7 (2.4)	1100	100 (50)	3.9 (2.0)	800 (600)	75 (30)	3.0 (1.2)	670	50 (25)	2.0 (1.0)

Depth of cut



() : Indicates standard revolution and feed rate in slotting.

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MSTAR END MILLS

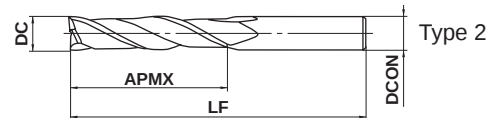
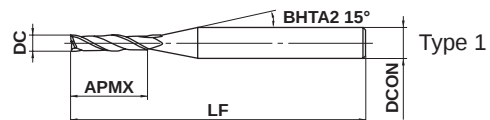
MS2LS

End mill, Long cut length, 2 flute



CARBIDE

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



0.2 ≤ DC ≤ 12				
0 - 0.020				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 2 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2LSD0020	0.2	0.8	40	4	2	★	1
MS2LSD0030	0.3	1.2	40	4	2	★	1
MS2LSD0040	0.4	1.6	40	4	2	★	1
MS2LSD0050	0.5	2	40	4	2	★	1
MS2LSD0060	0.6	2.4	40	4	2	★	1
MS2LSD0070	0.7	2.8	40	4	2	★	1
MS2LSD0080	0.8	3.2	40	4	2	★	1
MS2LSD0090	0.9	3.6	40	4	2	★	1
MS2LSD0100	1	4	40	4	2	★	1
MS2LSD0150	1.5	6	40	4	2	★	1
MS2LSD0200	2	8	40	4	2	★	1
MS2LSD0250	2.5	10	50	4	2	★	1
MS2LSD0300	3	12	50	6	2	★	1
MS2LSD0400	4	16	50	6	2	★	1
MS2LSD0500	5	20	60	6	2	★	1
MS2LSD0600	6	24	60	6	2	★	2
MS2LSD0800	8	32	70	8	2	★	2
MS2LSD1000	10	40	90	10	2	★	2
MS2LSD1200	12	48	110	12	2	★	2

RECOMMENDED CUTTING CONDITIONS

Slotting

DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
0.2	40000	400	15.7	0.001	30000	250	9.8	0.001
0.3	40000	600	23.6	0.005	35000	420	16.5	0.005
0.4	40000	700	27.6	0.007	30000	420	16.5	0.007
0.5	40000	800	31.5	0.01	24000	380	15.0	0.01
0.6	33000	800	31.5	0.015	21000	480	18.9	0.01
0.7	28000	800	31.5	0.015	18000	480	18.9	0.015
0.8	25000	800	31.5	0.02	16000	480	18.9	0.02
0.9	22000	800	31.5	0.03	15000	500	19.7	0.03
1	20000	800	31.5	0.04	13000	500	19.7	0.04
1.5	13000	800	31.5	0.10	9000	500	19.7	0.10
2	10000	800	31.5	0.15	6700	500	19.7	0.15
2.5	9000	800	31.5	0.20	6000	500	19.7	0.20
3	8000	800	31.5	0.20	5200	460	18.1	0.20
4	6000	600	23.6	0.20	4000	340	13.4	0.20
5	4800	480	18.9	0.30	3200	280	11.0	0.20
6	4000	400	15.7	0.30	2600	210	8.3	0.20
8	3000	300	11.8	0.30	2000	170	6.7	0.30
10	2400	240	9.4	0.30	1600	140	5.5	0.30
12	2000	200	7.9	0.30	1300	110	4.3	0.30

Depth of cut

DC: Dia.

Shoulder milling

DC (mm)	Revolution (min ⁻¹)	Table feed		Width of cut (mm)	Revolution (min ⁻¹)	Table feed		Width of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
3	3500	370	14.6	0.05	2600	250	9.8	0.03
4	2800	370	14.6	0.06	2100	200	7.9	0.03
5	2200	330	13.0	0.06	1700	160	6.3	0.03
6	1800	300	11.8	0.06	1500	140	5.5	0.03
8	1600	270	10.6	0.08	1100	140	5.5	0.04
10	1400	240	9.4	0.10	900	140	5.5	0.05
12	1200	200	7.9	0.10	750	120	4.7	0.06

Depth of cut

DC: Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

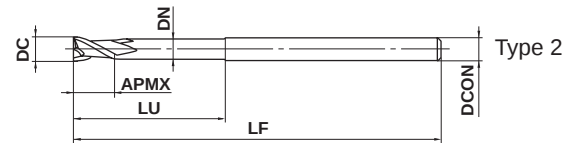
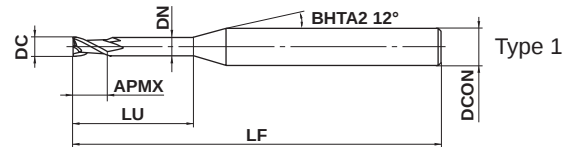
MS2XL

End mill, Short cut length, 2 flute, Long neck



CARBIDE

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



DC < 0.5	DC ≥ 0.5			
0 - 0.010	0 - 0.020			
4 ≤ DCON ≤ 6				
h6 0 - 0.008				



● 2 flute long neck end mill.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XLD0020N005	0.2	0.3	0.5	0.17	45	4	2	★	1
MS2XLD0020N010	0.2	0.3	1	0.17	45	4	2	★	1
MS2XLD0020N015	0.2	0.3	1.5	0.17	45	4	2	★	1
MS2XLD0030N010	0.3	0.4	1	0.27	45	4	2	★	1
MS2XLD0030N020	0.3	0.4	2	0.27	45	4	2	★	1
MS2XLD0030N030	0.3	0.4	3	0.27	45	4	2	★	1
MS2XLD0030N060	0.3	0.4	6	0.27	45	4	2	★	1
MS2XLD0030N090	0.3	0.4	9	0.27	45	4	2	★	1
MS2XLD0040N020	0.4	0.6	2	0.36	45	4	2	★	1
MS2XLD0040N030	0.4	0.6	3	0.36	45	4	2	★	1
MS2XLD0040N040	0.4	0.6	4	0.36	45	4	2	★	1
MS2XLD0040N080	0.4	0.6	8	0.36	45	4	2	★	1
MS2XLD0040N120	0.4	0.6	12	0.36	45	4	2	★	1
MS2XLD0050N020	0.5	0.7	2	0.46	45	4	2	★	1
MS2XLD0050N040	0.5	0.7	4	0.46	45	4	2	●	1
MS2XLD0050N060	0.5	0.7	6	0.46	45	4	2	●	1
MS2XLD0050N080	0.5	0.7	8	0.46	50	4	2	●	1
MS2XLD0050N100	0.5	0.7	10	0.46	50	4	2	●	1
MS2XLD0050N150	0.5	0.7	15	0.46	50	4	2	●	1
MS2XLD0060N020	0.6	0.9	2	0.56	45	4	2	★	1
MS2XLD0060N040	0.6	0.9	4	0.56	45	4	2	★	1
MS2XLD0060N060	0.6	0.9	6	0.56	45	4	2	★	1
MS2XLD0060N080	0.6	0.9	8	0.56	50	4	2	★	1
MS2XLD0060N100	0.6	0.9	10	0.56	50	4	2	★	1
MS2XLD0060N120	0.6	0.9	12	0.56	50	4	2	★	1
MS2XLD0060N180	0.6	0.9	18	0.56	50	4	2	★	1
MS2XLD0070N020	0.7	1	2	0.66	45	4	2	★	1
MS2XLD0070N040	0.7	1	4	0.66	45	4	2	★	1
MS2XLD0070N060	0.7	1	6	0.66	45	4	2	★	1
MS2XLD0070N080	0.7	1	8	0.66	50	4	2	★	1
MS2XLD0070N100	0.7	1	10	0.66	50	4	2	★	1

(mm)

CARBIDE

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XLD0080N040	0.8	1.2	4	0.76	45	4	2	★	1
MS2XLD0080N060	0.8	1.2	6	0.76	45	4	2	★	1
MS2XLD0080N080	0.8	1.2	8	0.76	50	4	2	★	1
MS2XLD0080N100	0.8	1.2	10	0.76	50	4	2	★	1
MS2XLD0080N120	0.8	1.2	12	0.76	50	4	2	★	1
MS2XLD0080N160	0.8	1.2	16	0.76	50	4	2	★	1
MS2XLD0080N240	0.8	1.2	24	0.76	60	4	2	★	1
MS2XLD0090N060	0.9	1.4	6	0.86	45	4	2	★	1
MS2XLD0090N080	0.9	1.4	8	0.86	50	4	2	★	1
MS2XLD0090N100	0.9	1.4	10	0.86	50	4	2	★	1
MS2XLD0090N150	0.9	1.4	15	0.86	60	4	2	★	1
MS2XLD0100N040	1	1.5	4	0.94	50	4	2	●	1
MS2XLD0100N060	1	1.5	6	0.94	50	4	2	●	1
MS2XLD0100N080	1	1.5	8	0.94	50	4	2	●	1
MS2XLD0100N100	1	1.5	10	0.94	50	4	2	●	1
MS2XLD0100N120	1	1.5	12	0.94	50	4	2	●	1
MS2XLD0100N160	1	1.5	16	0.94	60	4	2	●	1
MS2XLD0100N200	1	1.5	20	0.94	60	4	2	●	1
MS2XLD0100N250	1	1.5	25	0.94	70	4	2	★	1
MS2XLD0100N300	1	1.5	30	0.94	70	4	2	★	1
MS2XLD0120N060	1.2	1.8	6	1.14	50	4	2	★	1
MS2XLD0120N080	1.2	1.8	8	1.14	50	4	2	★	1
MS2XLD0120N100	1.2	1.8	10	1.14	50	4	2	★	1
MS2XLD0120N120	1.2	1.8	12	1.14	50	4	2	★	1
MS2XLD0120N160	1.2	1.8	16	1.14	60	4	2	★	1
MS2XLD0120N200	1.2	1.8	20	1.14	60	4	2	★	1
MS2XLD0150N060	1.5	2.3	6	1.44	50	4	2	★	1
MS2XLD0150N080	1.5	2.3	8	1.44	50	4	2	★	1
MS2XLD0150N100	1.5	2.3	10	1.44	50	4	2	★	1
MS2XLD0150N120	1.5	2.3	12	1.44	50	4	2	★	1
MS2XLD0150N140	1.5	2.3	14	1.44	60	4	2	★	1
MS2XLD0150N160	1.5	2.3	16	1.44	60	4	2	★	1
MS2XLD0150N180	1.5	2.3	18	1.44	60	4	2	★	1
MS2XLD0150N200	1.5	2.3	20	1.44	60	4	2	★	1
MS2XLD0150N250	1.5	2.3	25	1.44	70	4	2	★	1
MS2XLD0150N300	1.5	2.3	30	1.44	70	4	2	★	1
MS2XLD0150N380	1.5	2.3	38	1.44	80	4	2	★	1
MS2XLD0150N450	1.5	2.3	45	1.44	80	4	2	★	1
MS2XLD0200N060	2	3	6	1.9	50	4	2	★	1
MS2XLD0200N080	2	3	8	1.9	50	4	2	★	1
MS2XLD0200N100	2	3	10	1.9	50	4	2	●	1
MS2XLD0200N120	2	3	12	1.9	50	4	2	★	1
MS2XLD0200N140	2	3	14	1.9	60	4	2	●	1
MS2XLD0200N160	2	3	16	1.9	60	4	2	●	1
MS2XLD0200N180	2	3	18	1.9	60	4	2	★	1
MS2XLD0200N200	2	3	20	1.9	60	4	2	●	1
MS2XLD0200N250	2	3	25	1.9	70	4	2	●	1
MS2XLD0200N300	2	3	30	1.9	70	4	2	●	1
MS2XLD0200N350	2	3	35	1.9	80	4	2	★	1
MS2XLD0200N400	2	3	40	1.9	90	4	2	★	1
MS2XLD0200N500	2	3	50	1.9	100	4	2	★	1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

MSTAR END MILLS

MS2XL

End mill, Short cut length, 2 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

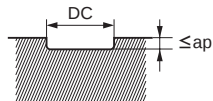
SOLID END MILLS

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XLD0200N600	2	3	60	1.9	110	4	2	★	1
MS2XLD0250N080	2.5	3.7	8	2.4	50	4	2	★	1
MS2XLD0250N120	2.5	3.7	12	2.4	50	4	2	●	1
MS2XLD0250N160	2.5	3.7	16	2.4	60	4	2	●	1
MS2XLD0250N200	2.5	3.7	20	2.4	60	4	2	●	1
MS2XLD0250N250	2.5	3.7	25	2.4	70	4	2	●	1
MS2XLD0250N300	2.5	3.7	30	2.4	70	4	2	●	1
MS2XLD0250N400	2.5	3.7	40	2.4	90	4	2	★	1
MS2XLD0250N500	2.5	3.7	50	2.4	100	4	2	★	1
MS2XLD0300N080	3	4.5	8	2.8	50	6	2	★	1
MS2XLD0300N120	3	4.5	12	2.8	50	6	2	★	1
MS2XLD0300N160	3	4.5	16	2.8	60	6	2	●	1
MS2XLD0300N200	3	4.5	20	2.8	60	6	2	●	1
MS2XLD0300N250	3	4.5	25	2.8	70	6	2	●	1
MS2XLD0300N300	3	4.5	30	2.8	70	6	2	●	1
MS2XLD0300N400	3	4.5	40	2.8	90	6	2	●	1
MS2XLD0300N500	3	4.5	50	2.8	100	6	2	★	1
MS2XLD0400N120	4	6	12	3.8	50	6	2	★	1
MS2XLD0400N160	4	6	16	3.8	60	6	2	★	1
MS2XLD0400N200	4	6	20	3.8	60	6	2	★	1
MS2XLD0400N250	4	6	25	3.8	70	6	2	★	1
MS2XLD0400N300	4	6	30	3.8	70	6	2	★	1
MS2XLD0400N350	4	6	35	3.8	80	6	2	★	1
MS2XLD0400N400	4	6	40	3.8	90	6	2	★	1
MS2XLD0400N450	4	6	45	3.8	90	6	2	★	1
MS2XLD0400N500	4	6	50	3.8	100	6	2	★	1
MS2XLD0400N600	4	6	60	3.8	110	6	2	★	1
MS2XLD0500N160	5	7.5	16	4.8	60	6	2	●	1
MS2XLD0500N250	5	7.5	25	4.8	70	6	2	●	1
MS2XLD0500N350	5	7.5	35	4.8	80	6	2	●	1
MS2XLD0500N500	5	7.5	50	4.8	110	6	2	●	1
MS2XLD0500N600	5	7.5	60	4.8	120	6	2	★	1
MS2XLD0600N200	6	9	20	5.8	80	6	2	★	2
MS2XLD0600N300	6	9	30	5.8	90	6	2	★	2
MS2XLD0600N400	6	9	40	5.8	100	6	2	★	2
MS2XLD0600N500	6	9	50	5.8	110	6	2	★	2
MS2XLD0600N600	6	9	60	5.8	120	6	2	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel			
		AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.			
DC (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)	
0.2	0.5	40000	600	23.6	0.004
	1	40000	400	15.7	0.001
0.3	1	40000	650	25.6	0.007
	3	40000	500	19.7	0.002
	9	22000	150	5.9	0.001
0.4	2	40000	800	31.5	0.007
	4	40000	800	31.5	0.003
	12	17000	150	5.9	0.001
0.5	2	40000	950	37.4	0.01
	6	40000	700	27.6	0.003
	10	25000	400	15.7	0.002
	15	14000	150	5.9	0.001
0.6	2	40000	950	37.4	0.01
	6	40000	800	31.5	0.005
	10	25000	450	17.7	0.003
	18	12000	150	5.9	0.001
0.7	2	40000	1000	39.4	0.02
	6	40000	900	35.4	0.01
	8	30000	700	27.6	0.005
	10	11000	300	11.8	0.005
	4	40000	1200	47.2	0.02
0.8	8	40000	1000	39.4	0.01
	12	25000	400	15.7	0.003
	24	10000	150	5.9	0.001
	6	40000	1300	51.2	0.02
0.9	10	35000	1000	39.4	0.01
	15	9000	400	15.7	0.003
1	6	40000	1600	63.0	0.04
	8	40000	1600	63.0	0.03
	12	30000	1000	39.4	0.02
	20	15000	400	15.7	0.005
	30	8000	150	5.9	0.001
	6	40000	1900	74.8	0.06
1.2	8	40000	1900	74.8	0.04
	12	25000	1000	39.4	0.03
	20	6500	150	5.9	0.01

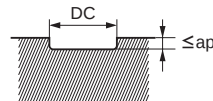
Depth of cut



DC:Dia.

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel			
		AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.			
DC (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)	
1.5	6	40000	2400	94.5	0.10
	10	30000	1800	70.9	0.05
	20	15000	600	23.6	0.02
	30	7500	300	11.8	0.005
	45	5000	150	5.9	0.001
1.6	6	40000	2400	94.5	0.12
	10	30000	1800	70.9	0.07
	16	20000	1000	39.4	0.04
2	6	40000	2400	94.5	0.18
	10	30000	1800	70.9	0.10
	16	20000	1000	39.4	0.06
	30	8000	500	19.7	0.04
	40	6000	250	9.8	0.01
	60	4200	150	5.9	0.003
2.5	8	25000	2500	98.4	0.20
	16	18000	1700	66.9	0.10
	20	12000	1000	39.4	0.08
	40	8000	400	15.7	0.03
	50	4000	150	5.9	0.015
3	8	20000	2000	78.7	0.30
	16	15000	1400	55.1	0.15
	20	10000	800	31.5	0.10
	40	5000	250	9.8	0.02
	50	3700	150	5.9	0.01
4	12	15000	3000	118.1	0.30
	20	11000	2200	86.6	0.22
	30	6400	1200	47.2	0.12
	40	4500	400	15.7	0.05
	50	2800	150	5.9	0.018
	60	1800	60	2.6	0.005
5	16	12000	2500	98.4	0.35
	35	5100	750	29.5	0.15
	60	2200	150	5.9	0.02
6	20	10000	2000	78.7	0.40
	40	4200	800	31.5	0.20
	60	1900	150	5.9	0.10

Depth of cut



DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

SQUARE

BALL

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TAPER

BARREL

ROUGHING

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SOLID END MILLS

MSTAR END MILLS

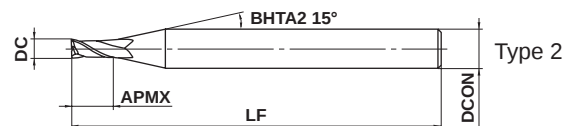
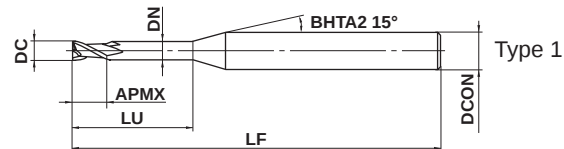
MS2XL6

End mill, Short cut length, 2 flute, 6mm shank



CARBIDE

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



0.3 ≤ DC ≤ 2.5				
0 - 0.020				
DCON=6				
0 - 0.008				



- 2 flute long neck end mill.
- φ6 shank type.

SQUARE

BALL

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TAPER

BARREL

ROUGHING

SOLID END MILLS

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XL6D0030N008	0.3	0.8	—	—	50	6	2	●	2
MS2XL6D0030N015	0.3	0.5	1.5	0.27	50	6	2	●	1
MS2XL6D0040N010	0.4	0.6	1	0.36	50	6	2	●	1
MS2XL6D0040N020	0.4	0.6	2	0.36	50	6	2	●	1
MS2XL6D0050N013	0.5	0.8	1.3	0.46	50	6	2	●	1
MS2XL6D0050N025	0.5	0.8	2.5	0.46	50	6	2	●	1
MS2XL6D0060N015	0.6	0.9	1.5	0.56	50	6	2	●	1
MS2XL6D0060N030	0.6	0.9	3	0.56	50	6	2	●	1
MS2XL6D0070N018	0.7	1.1	1.8	0.66	50	6	2	●	1
MS2XL6D0070N035	0.7	1.1	3.5	0.66	50	6	2	●	1
MS2XL6D0080N020	0.8	1.2	2	0.76	50	6	2	●	1
MS2XL6D0080N040	0.8	1.2	4	0.76	50	6	2	●	1
MS2XL6D0090N023	0.9	1.4	2.3	0.86	50	6	2	●	1
MS2XL6D0090N045	0.9	1.4	4.5	0.86	50	6	2	●	1
MS2XL6D0100N025	1	1.5	2.5	0.94	50	6	2	●	1
MS2XL6D0100N050	1	1.5	5	0.94	50	6	2	●	1
MS2XL6D0110N028	1.1	1.7	2.8	1.04	50	6	2	●	1
MS2XL6D0110N055	1.1	1.7	5.5	1.04	50	6	2	●	1
MS2XL6D0120N030	1.2	1.8	3	1.14	50	6	2	●	1
MS2XL6D0120N060	1.2	1.8	6	1.14	50	6	2	●	1
MS2XL6D0130N033	1.3	2	3.3	1.24	50	6	2	●	1
MS2XL6D0130N065	1.3	2	6.5	1.24	50	6	2	●	1
MS2XL6D0140N035	1.4	2.1	3.5	1.34	50	6	2	●	1
MS2XL6D0140N070	1.4	2.1	7	1.34	50	6	2	●	1
MS2XL6D0150N038	1.5	2.3	3.8	1.44	50	6	2	●	1
MS2XL6D0150N075	1.5	2.3	7.5	1.44	50	6	2	●	1
MS2XL6D0160N040	1.6	2.4	4	1.54	50	6	2	●	1
MS2XL6D0160N080	1.6	2.4	8	1.54	50	6	2	●	1
MS2XL6D0170N043	1.7	2.6	4.3	1.64	50	6	2	●	1
MS2XL6D0170N085	1.7	2.6	8.5	1.64	50	6	2	●	1
MS2XL6D0180N045	1.8	2.7	4.5	1.74	50	6	2	●	1

(mm)

CARBIDE

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XL6D0180N090	1.8	2.7	9	1.74	50	6	2	●	1
MS2XL6D0190N048	1.9	2.9	4.8	1.84	50	6	2	●	1
MS2XL6D0190N095	1.9	2.9	9.5	1.84	50	6	2	●	1
MS2XL6D0200N050	2	3	5	1.90	50	6	2	●	1
MS2XL6D0200N100	2	3	10	1.90	50	6	2	●	1
MS2XL6D0210N053	2.1	3.2	5.3	2.00	50	6	2	●	1
MS2XL6D0210N105	2.1	3.2	10.5	2.00	60	6	2	●	1
MS2XL6D0220N055	2.2	3.3	5.5	2.10	50	6	2	●	1
MS2XL6D0220N110	2.2	3.3	11	2.10	60	6	2	●	1
MS2XL6D0230N058	2.3	3.5	5.8	2.20	50	6	2	●	1
MS2XL6D0230N115	2.3	3.5	11.5	2.20	60	6	2	●	1
MS2XL6D0240N060	2.4	3.6	6	2.30	50	6	2	●	1
MS2XL6D0240N120	2.4	3.6	12	2.30	60	6	2	●	1
MS2XL6D0250N063	2.5	3.8	6.3	2.40	50	6	2	●	1
MS2XL6D0250N125	2.5	3.8	12.5	2.40	60	6	2	●	1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

MSTAR END MILLS

MS2XL6

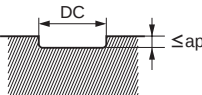
End mill, Short cut length, 2 flute, 6mm shank

CARBIDE

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel (—30HRC)				Alloy steel, Tool steel, Pre-hardened steel			
		AISI 1050, AISI 35, AISI P20 etc.				AISI H13, AISI W1-10, AISI P21 etc.			
DC (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)			(mm/min)	(IPM)	
0.3	0.8	40000	500—1000	19.7—39.4	0.01	30000	300—800	11.8—31.5	0.01
	1.5				0.007				0.007
0.4	1	40000	500—1000	19.7—39.4	0.015	30000	300—800	11.8—31.5	0.015
	2				0.01				0.01
0.5	1.3	40000	500—1000	19.7—39.4	0.02	30000	300—800	11.8—31.5	0.02
	2.5				0.013				0.013
0.6	1.5	33000	500—1000	19.7—39.4	0.03	25000	300—800	11.8—31.5	0.03
	3				0.018				0.018
0.7	1.8	29000	500—1000	19.7—39.4	0.04	22000	300—800	11.8—31.5	0.04
	3.5				0.025				0.025
0.8	2	25000	500—1000	19.7—39.4	0.06	20000	300—800	11.8—31.5	0.06
	4				0.03				0.03
0.9	2.3	22000	500—1000	19.7—39.4	0.08	18000	300—800	11.8—31.5	0.08
	4.5				0.05				0.05
1	2.5	20000	500—1000	19.7—39.4	0.1	16000	300—800	11.8—31.5	0.1
	5				0.07				0.07
1.1	2.8	18000	500—1000	19.7—39.4	0.12	14000	300—800	11.8—31.5	0.12
	5.5				0.08				0.08
1.2	3	16000	500—1000	19.7—39.4	0.12	13000	300—800	11.8—31.5	0.12
	6				0.08				0.08
1.3	3.3	15000	500—1000	19.7—39.4	0.12	12000	300—800	11.8—31.5	0.12
	6.5				0.08				0.08
1.4	3.5	14000	500—1000	19.7—39.4	0.12	11000	300—800	11.8—31.5	0.12
	7				0.08				0.08
1.5	3.8	13000	500—1000	19.7—39.4	0.15	10000	300—800	11.8—31.5	0.15
	7.5				0.1				0.1
1.6	4	12000	500—1000	19.7—39.4	0.15	10000	300—800	11.8—31.5	0.15
	8				0.1				0.1
1.7	4.3	12000	500—1000	19.7—39.4	0.17	9500	300—800	11.8—31.5	0.17
	8.5				0.12				0.12
1.8	4.5	11000	500—1000	19.7—39.4	0.17	9000	300—800	11.8—31.5	0.17
	9				0.12				0.12
1.9	4.8	10000	500—1000	19.7—39.4	0.17	9000	300—800	11.8—31.5	0.17
	9.5				0.12				0.12

Depth of cut

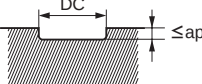


DC:Dia.

DC: Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

Work Material		Carbon steel, Cast iron, Alloy steel (−30HRC)				Alloy steel, Tool steel, Pre-hardened steel			
		AISI 1050, AISI 35, AISI P20 etc.				AISI H13, AISI W1-10, AISI P21 etc.			
DC (mm)	LU (mm)	Revolution (min ^{−1})	Table feed		Depth of cut ap (mm)	Revolution (min ^{−1})	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)			(mm/min)	(IPM)	
2	5	10000	500—1000	19.7—39.4	0.2	9000	300—800	11.8—31.5	0.2
	10				0.15				0.15
2.1	5.3	9800	500—1000	19.7—39.4	0.2	9000	300—800	11.8—31.5	0.2
	10.5				0.15				0.15
2.2	5.5	9600	500—1000	19.7—39.4	0.2	9000	300—800	11.8—31.5	0.2
	11				0.15				0.15
2.3	5.8	9400	500—1000	19.7—39.4	0.2	8800	300—800	11.8—31.5	0.2
	11.5				0.15				0.15
2.4	6	9200	500—1000	19.7—39.4	0.25	8700	300—800	11.8—31.5	0.25
	12				0.2				0.2
2.5	6.3	9000	500—1000	19.7—39.4	0.25	8500	300—800	11.8—31.5	0.25
	12.5				0.2				0.2
Depth of cut									
		DC: Dia.							

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

MSTAR END MILLS

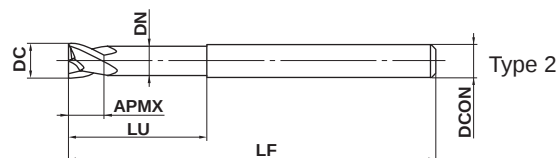
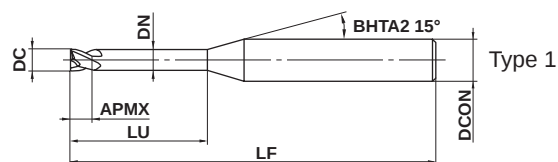
MS2XL - Inch sizes

End mill, Short cut length, 2 flute, Long neck



CARBIDE

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



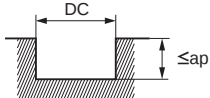
DC ≤ .2500"				
0 - .0008"				
DCON = .1250"	DCON = .1875"	DCON = .2500"		
0 - .00024"	0 - .00031"	0 - .00035"		

● 2 flute, long neck, square end mill for general purpose.

(inch)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XLD1/64N0094	.0156	.0156	.0938	.0144	2.0	.1250	2	●	1
MS2XLD1/64N0125	.0156	.0156	.1250	.0144	2.0	.1250	2	●	1
MS2XLD1/64N0187	.0156	.0156	.1875	.0144	2.0	.1250	2	●	1
MS2XLD1/32N0187	.0313	.0313	.1875	.0301	2.0	.1250	2	●	1
MS2XLD1/32N0250	.0313	.0313	.2500	.0301	2.0	.1250	2	●	1
MS2XLD1/32N0375	.0313	.0313	.3750	.0301	2.0	.1250	2	●	1
MS2XLD1/16N0375	.0625	.0625	.3750	.0601	2.0	.1250	2	●	1
MS2XLD1/16N0500	.0625	.0625	.5000	.0601	2.0	.1250	2	●	1
MS2XLD1/16N0750	.0625	.0625	.7500	.0601	2.0	.1250	2	●	1
MS2XLD3/32N0562	.0938	.0938	.5625	.0898	2.0	.1250	2	●	1
MS2XLD3/32N0750	.0938	.0938	.7500	.0898	2.0	.1250	2	●	1
MS2XLD3/32N1125	.0938	.0938	1.1250	.0898	2.5	.1250	2	●	1
MS2XLD1/8N0750	.1250	.1250	.7500	.1211	2.0	.1250	2	●	2
MS2XLD3/16N1125	.1875	.1875	1.1250	.1836	2.5	.1875	2	●	2
MS2XLD1/4N1500	.2500	.2500	1.5000	.2441	3.0	.2500	2	●	2

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel		
		AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.		
DC (inch)	LU (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut _{ap} (inch)
.0156	.0938	40000	17.0	.0002
	.1250	30000	10.6	.0002
	.1875	20000	5.6	.0001
.0313	.1875	40000	56.7	.0008
	.2500	25000	26.6	.0008
	.3750	15000	10.6	.0004
.0625	.3750	40000	90.7	.0028
	.5000	30000	51.0	.0016
	.7500	10000	10.6	.0008
.0938	.5625	33000	81.8	.003
	.7500	20000	42.5	.002
	1.1250	10000	14.1	.001
.1250	.7500	25000	72.4	.004
.1875	1.1250	17000	54.2	.006
.2500	1.5000	13000	55.3	.008
Depth of cut				
		DC: Dia.		

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

MSTAR END MILLS

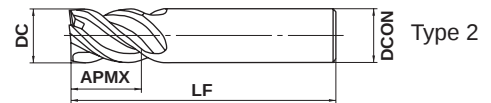
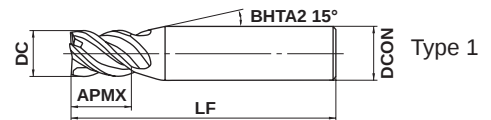
MSSHDD

High power, Short cut length, 4 flute



CARBIDE

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



DC≤12	DC>12			
0 - 0.020	0 - 0.030			
DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	



● 4 flute high power end mill.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

(mm)

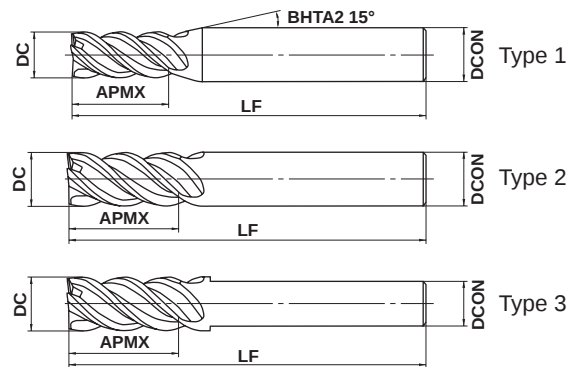
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MSSHDD0300	3	4.5	45	6	4	★	1
MSSHDD0350	3.5	5.3	45	6	4	★	1
MSSHDD0400	4	6	45	6	4	★	1
MSSHDD0450	4.5	6.8	45	6	4	★	1
MSSHDD0500	5	7.5	50	6	4	★	1
MSSHDD0550	5.5	8.3	50	6	4	★	1
MSSHDD0600	6	9	50	6	4	★	2
MSSHDD0650	6.5	9.8	60	8	4	★	1
MSSHDD0700	7	10.5	60	8	4	★	1
MSSHDD0750	7.5	11.3	60	8	4	★	1
MSSHDD0800	8	12	60	8	4	★	2
MSSHDD0850	8.5	12.8	70	10	4	★	1
MSSHDD0900	9	13.5	70	10	4	★	1
MSSHDD0950	9.5	14.3	70	10	4	★	1
MSSHDD1000	10	15	70	10	4	★	2
MSSHDD1100	11	16.5	75	12	4	★	1
MSSHDD1200	12	18	75	12	4	★	2
MSSHDD1300	13	19.5	75	12	4	★	3
MSSHDD1400	14	21	90	16	4	★	1
MSSHDD1500	15	22.5	90	16	4	★	1
MSSHDD1600	16	24	90	16	4	★	2
MSSHDD1700	17	25.5	100	16	4	★	3
MSSHDD1800	18	27	100	16	4	★	3
MSSHDD1900	19	28.5	110	20	4	★	1
MSSHDD2000	20	30	110	20	4	★	2

MSMHD

High power, Medium cut length, 4 flute



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



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

● 4 flute high power end mill.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MSMHDD0200	2	4	45	4	4	★	1
MSMHDD0210	2.1	5	45	4	4	★	1
MSMHDD0220	2.2	5	45	4	4	★	1
MSMHDD0230	2.3	5	45	4	4	★	1
MSMHDD0240	2.4	5	45	4	4	★	1
MSMHDD0250	2.5	5	45	4	4	★	1
MSMHDD0260	2.6	6	45	4	4	★	1
MSMHDD0270	2.7	6	45	4	4	★	1
MSMHDD0280	2.8	6	45	4	4	★	1
MSMHDD0290	2.9	6	45	4	4	★	1
MSMHDD0300	3	8	45	6	4	★	1
MSMHDD0310	3.1	8	45	6	4	★	1
MSMHDD0320	3.2	8	45	6	4	★	1
MSMHDD0330	3.3	8	45	6	4	★	1
MSMHDD0340	3.4	8	45	6	4	★	1
MSMHDD0350	3.5	8	45	6	4	★	1
MSMHDD0360	3.6	11	45	6	4	★	1
MSMHDD0370	3.7	11	45	6	4	★	1
MSMHDD0380	3.8	11	45	6	4	★	1
MSMHDD0390	3.9	11	45	6	4	★	1
MSMHDD0400	4	11	45	6	4	★	1
MSMHDD0410	4.1	12	45	6	4	★	1
MSMHDD0420	4.2	12	45	6	4	★	1
MSMHDD0430	4.3	12	45	6	4	★	1
MSMHDD0440	4.4	12	45	6	4	★	1
MSMHDD0450	4.5	12	45	6	4	★	1
MSMHDD0460	4.6	13	50	6	4	★	1
MSMHDD0470	4.7	13	50	6	4	★	1
MSMHDD0480	4.8	13	50	6	4	★	1
MSMHDD0490	4.9	13	50	6	4	★	1
MSMHDD0500	5	13	50	6	4	★	1

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MSTAR END MILLS

MSMHD

High power, Medium cut length, 4 flute

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MSMHDD0510	5.1	13	50	6	4	★	1
MSMHDD0520	5.2	13	50	6	4	★	1
MSMHDD0530	5.3	13	50	6	4	★	1
MSMHDD0540	5.4	13	50	6	4	★	1
MSMHDD0550	5.5	13	50	6	4	★	1
MSMHDD0560	5.6	13	50	6	4	★	1
MSMHDD0570	5.7	13	50	6	4	★	1
MSMHDD0580	5.8	13	50	6	4	★	1
MSMHDD0590	5.9	13	50	6	4	★	1
MSMHDD0600	6	13	50	6	4	★	2
MSMHDD0650	6.5	16	60	8	4	★	1
MSMHDD0700	7	19	60	8	4	★	1
MSMHDD0750	7.5	19	60	8	4	★	1
MSMHDD0800	8	19	60	8	4	★	2
MSMHDD0850	8.5	19	70	10	4	★	1
MSMHDD0900	9	22	70	10	4	★	1
MSMHDD0950	9.5	22	70	10	4	★	1
MSMHDD1000	10	22	70	10	4	★	2
MSMHDD1100	11	26	75	12	4	★	1
MSMHDD1200S10	12	26	75	10	4	★	3
MSMHDD1200	12	26	75	12	4	★	2
MSMHDD1300	13	26	75	12	4	★	3
MSMHDD1400	14	30	90	16	4	★	1
MSMHDD1500	15	35	90	16	4	★	1
MSMHDD1600	16	35	90	16	4	★	2
MSMHDD1700	17	35	100	16	4	★	3
MSMHDD1800	18	40	100	16	4	★	3
MSMHDD1900	19	40	110	20	4	★	1
MSMHDD2000	20	45	110	20	4	★	2
MSMHDD2200	22	50	125	20	4	★	3
MSMHDD2500	25	55	125	25	4	★	2

MSSHD

High power, Short cut length, 4 flute

MSMHD

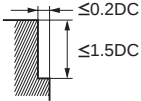
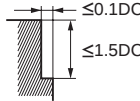
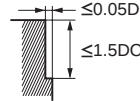
High power, Medium cut length, 4 flute

CARBIDE

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

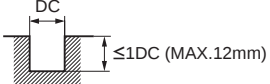
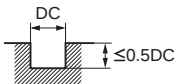
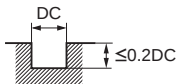
Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45–55HRC)			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
2	15000	550	21.7	10000	340	13.4	10000	320	12.6	6400	160	6.3	4800	100	3.9
3	11000	800	31.5	7400	500	19.7	7400	480	18.9	4800	250	9.8	4000	170	6.7
4	8000	900	35.4	5600	540	21.3	5600	520	20.5	3600	270	10.6	3200	240	9.4
5	6400	1000	39.4	4500	600	23.6	4500	580	22.8	2900	300	11.8	2600	240	9.4
6	5800	1100	43.3	3700	640	25.2	3700	600	23.6	2400	320	12.6	2100	230	9.1
8	4400	1100	43.3	2800	660	26.0	2800	600	23.6	1800	330	13.0	1600	220	8.7
10	3500	1000	39.4	2200	640	25.2	2200	560	22.0	1400	320	12.6	1300	200	7.9
12	2900	1000	39.4	1900	640	25.2	1900	530	20.9	1200	320	12.6	1100	170	6.7
16	2200	800	31.5	1400	500	19.7	1400	450	17.7	900	250	9.8	800	130	5.1
20	1800	750	29.5	1100	460	18.1	1100	440	17.3	720	230	9.1	640	100	3.9
25	1400	600	23.6	900	400	15.7	900	380	15.0	570	200	7.9	510	80	3.1

Depth of cut																		

DC: Dia.

Slotting

Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45–55HRC)			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
2	12000	400	15.7	7000	200	7.9	7000	100	3.9	4200	80	3.1	2300	40	1.6
3	9000	600	23.6	5300	300	11.8	5300	150	5.9	3200	130	5.1	1900	70	2.8
4	7200	720	28.3	4000	360	14.2	4000	180	7.1	2400	140	5.5	1400	95	3.7
5	5800	720	28.3	3200	360	14.2	3200	180	7.1	1900	150	5.9	1100	95	3.7
6	5000	800	31.5	2700	400	15.7	2700	200	7.9	1600	160	6.3	950	95	3.7
8	3700	800	31.5	2000	400	15.7	2000	200	7.9	1200	170	6.7	720	90	3.5
10	3000	720	28.3	1600	360	14.2	1600	180	7.1	960	160	6.3	570	80	3.1
12	2500	720	28.3	1300	360	14.2	1300	180	7.1	800	160	6.3	480	70	2.8
16	2000	600	23.6	1000	280	11.0	1000	150	5.9	600	130	5.1	360	50	2.0
20	1600	540	21.3	800	250	9.8	800	130	5.1	480	120	4.7	290	40	1.6
25	1300	480	18.9	640	220	8.7	640	120	4.7	380	100	3.9	230	35	1.4

Depth of cut																		

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MSTAR END MILLS

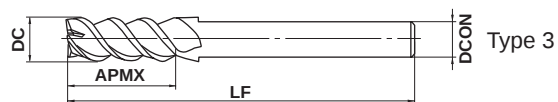
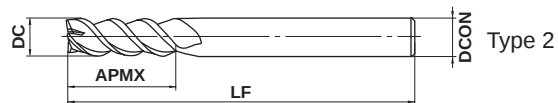
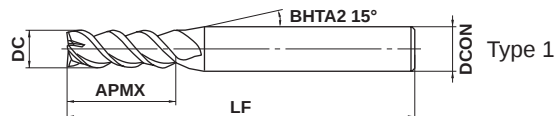
MSMHZD

Slotting, Medium cut length, 3 flute



CARBIDE

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



DC ≤ 12	DC > 12			
0 - 0.020	0 - 0.030			
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● A single end mill for both plunging and slotting.

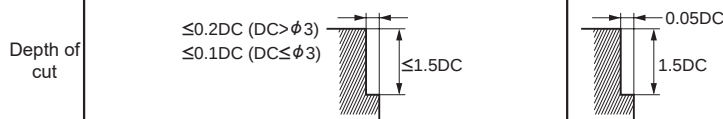
(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MSMHZDD0100	1	2	45	4	3	★	1
MSMHZDD0150	1.5	3	45	4	3	★	1
MSMHZDD0200	2	4	50	6	3	●	1
MSMHZDD0250	2.5	5	50	6	3	●	1
MSMHZDD0300	3	6	50	6	3	●	1
MSMHZDD0350	3.5	8	50	6	3	●	1
MSMHZDD0400	4	8	50	6	3	●	1
MSMHZDD0450	4.5	10	50	6	3	●	1
MSMHZDD0500	5	10	50	6	3	●	1
MSMHZDD0550	5.5	13	50	6	3	●	1
MSMHZDD0600	6	13	60	6	3	●	2
MSMHZDD0650	6.5	16	60	8	3	●	1
MSMHZDD0700	7	16	60	8	3	●	1
MSMHZDD0750	7.5	16	60	8	3	●	1
MSMHZDD0800	8	19	70	8	3	●	2
MSMHZDD0850	8.5	19	70	10	3	●	1
MSMHZDD0900	9	19	70	10	3	●	1
MSMHZDD0950	9.5	19	70	10	3	●	1
MSMHZDD1000	10	22	80	10	3	●	2
MSMHZDD1100	11	22	80	12	3	●	1
MSMHZDD1200	12	26	90	12	3	●	2
MSMHZDD1300	13	26	90	12	3	●	3
MSMHZDD1400	14	26	90	12	3	●	3
MSMHZDD1500	15	26	110	16	3	●	1
MSMHZDD1600	16	30	110	16	3	●	2
MSMHZDD2000	20	32	140	20	3	●	2

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

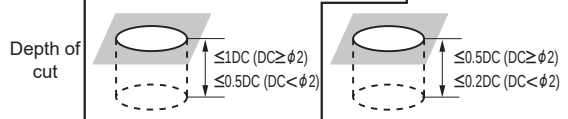
Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
1	19000	600	23.6	13000	310	12.2	10000	200	7.9	9500	65	2.6
1.5	14000	600	23.6	9000	310	12.2	7500	210	8.3	6400	75	3.0
2	11000	600	23.6	7200	310	12.2	6000	210	8.3	4800	75	3.0
3	8500	770	30.3	5300	380	15.0	4400	220	8.7	3200	100	3.9
4	7200	850	33.5	4400	480	18.9	3700	250	9.8	2400	130	5.1
6	5300	940	37.0	3200	490	19.3	2700	270	10.6	1600	130	5.1
8	4000	1010	39.8	2400	560	22.0	2000	280	11.0	1200	120	4.7
10	3200	1000	39.4	1900	480	18.9	1600	300	11.8	950	110	4.3
12	2700	950	37.4	1600	440	17.3	1300	300	11.8	800	90	3.5
16	2000	720	28.3	1200	350	13.8	1000	260	10.2	600	70	2.8
20	1600	600	23.6	1000	290	11.4	800	240	9.4	480	60	2.4



DC: Dia.

Plunging

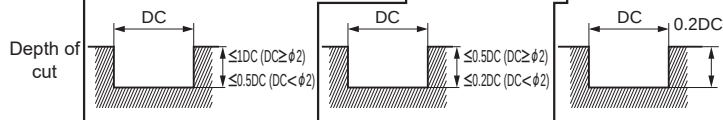
Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
1	13000	80	3.1	10000	50	2.0	6000	10	0.4
1.5	12000	120	4.7	8000	80	3.1	6000	20	0.8
2	11000	200	7.9	7200	140	5.5	6000	30	1.2
3	8500	250	9.8	5300	180	7.1	4200	50	2.0
4	7200	300	11.8	4400	210	8.3	3300	60	2.4
6	5300	300	11.8	3200	210	8.3	2200	70	2.8
8	4000	320	12.6	2400	220	8.7	1600	80	3.1
10	3200	340	13.4	1900	240	9.4	1300	70	2.8
12	2700	320	12.6	1600	220	8.7	1100	70	2.8
16	2000	250	9.8	1200	180	7.1	800	55	2.2
20	1600	200	7.9	1000	140	5.5	640	55	2.2



DC: Dia.

Slotting

Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
1	13000	130	5.1	10000	80	3.1	6000	30	1.2	5700	25	1.0
1.5	12000	250	9.8	8000	150	5.9	6000	60	2.4	3800	30	1.2
2	11000	500	19.7	7200	260	10.2	6000	130	5.1	2800	35	1.4
3	8500	640	25.2	5300	320	12.6	4200	130	5.1	1900	50	2.0
4	7200	650	25.6	4400	370	14.6	3300	140	5.5	1400	70	2.8
6	5300	720	28.3	3200	380	15.0	2200	140	5.5	950	70	2.8
8	4000	780	30.7	2400	430	16.9	1600	140	5.5	720	60	2.4
10	3200	770	30.3	1900	370	14.6	1300	150	5.9	570	50	2.0
12	2700	730	28.7	1600	340	13.4	1100	150	5.9	480	40	1.6
16	2000	600	23.6	1200	290	11.4	800	130	5.1	360	30	1.2
20	1600	500	19.7	1000	240	9.4	640	120	4.7	290	25	1.0



DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MSTAR END MILLS

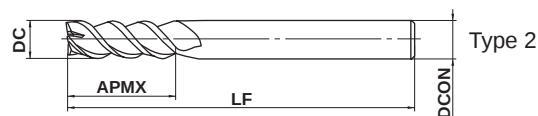
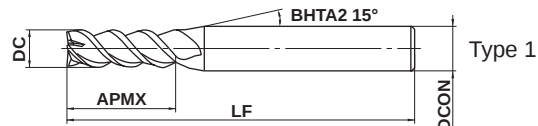
MSMHZD – Inch sizes

Slotting, Medium cut length, 3 flute



CARBIDE

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



DC < .5000"	DC ≥ .5000"			
0 - .0008"	0 - .0012"			
.2500" ≤ DCON ≤ .3750"	.5000" ≤ DCON ≤ .6250"	DCON = .7500"		
0 - .00035"	0 - .00043"	0 - .00051"		

● A single end mill for both plunging and slotting.

(inch)

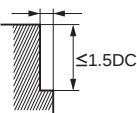
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MSMHZDD1/16	.0625	.125	2.000	.2500	3	●	1
MSMHZDD5/64	.0781	.156	2.000	.2500	3	●	1
MSMHZDD3/32	.0938	.188	2.000	.2500	3	●	1
MSMHZDD7/64	.1094	.250	2.000	.2500	3	●	1
MSMHZDD1/8	.1250	.313	2.000	.2500	3	●	2
MSMHZDD5/32	.1563	.313	2.000	.2500	3	●	1
MSMHZDD3/16	.1875	.406	2.000	.2500	3	●	1
MSMHZDD7/32	.2188	.406	2.000	.2500	3	●	1
MSMHZDD1/4	.2500	.625	2.500	.2500	3	●	2
MSMHZDD9/32	.2813	.625	2.500	.3750	3	●	1
MSMHZDD5/16	.3125	.750	2.750	.3750	3	●	1
MSMHZDD11/32	.3438	.750	2.750	.3750	3	●	2
MSMHZDD3/8	.3750	.750	3.000	.3750	3	●	2
MSMHZDD13/32	.4063	.875	3.000	.5000	3	●	1
MSMHZDD7/16	.4375	.875	3.000	.5000	3	●	1
MSMHZDD15/32	.4688	1.000	3.500	.5000	3	●	2
MSMHZDD1/2	.5000	1.000	3.500	.5000	3	●	2
MSMHZDD9/16	.5625	1.000	3.500	.6250	3	●	1
MSMHZDD5/8	.6250	1.125	4.250	.6250	3	●	2
MSMHZDD3/4	.7500	1.250	5.500	.7500	3	●	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.		
DC (inch)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
.0625	13000	550	21.7	8500	310	12.2	7100	200	7.9
.1250	8000	770	30.3	5100	380	15.0	4200	220	8.7
.1875	6300	880	34.6	3800	490	19.3	3200	250	9.8
.2500	5000	950	37.4	3000	500	19.7	2500	270	10.6
.3125	4000	1000	39.4	2400	560	22.0	2000	280	11.0
.3750	3300	1000	39.4	2000	490	19.3	1700	290	11.4
.4375	2900	970	38.2	1700	450	17.7	1400	300	11.8
.5000	2500	860	33.9	1500	420	16.5	1300	300	11.8
.5625	2200	790	31.1	1300	370	14.6	1100	280	11.0
.6250	2000	720	28.3	1200	350	13.8	1000	260	10.2
.7500	1700	610	24.0	1000	290	11.4	800	240	9.4

Depth of cut

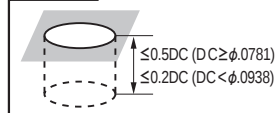
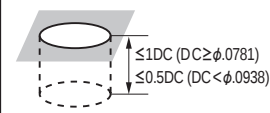
 $\leq 0.2DC$ ($DC > \phi.1094$)
 $\leq 0.1DC$ ($DC \leq \phi.1250$)


DC: Dia.

Plunging

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.		
DC (inch)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
.0625	11000	120	4.7	7600	80	3.1	6000	20	0.8
.1250	8000	260	10.2	5000	180	7.1	4000	50	2.0
.1875	6300	300	11.8	3800	210	8.3	2700	60	2.4
.2500	5000	310	12.2	3000	210	8.3	2000	70	2.8
.3125	4000	320	12.6	2400	220	8.7	1600	80	3.1
.3750	3300	330	13.0	2000	240	9.4	1300	70	2.8
.4375	2900	330	13.0	1700	220	8.7	1100	70	2.8
.5000	2500	310	12.2	1500	210	8.3	1000	70	2.8
.5625	2200	270	10.6	1300	180	7.1	900	60	2.4
.6250	2000	250	9.8	1200	180	7.1	800	55	2.2
.7500	1700	200	7.9	1000	140	5.5	700	55	2.2

Depth of cut

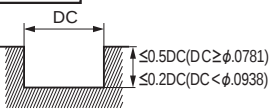
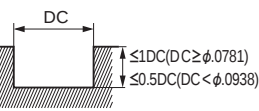


DC: Dia.

Slotting

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.		
DC (inch)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
.0625	11000	230	9.1	7600	150	5.9	6000	60	2.4
.1250	8000	600	23.6	5000	320	12.6	4000	130	5.1
.1875	6300	660	26.0	3800	360	14.2	2700	140	5.5
.2500	5000	720	28.3	3000	390	15.4	2000	140	5.5
.3125	4000	780	30.7	2400	430	16.9	1600	140	5.5
.3750	3300	740	29.1	2000	380	15.0	1300	150	5.9
.4375	2900	730	28.7	1700	340	13.4	1100	150	5.9
.5000	2500	700	27.6	1500	330	13.0	1000	140	5.5
.5625	2200	630	24.8	1300	300	11.8	900	140	5.5
.6250	2000	600	23.6	1200	290	11.4	800	130	5.1
.7500	1700	510	20.1	1000	240	9.4	700	120	4.7

Depth of cut



DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MSTAR END MILLS

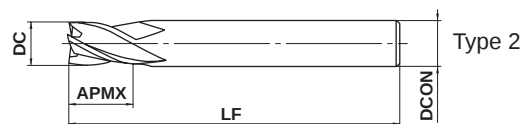
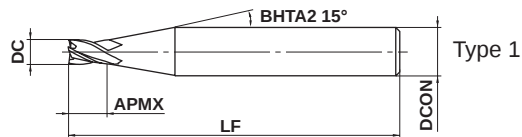
MS4SC

End mill, Short cut length, 4 flute



CARBIDE

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



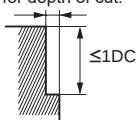
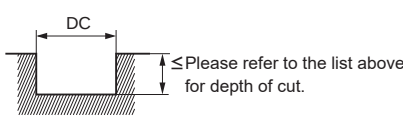
1 ≤ DC ≤ 12				
0 - 0.020				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 4 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4SCD0100	1	1.5	40	4	4	★	1
MS4SCD0150	1.5	2.3	40	4	4	★	1
MS4SCD0200	2	3	40	4	4	★	1
MS4SCD0250	2.5	3.8	40	4	4	★	1
MS4SCD0300	3	4.5	50	6	4	★	1
MS4SCD0400	4	6	50	6	4	★	1
MS4SCD0500	5	7.5	50	6	4	★	1
MS4SCD0600	6	9	50	6	4	★	2
MS4SCD0800	8	12	60	8	4	★	2
MS4SCD1000	10	15	70	10	4	★	2
MS4SCD1200	12	18	75	12	4	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel				Hardened steel (45—55HRC)			
	AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.				AISI H13 etc.			
	DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed	
(mm/min)			(IPM)	(mm/min)			(IPM)	
1	40000	3000	118.1	0.06	32000	2400	94.5	0.06
1.5	40000	4500	177.2	0.12	32000	3600	141.7	0.08
2	30000	4500	177.2	0.18	24000	3600	141.7	0.10
2.5	24000	3900	153.5	0.25	19000	3000	118.1	0.13
3	20000	3500	137.8	0.30	16000	2700	106.3	0.15
4	15000	3000	118.1	0.40	12000	2400	94.5	0.20
5	12000	2400	94.5	0.50	9000	1800	70.9	0.25
6	10000	2100	82.7	0.60	7000	1500	59.1	0.30
8	8000	1500	59.1	0.80	5600	1100	43.3	0.40
10	6400	1400	55.1	1.00	4500	950	37.4	0.50
12	5400	1200	47.2	1.00	3800	860	33.9	0.50
16	2400	550	21.7	3.00	1200	120	4.7	0.80
20	1900	480	18.9	4.00	1000	100	3.9	1.00
Depth of cut	≤Please refer to the list above for depth of cut.  							
	DC: Dia.							

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

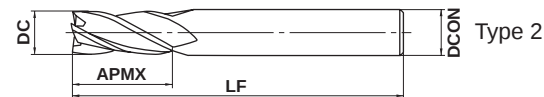
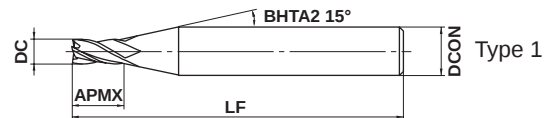
MS4MC

End mill, Medium cut length, 4 flute



CARBIDE

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



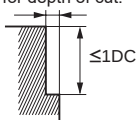
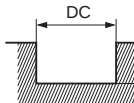
DC ≤ 12	DC > 12			
0 - 0.020	0 - 0.030			
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● 4 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4MCD0100	1	2.5	40	4	4	●	1
MS4MCD0150	1.5	3.8	40	4	4	●	1
MS4MCD0200	2	5	40	4	4	●	1
MS4MCD0250	2.5	6.3	40	4	4	●	1
MS4MCD0300	3	7.5	50	6	4	●	1
MS4MCD0350	3.5	9	50	6	4	★	1
MS4MCD0400	4	10	50	6	4	●	1
MS4MCD0450	4.5	11.5	50	6	4	★	1
MS4MCD0500	5	12.5	50	6	4	●	1
MS4MCD0550	5.5	14	50	6	4	★	1
MS4MCD0600	6	15	50	6	4	●	2
MS4MCD0650	6.5	16.5	60	8	4	★	1
MS4MCD0700	7	17.5	60	8	4	★	1
MS4MCD0750	7.5	19	60	8	4	★	1
MS4MCD0800	8	20	60	8	4	●	2
MS4MCD0850	8.5	21.5	70	10	4	★	1
MS4MCD0900	9	22.5	70	10	4	★	1
MS4MCD0950	9.5	24	70	10	4	★	1
MS4MCD1000	10	25	70	10	4	●	2
MS4MCD1100	11	27.5	75	12	4	★	1
MS4MCD1200	12	30	90	12	4	●	2
MS4MCD1400	14	35	90	12	4	★	3
MS4MCD1600	16	40	100	16	4	★	2
MS4MCD1800	18	45	100	16	4	★	3
MS4MCD2000	20	50	110	20	4	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel				Hardened steel (45—55HRC)			
	AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.				AISI H13 etc.			
	DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed	
(mm/min)			(IPM)	(mm/min)			(IPM)	
1	40000	3000	118.1	0.06	32000	2400	94.5	0.06
1.5	40000	4500	177.2	0.12	32000	3600	141.7	0.08
2	30000	4500	177.2	0.18	24000	3600	141.7	0.10
2.5	24000	3900	153.5	0.25	19000	3000	118.1	0.13
3	20000	3500	137.8	0.30	16000	2700	106.3	0.15
4	15000	3000	118.1	0.40	12000	2400	94.5	0.20
5	12000	2400	94.5	0.50	9000	1800	70.9	0.25
6	10000	2100	82.7	0.60	7000	1500	59.1	0.30
8	8000	1500	59.1	0.80	5600	1100	43.3	0.40
10	6400	1400	55.1	1.00	4500	950	37.4	0.50
12	5400	1200	47.2	1.00	3800	860	33.9	0.50
16	2400	550	21.7	3.00	1200	120	4.7	0.80
20	1900	480	18.9	4.00	1000	100	3.9	1.00
Depth of cut	≤Please refer to the list above for depth of cut.  ≤Please refer to the list above for depth of cut. 							
	DC: Dia.							

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

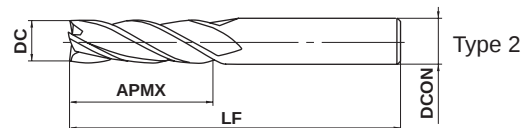
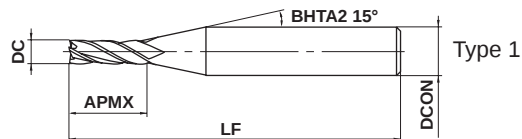
MS4JC

End mill, Semi long cut length, 4 flute



CARBIDE

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



1≤DC≤12				
0 - 0.020				



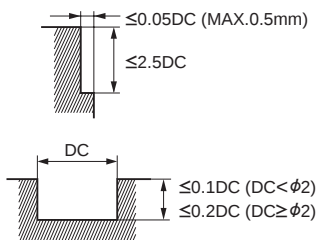
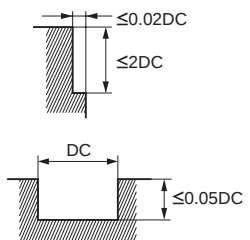
4≤DCON≤6	8≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 4 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4JCD0100	1	4	40	4	4	●	1
MS4JCD0150	1.5	6	40	4	4	●	1
MS4JCD0200	2	8	40	4	4	●	1
MS4JCD0250	2.5	10	50	4	4	●	1
MS4JCD0300	3	12	50	6	4	●	1
MS4JCD0400	4	16	50	6	4	●	1
MS4JCD0500	5	20	60	6	4	●	1
MS4JCD0600	6	24	60	6	4	●	2
MS4JCD0800	8	32	70	8	4	●	2
MS4JCD1000	10	40	90	10	4	●	2
MS4JCD1200	12	48	110	12	4	●	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (≤30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
1	11100	85	3.3	9500	65	2.6	8000	50	2.0	6400	35	1.4
1.5	7400	85	3.3	6400	90	3.5	5300	50	2.0	4200	35	1.4
2	5600	85	3.3	4800	90	3.5	4000	50	2.0	3200	35	1.4
2.5	4500	85	3.3	3800	90	3.5	3200	55	2.2	2500	35	1.4
3	3700	90	3.5	3400	90	3.5	2600	60	2.4	2100	35	1.4
4	3000	110	4.3	2700	90	3.5	2100	70	2.8	1700	50	2.0
5	2600	140	5.5	2300	110	4.3	1800	85	3.3	1500	55	2.2
6	2300	170	6.7	2000	140	5.5	1500	110	4.3	1300	70	2.8
8	1700	180	7.1	1500	140	5.5	1200	110	4.3	1000	70	2.8
10	1400	180	7.1	1300	140	5.5	950	110	4.3	800	70	2.8
12	1200	170	6.7	1100	140	5.5	800	110	4.3	670	70	2.8
Depth of cut												

DC:Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When drilling, please set the feed rate at 1/3 or below the values above.

Note 4) If the rigidity of the machine or the work material installation is very low, or chatter is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

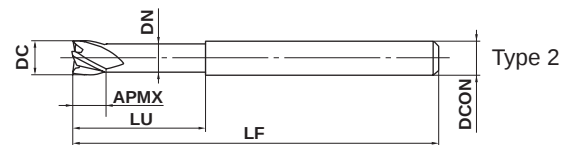
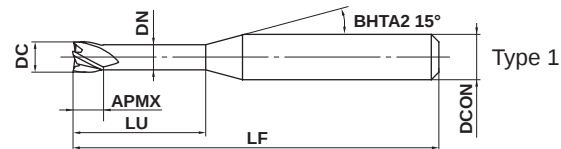
MS4XL

End mill, Short cut length, 4 flute, Long neck



CARBIDE

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



1 ≤ DC ≤ 10				
0 - 0.020				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10			
0 - 0.008	0 - 0.009			

● 4 flute long neck end mill.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS4XLD0100N040	1	1	4	0.94	50	4	4	★	1
MS4XLD0100N060	1	1	6	0.94	50	4	4	★	1
MS4XLD0100N080	1	1	8	0.94	50	4	4	★	1
MS4XLD0100N100	1	1	10	0.94	50	4	4	★	1
MS4XLD0100N120	1	1	12	0.94	50	4	4	★	1
MS4XLD0100N160	1	1	16	0.94	60	4	4	★	1
MS4XLD0110N060	1.1	1.1	6	1.04	50	4	4	★	1
MS4XLD0110N100	1.1	1.1	10	1.04	50	4	4	★	1
MS4XLD0110N160	1.1	1.1	16	1.04	60	4	4	★	1
MS4XLD0120N060	1.2	1.2	6	1.14	50	4	4	★	1
MS4XLD0120N080	1.2	1.2	8	1.14	50	4	4	★	1
MS4XLD0120N100	1.2	1.2	10	1.14	50	4	4	★	1
MS4XLD0120N120	1.2	1.2	12	1.14	50	4	4	★	1
MS4XLD0120N160	1.2	1.2	16	1.14	60	4	4	★	1
MS4XLD0130N060	1.3	1.3	6	1.24	50	4	4	★	1
MS4XLD0130N120	1.3	1.3	12	1.24	50	4	4	★	1
MS4XLD0130N180	1.3	1.3	18	1.24	60	4	4	★	1
MS4XLD0140N060	1.4	1.4	6	1.34	50	4	4	★	1
MS4XLD0140N080	1.4	1.4	8	1.34	50	4	4	★	1
MS4XLD0140N100	1.4	1.4	10	1.34	50	4	4	★	1
MS4XLD0140N120	1.4	1.4	12	1.34	50	4	4	★	1
MS4XLD0140N140	1.4	1.4	14	1.34	60	4	4	★	1
MS4XLD0140N160	1.4	1.4	16	1.34	60	4	4	★	1
MS4XLD0140N220	1.4	1.4	22	1.34	60	4	4	★	1
MS4XLD0150N060	1.5	1.5	6	1.44	50	4	4	★	1
MS4XLD0150N080	1.5	1.5	8	1.44	50	4	4	★	1
MS4XLD0150N100	1.5	1.5	10	1.44	50	4	4	★	1
MS4XLD0150N120	1.5	1.5	12	1.44	50	4	4	★	1
MS4XLD0150N140	1.5	1.5	14	1.44	60	4	4	★	1
MS4XLD0150N160	1.5	1.5	16	1.44	60	4	4	★	1
MS4XLD0150N180	1.5	1.5	18	1.44	60	4	4	★	1

(mm)

CARBIDE

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS4XLD0150N200	1.5	1.5	20	1.44	60	4	4	★	1
MS4XLD0160N060	1.6	1.6	6	1.54	50	4	4	★	1
MS4XLD0160N080	1.6	1.6	8	1.54	50	4	4	★	1
MS4XLD0160N100	1.6	1.6	10	1.54	50	4	4	★	1
MS4XLD0160N120	1.6	1.6	12	1.54	50	4	4	★	1
MS4XLD0160N140	1.6	1.6	14	1.54	60	4	4	★	1
MS4XLD0160N160	1.6	1.6	16	1.54	60	4	4	★	1
MS4XLD0160N180	1.6	1.6	18	1.54	60	4	4	★	1
MS4XLD0160N200	1.6	1.6	20	1.54	60	4	4	★	1
MS4XLD0160N260	1.6	1.6	26	1.54	70	4	4	★	1
MS4XLD0170N060	1.7	1.7	6	1.64	50	4	4	★	1
MS4XLD0170N140	1.7	1.7	14	1.64	60	4	4	★	1
MS4XLD0170N240	1.7	1.7	24	1.64	70	4	4	★	1
MS4XLD0180N060	1.8	1.8	6	1.74	50	4	4	★	1
MS4XLD0180N080	1.8	1.8	8	1.74	50	4	4	★	1
MS4XLD0180N100	1.8	1.8	10	1.74	50	4	4	★	1
MS4XLD0180N120	1.8	1.8	12	1.74	50	4	4	★	1
MS4XLD0180N140	1.8	1.8	14	1.74	60	4	4	★	1
MS4XLD0180N160	1.8	1.8	16	1.74	60	4	4	★	1
MS4XLD0180N180	1.8	1.8	18	1.74	60	4	4	★	1
MS4XLD0180N200	1.8	1.8	20	1.74	60	4	4	★	1
MS4XLD0180N250	1.8	1.8	25	1.74	70	4	4	★	1
MS4XLD0190N060	1.9	1.9	6	1.84	50	4	4	★	1
MS4XLD0190N160	1.9	1.9	16	1.84	60	4	4	★	1
MS4XLD0190N280	1.9	1.9	28	1.84	70	4	4	★	1
MS4XLD0200N060	2	2	6	1.9	50	4	4	★	1
MS4XLD0200N080	2	2	8	1.9	50	4	4	★	1
MS4XLD0200N100	2	2	10	1.9	50	4	4	★	1
MS4XLD0200N120	2	2	12	1.9	50	4	4	★	1
MS4XLD0200N140	2	2	14	1.9	60	4	4	★	1
MS4XLD0200N160	2	2	16	1.9	60	4	4	★	1
MS4XLD0200N180	2	2	18	1.9	60	4	4	★	1
MS4XLD0200N200	2	2	20	1.9	60	4	4	★	1
MS4XLD0200N250	2	2	25	1.9	70	4	4	★	1
MS4XLD0200N300	2	2	30	1.9	70	4	4	★	1
MS4XLD0250N080	2.5	2.5	8	2.4	50	4	4	★	1
MS4XLD0250N120	2.5	2.5	12	2.4	50	4	4	★	1
MS4XLD0250N160	2.5	2.5	16	2.4	60	4	4	★	1
MS4XLD0250N200	2.5	2.5	20	2.4	60	4	4	★	1
MS4XLD0250N250	2.5	2.5	25	2.4	70	4	4	★	1
MS4XLD0300N080	3	3	8	2.9	50	6	4	★	1
MS4XLD0300N120	3	3	12	2.9	50	6	4	★	1
MS4XLD0300N160	3	3	16	2.9	60	6	4	★	1
MS4XLD0300N200	3	3	20	2.9	60	6	4	★	1
MS4XLD0300N250	3	3	25	2.9	70	6	4	★	1
MS4XLD0300N300	3	3	30	2.9	70	6	4	★	1
MS4XLD0350N150	3.5	3.5	15	3.4	60	6	4	★	1
MS4XLD0350N250	3.5	3.5	25	3.4	70	6	4	★	1
MS4XLD0350N350	3.5	3.5	35	3.4	80	6	4	★	1
MS4XLD0400N120	4	4	12	3.9	50	6	4	★	1
MS4XLD0400N160	4	4	16	3.9	60	6	4	★	1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MSTAR END MILLS

MS4XL

End mill, Short cut length, 4 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS4XLD0400N200	4	4	20	3.9	60	6	4	★	1
MS4XLD0400N250	4	4	25	3.9	70	6	4	★	1
MS4XLD0400N300	4	4	30	3.9	70	6	4	★	1
MS4XLD0400N350	4	4	35	3.9	80	6	4	★	1
MS4XLD0400N400	4	4	40	3.9	90	6	4	★	1
MS4XLD0400N450	4	4	45	3.9	90	6	4	★	1
MS4XLD0400N500	4	4	50	3.9	100	6	4	★	1
MS4XLD0500N160	5	5	16	4.9	60	6	4	★	1
MS4XLD0500N250	5	5	25	4.9	70	6	4	★	1
MS4XLD0500N350	5	5	35	4.9	80	6	4	★	1
MS4XLD0500N500	5	5	50	4.9	110	6	4	★	1
MS4XLD0600N200	6	6	20	5.85	80	6	4	★	2
MS4XLD0600N300	6	6	30	5.85	90	6	4	★	2
MS4XLD0600N400	6	6	40	5.85	100	6	4	★	2
MS4XLD0600N500	6	6	50	5.85	110	6	4	★	2
MS4XLD0800N300	8	8	30	7.85	90	8	4	★	2
MS4XLD0800N500	8	8	50	7.85	110	8	4	★	2
MS4XLD0800N700	8	8	70	7.85	130	8	4	★	2
MS4XLD1000N400	10	10	40	9.7	100	10	4	★	2
MS4XLD1000N600	10	10	60	9.7	120	10	4	★	2
MS4XLD1000N800	10	10	80	9.7	140	10	4	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel			
DC (mm)		AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.			
	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)	
1	4	40000	3000	118.1	0.04
	8	36000	2400	94.5	0.03
	12	20000	1000	39.4	0.02
	16	10000	500	19.7	0.005
1.2	6	40000	3000	118.1	0.05
	10	36000	2400	94.5	0.04
	12	20000	1200	47.2	0.03
	16	12000	600	23.6	0.01
1.5	6	40000	3200	126.0	0.06
	12	32000	2400	94.5	0.05
	16	16000	1100	43.3	0.03
	20	10000	600	23.6	0.01
1.8	6	40000	3600	141.7	0.08
	12	32000	2800	110.2	0.06
	20	12000	1000	39.4	0.02
	25	7000	600	23.6	0.01
2	6	40000	4000	157.5	0.1
	12	32000	3200	126.0	0.07
	16	24000	2400	94.5	0.05
	20	12000	1200	47.2	0.03
	30	5000	500	19.7	0.01
2.5	8	32000	4000	157.5	0.2
	25	9000	1100	43.3	0.04
	50	2500	300	11.8	0.005
3	8	25000	3600	141.7	0.4
	16	18000	2500	98.4	0.2
	25	12000	1700	66.9	0.1
	30	7000	800	31.5	0.05

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel			
DC (mm)		AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.			
	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)	
3.5	15	20000	3000	118.1	0.6
	25	11000	1600	63.0	0.15
	35	5500	800	31.5	0.06
4	12	18000	3000	118.1	1
	20	12000	2000	78.7	0.5
	30	8000	1300	51.2	0.2
	40	4200	700	27.6	0.08
	50	2400	400	15.7	0.03
5	16	14000	2700	106.3	1
	25	9500	1800	70.9	0.5
	35	6400	1200	47.2	0.2
	50	3200	600	23.6	0.05
6	20	11000	2200	86.6	1.2
	30	8000	1600	63.0	0.6
	40	5400	1100	43.3	0.25
	50	3200	640	25.2	0.15
8	30	8000	1600	63.0	1.6
	50	4000	800	31.5	0.5
	70	2000	400	15.7	0.2
10	40	6400	1300	51.2	2
	60	3200	640	25.2	0.6
	80	1600	320	12.6	0.3

Depth of cut

DC: Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

MSTAR END MILLS

MS4XL – Inch sizes

End mill, Short cut length, 4 flute, Long neck

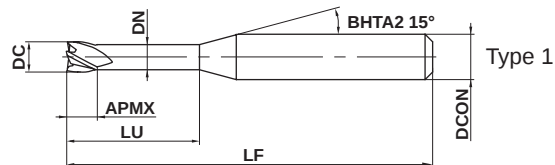


DC < 1/8

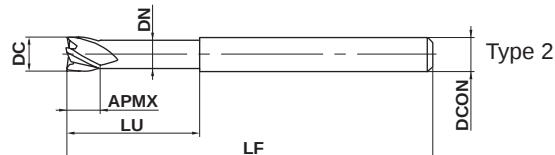
DC ≥ 1/8

CARBIDE

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



Type 1



Type 2



DC ≤ .2500"				
0 - .0008"				



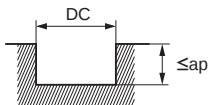
DCON = .1250"	DCON = .1875"	DCON = .2500"		
0 - .00024"	0 - .00031"	0 - .00035"		

● 4 flute long neck end mill.

(inch)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS4XLD1/16N0375	.0625	.0625	.3750	.0601	2.0	.1250	4	●	1
MS4XLD1/16N0500	.0625	.0625	.5000	.0601	2.0	.1250	4	●	1
MS4XLD1/16N0750	.0625	.0625	.7500	.0601	2.0	.1250	4	●	1
MS4XLD3/32N0562	.0938	.0938	.5625	.0898	2.0	.1250	4	●	1
MS4XLD3/32N0750	.0938	.0938	.7500	.0898	2.0	.1250	4	●	1
MS4XLD3/32N1125	.0938	.0938	1.1250	.0898	2.5	.1250	4	●	1
MS4XLD1/8N0750	.1250	.1250	.7500	.1211	2.0	.1250	4	●	2
MS4XLD3/16N1125	.1875	.1875	1.1250	.1836	2.5	.1875	4	●	2
MS4XLD1/4N1500	.2500	.2500	1.5000	.2441	3.0	.2500	4	●	2

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel		
		AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.		
DC (inch)	LU (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut _{ap} (inch)
.0156	.3750	40000	121.0	.0028
	.5000	30000	68.0	.0016
	.7500	10000	14.2	.0008
.0313	.5625	33000	109.1	.003
	.7500	20000	56.6	.002
	1.1250	10000	18.8	.001
.1250	.7500	25000	96.5	.004
.1875	1.1250	17000	72.2	.006
.2500	1.5000	13000	73.7	.008
Depth of cut		 DC: Dia.		

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions.
Please use the above table as a start reference point.

MSTAR END MILLS

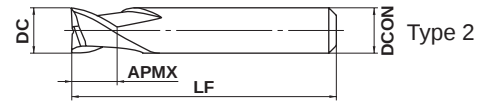
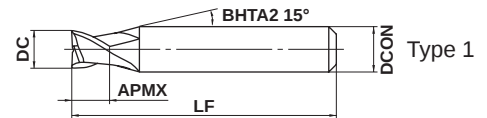
MS2ES

End mill, 2 flute, For Swiss style lathes



CARBIDE

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



$3 \leq DC \leq 12$				
0 $- 0.020$				
$4 \leq DCON \leq 6$	$7 \leq DCON \leq 10$			
0 $- 0.008$	0 $- 0.009$			

● 2 flute end mill.

Overall length 35mm

(mm)

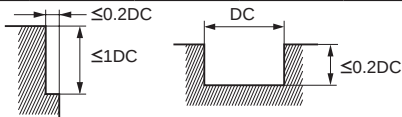
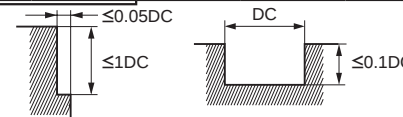
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2ESD0300L35S04	3	3	35	4	2	●	1
MS2ESD0350L35S04	3.5	3.5	35	4	2	●	1
MS2ESD0400L35S04	4	4	35	4	2	●	2
MS2ESD0500L35S05	5	5	35	5	2	●	2
MS2ESD0500L35S06	5	5	35	6	2	●	1
MS2ESD0600L35S05	6	6	35	5	2	●	3
MS2ESD0600L35S06	6	6	35	6	2	●	2
MS2ESD0700L35S07	7	6	35	7	2	●	2
MS2ESD0800L35S07	8	6	35	7	2	●	3
MS2ESD0800L35S08	8	6	35	8	2	●	2
MS2ESD1000L35S07	10	6	35	7	2	●	3
MS2ESD1000L35S10	10	6	35	10	2	●	2
MS2ESD1200L35S10	12	6	35	10	2	●	3

Overall length 45mm

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2ESD0300L45S04	3	3	45	4	2	●	1
MS2ESD0350L45S04	3.5	3.5	45	4	2	●	1
MS2ESD0400L45S04	4	4	45	4	2	●	2
MS2ESD0500L45S06	5	5	45	6	2	●	1
MS2ESD0600L45S06	6	6	45	6	2	●	2
MS2ESD0700L45S07	7	7	45	7	2	●	2
MS2ESD0800L45S07	8	8	45	7	2	●	3
MS2ESD0800L45S08	8	8	45	8	2	●	2
MS2ESD1000L45S07	10	10	45	7	2	●	3
MS2ESD1000L45S10	10	10	45	10	2	●	2
MS2ESD1200L45S10	12	12	45	10	2	●	3

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45–55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
3	10000	600	23.6	7000	400	15.7	6000	300	11.8	5000	120	4.7
4	7500	600	23.6	5200	400	15.7	4500	300	11.8	4000	120	4.7
5	6000	600	23.6	4200	400	15.7	3600	300	11.8	3200	120	4.7
6	5000	600	23.6	3500	400	15.7	3000	300	11.8	2700	120	4.7
7	4500	560	22.0	3000	360	14.2	2700	280	11.0	2300	110	4.3
8	4000	520	20.5	2800	350	13.8	2400	260	10.2	2000	110	4.3
10	3200	450	17.7	2200	300	11.8	1900	230	9.1	1600	100	3.9
12	2700	410	16.1	1900	270	10.6	1600	210	8.3	1300	100	3.9
Depth of cut												

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

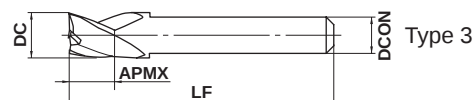
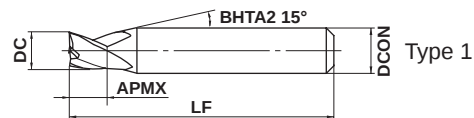
MS3ES

End mill, 3 flute, For Swiss style lathes



CARBIDE

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



$3 \leq DC \leq 12$				
0 $- 0.020$				
$4 \leq DCON \leq 6$	$7 \leq DCON \leq 10$			
0 $- 0.008$	0 $- 0.009$			

● 3 flute end mill.

Overall length 35mm

(mm)

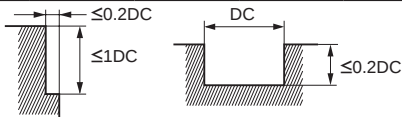
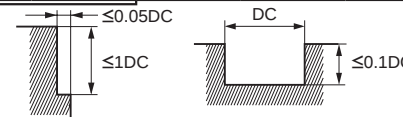
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS3ESD0300L35S04	3	3	35	4	3	●	1
MS3ESD0350L35S04	3.5	3.5	35	4	3	●	1
MS3ESD0400L35S04	4	4	35	4	3	●	2
MS3ESD0500L35S05	5	5	35	5	3	●	2
MS3ESD0500L35S06	5	5	35	6	3	●	1
MS3ESD0600L35S05	6	6	35	5	3	●	3
MS3ESD0600L35S06	6	6	35	6	3	●	2
MS3ESD0700L35S07	7	6	35	7	3	●	2
MS3ESD0800L35S07	8	6	35	7	3	●	3
MS3ESD0800L35S08	8	6	35	8	3	●	2
MS3ESD1000L35S07	10	6	35	7	3	●	3
MS3ESD1000L35S10	10	6	35	10	3	●	2
MS3ESD1200L35S10	12	6	35	10	3	●	3

Overall length 45mm

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS3ESD0300L45S04	3	3	45	4	3	●	1
MS3ESD0350L45S04	3.5	3.5	45	4	3	●	1
MS3ESD0400L45S04	4	4	45	4	3	●	2
MS3ESD0500L45S06	5	5	45	6	3	●	1
MS3ESD0600L45S06	6	6	45	6	3	●	2
MS3ESD0700L45S07	7	7	45	7	3	●	2
MS3ESD0800L45S07	8	8	45	7	3	●	3
MS3ESD0800L45S08	8	8	45	8	3	●	2
MS3ESD1000L45S07	10	10	45	7	3	●	3
MS3ESD1000L45S10	10	10	45	10	3	●	2
MS3ESD1200L45S10	12	12	45	10	3	●	3

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45–55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
3	10000	600	23.6	7000	400	15.7	6000	300	11.8	5000	120	4.7
4	7500	600	23.6	5200	400	15.7	4500	300	11.8	4000	120	4.7
5	6000	600	23.6	4200	400	15.7	3600	300	11.8	3200	120	4.7
6	5000	600	23.6	3500	400	15.7	3000	300	11.8	2700	120	4.7
7	4500	560	22.0	3000	360	14.2	2700	280	11.0	2300	110	4.3
8	4000	520	20.5	2800	350	13.8	2400	260	10.2	2000	110	4.3
10	3200	450	17.7	2200	300	11.8	1900	230	9.1	1600	100	3.9
12	2700	410	16.1	1900	270	10.6	1600	210	8.3	1300	100	3.9
Depth of cut												

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

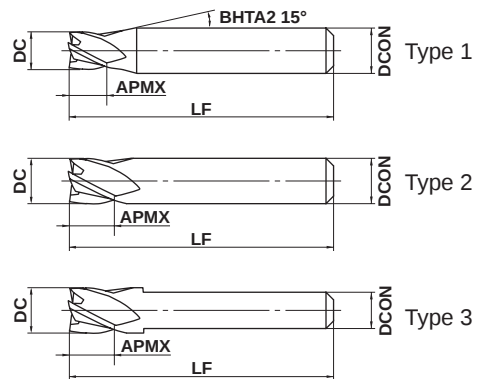
MS4EC

End mill, 4 flute, For Swiss style lathes



CARBIDE

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



DC ≤ 12	DC > 12			
0 - 0.020	0 - 0.030			
4 ≤ DCON ≤ 6	7 ≤ DCON ≤ 10			
0 - 0.008	0 - 0.009			

● 4 flute end mill.

Overall length 35mm

(mm)

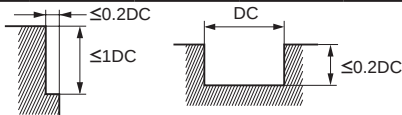
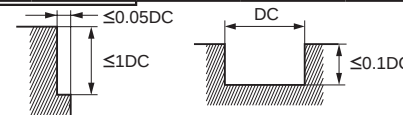
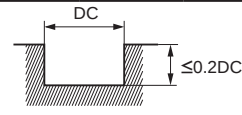
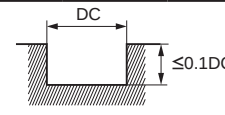
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4ECD0300L35S04	3	3	35	4	4	●	1
MS4ECD0350L35S04	3.5	3.5	35	4	4	●	1
MS4ECD0400L35S04	4	4	35	4	4	●	2
MS4ECD0500L35S05	5	5	35	5	4	●	2
MS4ECD0500L35S06	5	5	35	6	4	●	1
MS4ECD0600L35S05	6	6	35	5	4	●	3
MS4ECD0600L35S06	6	6	35	6	4	●	2
MS4ECD0700L35S07	7	6	35	7	4	●	2
MS4ECD0800L35S07	8	6	35	7	4	●	3
MS4ECD0800L35S08	8	6	35	8	4	●	2
MS4ECD1000L35S07	10	6	35	7	4	●	3
MS4ECD1000L35S10	10	6	35	10	4	●	2
MS4ECD1200L35S10	12	6	35	10	4	●	3

Overall length 45mm

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4ECD0300L45S04	3	3	45	4	4	●	1
MS4ECD0350L45S04	3.5	3.5	45	4	4	●	1
MS4ECD0400L45S04	4	4	45	4	4	●	2
MS4ECD0500L45S06	5	5	45	6	4	●	1
MS4ECD0600L45S06	6	6	45	6	4	●	2
MS4ECD0700L45S07	7	7	45	7	4	●	2
MS4ECD0800L45S07	8	8	45	7	4	●	3
MS4ECD0800L45S08	8	8	45	8	4	●	2
MS4ECD1000L45S07	10	10	45	7	4	●	3
MS4ECD1000L45S10	10	10	45	10	4	●	2
MS4ECD1200L45S10	12	12	45	10	4	●	3
MS4ECD1400L45S10	14	14	45	10	4	●	3

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45–55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
3	10000	900	35.4	7000	600	23.6	6000	450	17.7	5000	180	7.1
4	7500	900	35.4	5200	600	23.6	4500	450	17.7	4000	180	7.1
5	6000	900	35.4	4200	600	23.6	3600	450	17.7	3200	180	7.1
6	5000	900	35.4	3500	600	23.6	3000	450	17.7	2700	180	7.1
7	4500	840	33.1	3000	540	21.3	2700	420	16.5	2300	160	6.3
8	4000	780	30.7	2800	520	20.5	2400	390	15.4	2000	160	6.3
10	3200	680	26.8	2200	450	17.7	1900	340	13.4	1600	140	5.5
12	2700	620	24.4	1900	410	16.1	1600	310	12.2	1300	120	4.7
14	2300	550	21.7	1600	350	13.8	1400	280	11.0	1200	120	4.7
Depth of cut												
												

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When drilling, please set the feed rate at 1/3 or below the values above.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSTAR END MILLS

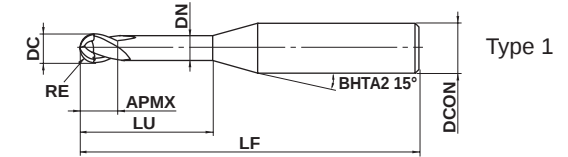
MS2XLB – Inch sizes

Ball nose, 2 flute, Long neck

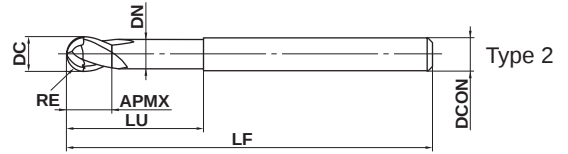


CARBIDE

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



Type 1



Type 2

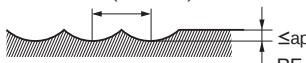
	.0078" ≤ RE ≤ .1250"				
	±.0004"				
	.0156" ≤ DC ≤ .2500"				
	0 - .0008"				
	DCON = .1250"	DCON = .1875"	DCON = .2500"		
	0 - .00024"	0 - .00031"	0 - .00035"		

● 2 flute, long neck, ball nose end mill for general purpose.

(inch)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XLBD1/64N0094	.00781	.0156	.01563	.0938	.0144	2.0	.1250	2	▲	1
MS2XLBD1/64N0125	.00781	.0156	.01563	.1250	.0144	2.0	.1250	2	▲	1
MS2XLBD1/64N0187	.00781	.0156	.01563	.1875	.0144	2.0	.1250	2	▲	1
MS2XLBD1/32N0187	.01563	.0313	.03125	.1875	.0301	2.0	.1250	2	▲	1
MS2XLBD1/32N0250	.01563	.0313	.03125	.2500	.0301	2.0	.1250	2	▲	1
MS2XLBD1/32N0375	.01563	.0313	.03125	.3750	.0301	2.0	.1250	2	▲	1
MS2XLBD1/16N0375	.03125	.0625	.0625	.3750	.0601	2.0	.1250	2	▲	1
MS2XLBD1/16N0500	.03125	.0625	.0625	.5000	.0601	2.0	.1250	2	▲	1
MS2XLBD1/16N0750	.03125	.0625	.0625	.7500	.0601	2.0	.1250	2	▲	1
MS2XLBD3/32N0562	.04688	.0938	.09375	.5625	.0898	2.0	.1250	2	▲	1
MS2XLBD3/32N0750	.04688	.0938	.09375	.7500	.0898	2.0	.1250	2	▲	1
MS2XLBD3/32N1125	.04688	.0938	.09375	1.1250	.0898	2.5	.1250	2	▲	1
MS2XLBD1/8N0750	.06250	.1250	.1250	.7500	.1211	2.0	.1250	2	▲	2
MS2XLBD3/16N1125	.09375	.1875	.1875	1.1250	.1836	2.5	.1875	2	▲	2
MS2XLBD1/4N1500	.12500	.2500	.2500	1.5000	.2441	3.0	.2500	2	▲	2

RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45—55HRC) AISI H13 etc.		
RE (inch)	LU (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut _{ap} (inch)
.0078	.0938	40000	21.2	.0002
	.1290	30000	17.7	.0002
	.1875	20000	10.6	.0001
.0156	.1875	40000	70.8	.0008
	.2500	25000	44.3	.0008
	.3750	15000	26.6	.0004
.0313	.3750	40000	113.4	.0028
	.5000	30000	85.1	.0016
	.7500	10000	28.4	.0008
.0469	.5625	40000	141.8	.003
	.7500	20000	70.8	.002
	1.1250	10000	35.5	.001
.0625	.7500	30000	124.0	.004
.0938	1.1250	20000	106.3	.006
.1250	1.5000	15000	106.3	.008
Depth of cut		$\leq 0.1RE$ ($RE \leq 3/64$) $\leq 0.2RE$ ($RE > 3/64$)  $\leq ap$ RE : Radius		

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

MSTAR END MILLS

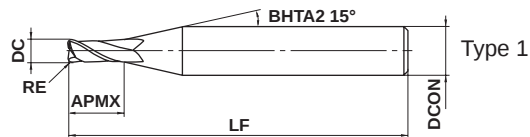
MS2MRB

Corner radius, Medium cut length, 2 flute



CARBIDE

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



1 ≤ DC ≤ 12				
0 - 0.020				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 2 flute corner radius end mill for general use.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2MRBD0100R010	1	0.1	2	40	4	2	★	1
MS2MRBD0100R020	1	0.2	2	40	4	2	●	1
MS2MRBD0100R030	1	0.3	2	40	4	2	●	1
MS2MRBD0150R010	1.5	0.1	3	40	4	2	★	1
MS2MRBD0150R020	1.5	0.2	3	40	4	2	●	1
MS2MRBD0150R030	1.5	0.3	3	40	4	2	●	1
MS2MRBD0150R050	1.5	0.5	3	40	4	2	●	1
MS2MRBD0200R010	2	0.1	4	40	4	2	★	1
MS2MRBD0200R020	2	0.2	4	40	4	2	●	1
MS2MRBD0200R030	2	0.3	4	40	4	2	●	1
MS2MRBD0200R050	2	0.5	4	40	4	2	●	1
MS2MRBD0250R010	2.5	0.1	5	40	4	2	★	1
MS2MRBD0250R020	2.5	0.2	5	40	4	2	●	1
MS2MRBD0250R030	2.5	0.3	5	40	4	2	●	1
MS2MRBD0250R050	2.5	0.5	5	40	4	2	●	1
MS2MRBD0300R010	3	0.1	6	50	6	2	★	1
MS2MRBD0300R020	3	0.2	6	50	6	2	●	1
MS2MRBD0300R030	3	0.3	6	50	6	2	●	1
MS2MRBD0300R050	3	0.5	6	50	6	2	●	1
MS2MRBD0300R100	3	1	6	50	6	2	●	1
MS2MRBD0400R010	4	0.1	8	50	6	2	★	1
MS2MRBD0400R020	4	0.2	8	50	6	2	●	1
MS2MRBD0400R030	4	0.3	8	50	6	2	●	1
MS2MRBD0400R050	4	0.5	8	50	6	2	●	1
MS2MRBD0400R100	4	1	8	50	6	2	●	1
MS2MRBD0500R010	5	0.1	10	50	6	2	★	1
MS2MRBD0500R020	5	0.2	10	50	6	2	●	1
MS2MRBD0500R030	5	0.3	10	50	6	2	●	1
MS2MRBD0500R050	5	0.5	10	50	6	2	●	1
MS2MRBD0500R100	5	1	10	50	6	2	●	1
MS2MRBD0600R010	6	0.1	12	50	6	2	★	2

								(mm)
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MS2MRBD0600R020	6	0.2	12	50	6	2	●	2
MS2MRBD0600R030	6	0.3	12	50	6	2	●	2
MS2MRBD0600R050	6	0.5	12	50	6	2	●	2
MS2MRBD0600R100	6	1	12	50	6	2	●	2
MS2MRBD0600R150	6	1.5	12	50	6	2	●	2
MS2MRBD0600R200	6	2	12	50	6	2	●	2
MS2MRBD0800R020	8	0.2	16	60	8	2	★	2
MS2MRBD0800R030	8	0.3	16	60	8	2	★	2
MS2MRBD0800R050	8	0.5	16	60	8	2	★	2
MS2MRBD0800R100	8	1	16	60	8	2	★	2
MS2MRBD0800R150	8	1.5	16	60	8	2	★	2
MS2MRBD0800R200	8	2	16	60	8	2	★	2
MS2MRBD0800R250	8	2.5	16	60	8	2	★	2
MS2MRBD0800R300	8	3	16	60	8	2	★	2
MS2MRBD1000R020	10	0.2	20	70	10	2	★	2
MS2MRBD1000R030	10	0.3	20	70	10	2	★	2
MS2MRBD1000R050	10	0.5	20	70	10	2	★	2
MS2MRBD1000R100	10	1	20	70	10	2	★	2
MS2MRBD1000R150	10	1.5	20	70	10	2	★	2
MS2MRBD1000R200	10	2	20	70	10	2	★	2
MS2MRBD1000R250	10	2.5	20	70	10	2	★	2
MS2MRBD1000R300	10	3	20	70	10	2	★	2
MS2MRBD1200R020	12	0.2	24	75	12	2	★	2
MS2MRBD1200R030	12	0.3	24	75	12	2	★	2
MS2MRBD1200R050	12	0.5	24	75	12	2	★	2
MS2MRBD1200R100	12	1	24	75	12	2	★	2
MS2MRBD1200R150	12	1.5	24	75	12	2	★	2
MS2MRBD1200R200	12	2	24	75	12	2	★	2
MS2MRBD1200R250	12	2.5	24	75	12	2	★	2
MS2MRBD1200R300	12	3	24	75	12	2	★	2

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MS2MRB

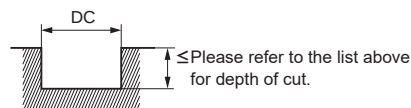
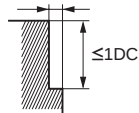
Corner radius, Medium cut length, 2 flute

CARBIDE

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel				Hardened steel (45—55HRC)			
	AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.				AISI H13 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
0.1	40000	40	1.6	0.001	40000	40	1.6	0.001
0.2	40000	100	3.9	0.002	40000	100	3.9	0.002
0.3	40000	200	7.9	0.005	40000	200	7.9	0.005
0.4	40000	600	23.6	0.01	40000	600	23.6	0.01
0.5	40000	1000	39.4	0.015	40000	960	37.8	0.015
0.6	40000	1200	47.2	0.02	40000	1200	47.2	0.02
0.7	40000	1400	55.1	0.02	40000	1400	55.1	0.02
0.8	40000	1600	63.0	0.03	40000	1600	63.0	0.03
0.9	40000	1800	70.9	0.04	40000	1600	63.0	0.04
1	40000	2000	78.7	0.06	32000	1600	63.0	0.06
1.5	40000	3000	118.1	0.12	32000	1900	74.8	0.08
2	30000	3000	118.1	0.18	24000	1900	74.8	0.10
2.5	24000	2600	102.4	0.25	19000	1600	63.0	0.13
3	20000	2300	90.6	0.30	16000	1400	55.1	0.15
4	15000	2000	78.7	0.40	12000	1200	47.2	0.20
5	12000	1600	63.0	0.50	9000	900	35.4	0.25
6	10000	1400	55.1	0.60	7000	700	27.6	0.30
8	8000	1000	39.4	0.80	5600	550	21.7	0.40
10	6400	900	35.4	1.00	4500	500	19.7	0.50
12	5400	820	32.3	1.00	3800	450	17.7	0.50

≤Please refer to the list above for depth of cut.



DC: Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.

Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.

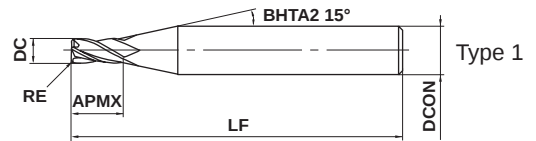
Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MS4MRB

Corner radius, Medium cut length, 4 flute



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



DC≤12	DC>12			
0 - 0.020	0 - 0.030			
DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● 4 flute corner radius end mill for general use.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4MRBD0300R010	3	0.1	8	45	6	4	★	1
MS4MRBD0300R020	3	0.2	8	45	6	4	★	1
MS4MRBD0300R030	3	0.3	8	45	6	4	★	1
MS4MRBD0300R050	3	0.5	8	45	6	4	★	1
MS4MRBD0300R100	3	1	8	45	6	4	★	1
MS4MRBD0400R010	4	0.1	11	45	6	4	★	1
MS4MRBD0400R020	4	0.2	11	45	6	4	★	1
MS4MRBD0400R030	4	0.3	11	45	6	4	★	1
MS4MRBD0400R050	4	0.5	11	45	6	4	★	1
MS4MRBD0400R100	4	1	11	45	6	4	★	1
MS4MRBD0500R010	5	0.1	13	50	6	4	★	1
MS4MRBD0500R020	5	0.2	13	50	6	4	★	1
MS4MRBD0500R030	5	0.3	13	50	6	4	★	1
MS4MRBD0500R050	5	0.5	13	50	6	4	★	1
MS4MRBD0500R100	5	1	13	50	6	4	★	1
MS4MRBD0600R010	6	0.1	13	50	6	4	★	2
MS4MRBD0600R020	6	0.2	13	50	6	4	★	2
MS4MRBD0600R030	6	0.3	13	50	6	4	★	2
MS4MRBD0600R050	6	0.5	13	50	6	4	★	2
MS4MRBD0600R100	6	1	13	50	6	4	★	2
MS4MRBD0600R150	6	1.5	13	50	6	4	★	2
MS4MRBD0600R200	6	2	13	50	6	4	★	2
MS4MRBD0800R020	8	0.2	19	60	8	4	★	2
MS4MRBD0800R030	8	0.3	19	60	8	4	★	2
MS4MRBD0800R050	8	0.5	19	60	8	4	★	2
MS4MRBD0800R100	8	1	19	60	8	4	★	2
MS4MRBD0800R150	8	1.5	19	60	8	4	★	2
MS4MRBD0800R200	8	2	19	60	8	4	★	2
MS4MRBD0800R250	8	2.5	19	60	8	4	★	2
MS4MRBD0800R300	8	3	19	60	8	4	★	2
MS4MRBD1000R020	10	0.2	22	70	10	4	★	2

★ : Stocked in Japan

SQUARE

BALL

RADIUS

TAPER

ROUGHING BARREL

SOLID END MILLS

MSTAR END MILLS

MS4MRB

Corner radius, Medium cut length, 4 flute

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

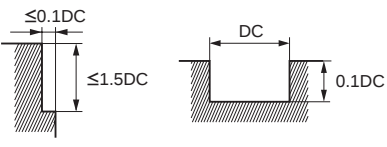
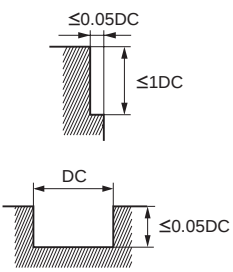
ROUGHING

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SOLID END MILLS

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4MRBD1000R030	10	0.3	22	70	10	4	★	2
MS4MRBD1000R050	10	0.5	22	70	10	4	★	2
MS4MRBD1000R100	10	1	22	70	10	4	★	2
MS4MRBD1000R150	10	1.5	22	70	10	4	★	2
MS4MRBD1000R200	10	2	22	70	10	4	★	2
MS4MRBD1000R250	10	2.5	22	70	10	4	★	2
MS4MRBD1000R300	10	3	22	70	10	4	★	2
MS4MRBD1200R020	12	0.2	26	75	12	4	★	2
MS4MRBD1200R030	12	0.3	26	75	12	4	★	2
MS4MRBD1200R050	12	0.5	26	75	12	4	★	2
MS4MRBD1200R100	12	1	26	75	12	4	★	2
MS4MRBD1200R150	12	1.5	26	75	12	4	★	2
MS4MRBD1200R200	12	2	26	75	12	4	★	2
MS4MRBD1200R250	12	2.5	26	75	12	4	★	2
MS4MRBD1200R300	12	3	26	75	12	4	★	2
MS4MRBD1600R050	16	0.5	32	90	16	4	★	2
MS4MRBD1600R100	16	1	32	90	16	4	★	2
MS4MRBD1600R150	16	1.5	32	90	16	4	★	2
MS4MRBD1600R200	16	2	32	90	16	4	★	2
MS4MRBD1600R250	16	2.5	32	90	16	4	★	2
MS4MRBD1600R300	16	3	32	90	16	4	★	2
MS4MRBD2000R050	20	0.5	38	100	20	4	★	2
MS4MRBD2000R100	20	1	38	100	20	4	★	2
MS4MRBD2000R150	20	1.5	38	100	20	4	★	2
MS4MRBD2000R200	20	2	38	100	20	4	★	2
MS4MRBD2000R250	20	2.5	38	100	20	4	★	2
MS4MRBD2000R300	20	3	38	100	20	4	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
3	16000	1500	59.1	10000	800	31.5	7400	480	18.9	8000	240	9.4
4	12000	1800	70.9	8000	1000	39.4	5600	600	23.6	6000	240	9.4
5	9600	1800	70.9	6400	1000	39.4	4400	600	23.6	4800	240	9.4
6	8000	1800	70.9	5300	1000	39.4	3700	600	23.6	4000	240	9.4
8	6000	1600	63.0	4000	900	35.4	2800	560	22.0	3000	240	9.4
10	4800	1400	55.1	3200	800	31.5	2200	500	19.7	2400	240	9.4
12	4000	1200	47.2	2700	700	27.6	1800	430	16.9	2000	230	9.1
16	3000	960	37.8	2000	560	22.0	1400	360	14.2	1500	190	7.5
20	2400	800	31.5	1600	480	18.9	1100	300	11.8	1200	170	6.7
Depth of cut												

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MS PLUS END MILLS

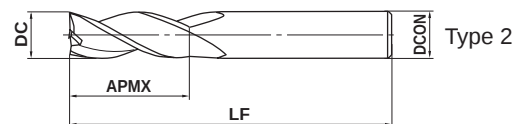
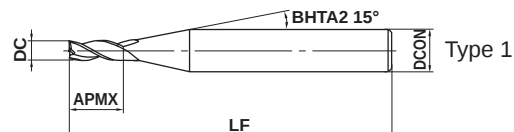
MP3MC - Inch sizes

End mill, Medium cut length, 3 flute



CARBIDE

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



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
DCON=.1250"	.250"≤DCON≤.375"	DCON=.500"		
0 - .00024"	0 - .00035"	0 - .00043"		



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

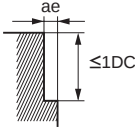
SOLID END MILLS

(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP3MCD1/32	.0312	.0780	1.50	.1250	3	●	1
MP3MCD1/16	.0625	.1560	1.50	.1250	3	●	1
MP3MCD3/32	.0938	.2340	1.50	.1250	3	●	1
MP3MCD1/8	.1250	.3130	1.50	.1250	3	●	2
MP3MCD5/32	.1562	.3910	2.00	.2500	3	●	1
MP3MCD3/16	.1875	.4690	2.00	.2500	3	●	1
MP3MCD7/32	.2188	.5470	2.50	.2500	3	●	1
MP3MCD1/4	.2500	.6250	2.50	.2500	3	●	2
MP3MCD5/16	.3125	.7810	2.75	.3125	3	●	2
MP3MCD3/8	.3750	.9380	3.00	.3750	3	●	2
MP3MCD1/2	.5000	1.2500	3.50	.5000	3	●	2

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon Steel, Alloy Steel (≤280HB) Mild Steel			Carbon Steel, Alloy Steel (>280HB) Alloy Tool Steel Pre-hardened Steel			Austenitic Stainless Steel Titanium Alloy			Hardened Steel (40-55HRC)		
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut a_e (inch)
1/32	30000	53.1	.006	30000	53.1	.006	28000	49.6	.006	20000	35.4	.002
1/16	30000	70.9	.012	15000	35.4	.012	14000	33.1	.012	10000	23.6	.003
3/32	13400	31.7	.019	10000	23.6	.019	9400	22.2	.019	6700	15.8	.006
1/8	10000	35.4	.025	7500	26.6	.025	7000	24.8	.025	5000	17.7	.006
5/32	8000	33.1	.031	6000	24.8	.031	5600	23.1	.031	4000	16.5	.008
3/16	6700	31.7	.037	5000	23.6	.037	4700	22.2	.037	3300	15.6	.009
7/32	5700	26.9	.044	4300	20.3	.044	4000	18.9	.044	2900	13.7	.011
1/4	5000	26.6	.050	3800	20.2	.050	3500	18.6	.050	2500	13.3	.013
5/16	4000	23.6	.062	3000	17.7	.062	2800	16.5	.062	2000	11.8	.016
3/8	3300	23.4	.075	2500	17.7	.075	2300	16.3	.075	1700	12.0	.019
1/2	2500	17.7	.100	1900	13.5	.100	1800	12.8	.100	1300	9.2	.025
Depth of Cut												

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

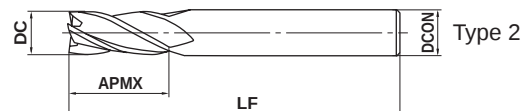
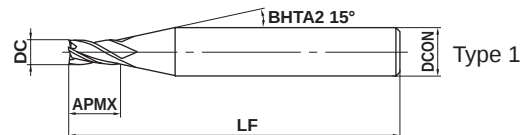
MP4MC - Inch sizes

End mill, Medium cut length, 4 flute



CARBIDE

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



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
DCON=.1250"	.250"≤DCON≤.375"	DCON=.500"		
0 - .00024"	0 - .00035"	0 - .00043"		

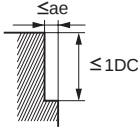


(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP4MCD1/32	.0312	.0780	1.50	.1250	4	●	1
MP4MCD1/16	.0625	.1560	1.50	.1250	4	●	1
MP4MCD3/32	.0938	.2340	1.50	.1250	4	●	1
MP4MCD1/8	.1250	.3130	1.50	.1250	4	●	2
MP4MCD5/32	.1562	.3910	2.00	.2500	4	●	1
MP4MCD3/16	.1875	.4690	2.00	.2500	4	●	1
MP4MCD7/32	.2188	.5470	2.50	.2500	4	●	1
MP4MCD1/4	.2500	.6250	2.50	.2500	4	●	2
MP4MCD5/16	.3125	.7810	2.75	.3125	4	●	2
MP4MCD3/8	.3750	.9380	3.00	.3750	4	●	2
MP4MCD1/2	.5000	1.2500	3.50	.5000	4	●	2

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon Steel, Alloy Steel ($\leq 280\text{HB}$) Mild Steel			Carbon Steel, Alloy Steel ($> 280\text{HB}$) Alloy Tool Steel Pre-hardened Steel			Austenitic Stainless Steel Titanium Alloy			Hardened Steel (40-55HRC)		
DC (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)
1/32	30000	70.9	.006	30000	70.9	.006	28000	66.1	.006	20000	47.2	.002
1/16	20100	63.3	.012	15000	47.2	.012	14000	44.1	.012	10000	31.5	.003
3/32	13400	42.2	.019	10000	31.5	.019	9400	29.6	.019	6700	21.1	.005
1/8	10000	47.2	.025	7500	35.4	.025	7000	33.1	.025	5000	23.6	.006
5/32	8000	44.1	.031	6000	33.1	.031	5600	30.9	.031	4000	22.0	.008
3/16	6700	42.2	.037	5000	31.5	.037	4700	29.6	.037	3300	20.8	.009
7/32	5700	35.9	.044	4300	27.1	.044	4000	25.2	.044	2900	18.3	.011
1/4	5000	35.4	.050	3800	26.9	.050	3500	24.8	.050	2500	17.7	.013
5/16	4000	31.5	.062	3000	23.6	.062	2800	22.0	.062	2000	15.7	.016
3/8	3300	31.2	.075	2500	23.6	.075	2300	21.7	.075	1700	16.1	.019
1/2	2500	23.6	.100	1900	18.0	.100	1800	17.0	.100	1300	12.3	.025
Depth of Cut	 DC : Dia.											

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

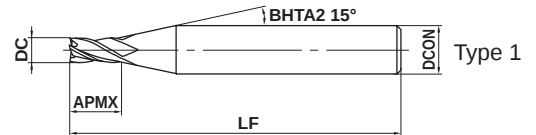
MP4JC - Inch sizes

End mill, Semi long cut length, 4 flute



CARBIDE

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



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
DCON=.1250"	.250"≤DCON≤.375"	DCON=.500"		
0 - .00024"	0 - .00035"	0 - .00043"		

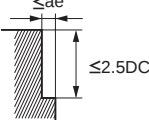
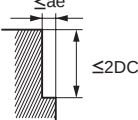


(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP4JCD1/16	.0625	.2500	1.50	.1250	4	●	1
MP4JCD3/32	.0938	.3750	1.50	.1250	4	●	1
MP4JCD1/8	.1250	.5000	2.00	.1250	4	●	2
MP4JCD3/16	.1875	.7500	2.50	.2500	4	●	1
MP4JCD1/4	.2500	1.0000	2.50	.2500	4	●	2
MP4JCD5/16	.3125	1.2500	2.75	.3125	4	●	2
MP4JCD3/8	.3750	1.5000	3.50	.3750	4	●	2
MP4JCD1/2	.5000	2.0000	4.50	.5000	4	●	2

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon Steel, Alloy Steel ($\leq 280\text{HB}$) Mild Steel			Carbon Steel, Alloy Steel ($> 280\text{HB}$) Alloy Tool Steel Pre-hardened Steel			Austenitic Stainless Steel Titanium Alloy			Hardened Steel (40-55HRC)		
DC (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)
1/16	18100	39.9	.012	14000	30.9	.012	12000	26.5	.012	10000	22.0	.0010
3/32	12000	26.5	.019	9400	20.7	.019	8000	17.6	.019	6700	14.8	.0020
1/8	9000	29.8	.025	7000	23.1	.025	6000	19.8	.025	5000	16.5	.0030
3/16	6000	26.5	.037	4700	20.7	.037	4000	17.6	.037	3300	14.6	.0040
1/4	4500	22.7	.050	3500	17.6	.050	3000	15.1	.050	2500	12.6	.0050
5/16	3600	19.8	.062	2800	15.4	.062	2400	13.2	.062	2000	11.0	.0060
3/8	3000	19.8	.075	2300	15.2	.075	2000	13.2	.075	1700	11.3	.0080
1/2	2300	15.2	.100	1800	11.9	.100	1500	9.9	.100	1300	8.6	.0100
Depth of Cut												

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

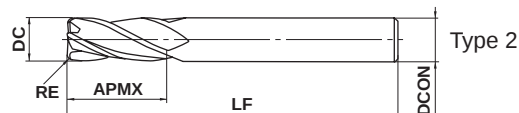
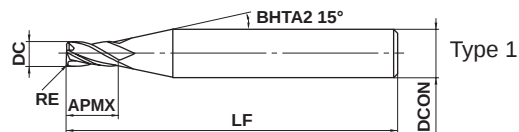
MP4MRB - Inch sizes

Corner radius, Medium cut length, 4 flute



CARBIDE

Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○	○	○	○	○		



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	RE<.0200"	.0200"≤RE≤.0450"		
DC<.3750"	±.0006"	±.0008"		
DC=.5000"	±.0008"	±.0008"		
DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
DCON=.1250"	.250"≤DCON≤.375"	DCON=.500"		
0 - .00024"	0 - .00035"	0 - .00043"		

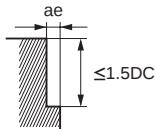
(inch)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MP4MRBD1/8R010	.1250	.0100	.3130	1.50	.1250	4	●	2
MP4MRBD1/8R015	.1250	.0150	.3130	1.50	.1250	4	●	2
MP4MRBD1/8R020	.1250	.0200	.3130	1.50	.1250	4	●	2
MP4MRBD3/16R010	.1875	.0100	.4690	2.00	.2500	4	●	1
MP4MRBD3/16R015	.1875	.0150	.4690	2.00	.2500	4	●	1
MP4MRBD3/16R020	.1875	.0200	.4690	2.00	.2500	4	●	1
MP4MRBD3/16R030	.1875	.0300	.4690	2.00	.2500	4	●	1
MP4MRBD1/4R010	.2500	.0100	.6250	2.50	.2500	4	●	2
MP4MRBD1/4R015	.2500	.0150	.6250	2.50	.2500	4	●	2
MP4MRBD1/4R020	.2500	.0200	.6250	2.50	.2500	4	●	2
MP4MRBD1/4R030	.2500	.0300	.6250	2.50	.2500	4	●	2
MP4MRBD1/4R045	.2500	.0450	.6250	2.50	.2500	4	●	2
MP4MRBD5/16R015	.3125	.0150	.7810	2.75	.3125	4	●	2
MP4MRBD5/16R020	.3125	.0200	.7810	2.75	.3125	4	●	2
MP4MRBD5/16R030	.3125	.0300	.7810	2.75	.3125	4	●	2
MP4MRBD5/16R045	.3125	.0450	.7810	2.75	.3125	4	●	2
MP4MRBD3/8R015	.3750	.0150	.9380	3.00	.3750	4	●	2
MP4MRBD3/8R020	.3750	.0200	.9380	3.00	.3750	4	●	2
MP4MRBD3/8R030	.3750	.0300	.9380	3.00	.3750	4	●	2
MP4MRBD3/8R045	.3750	.0450	.9380	3.00	.3750	4	●	2
MP4MRBD1/2R015	.5000	.0150	1.2500	3.50	.5000	4	●	2
MP4MRBD1/2R020	.5000	.0200	1.2500	3.50	.5000	4	●	2
MP4MRBD1/2R030	.5000	.0300	1.2500	3.50	.5000	4	●	2
MP4MRBD1/2R045	.5000	.0450	1.2500	3.50	.5000	4	●	2

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon Steel, Alloy Steel ($\leq 280\text{HB}$) Mild Steel			Carbon Steel, Alloy Steel ($> 280\text{HB}$) Alloy Tool Steel Pre-hardened Steel			Austenitic Stainless Steel Titanium Alloy			Hardened Steel (40-55HRC)		
DC (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut a_e (inch)
1/8	10000	47.2	.025	7500	8.9	.025	7000	8.3	.025	5000	5.9	.006
3/16	6700	42.2	.037	5000	7.9	.037	4700	7.4	.037	3300	5.2	.009
1/4	5000	35.4	.050	3800	6.7	.050	3500	6.2	.050	2500	4.4	.013
5/16	4000	31.5	.062	3000	5.9	.062	2800	5.5	.062	2000	3.9	.016
3/8	3300	31.2	.075	2500	5.9	.075	2300	5.4	.075	1700	4.0	.019
1/2	2500	23.6	.100	1900	4.5	.100	1800	4.3	.100	1300	3.1	.025

Depth of Cut		DC : Dia.
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Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

MS PLUS END MILLS

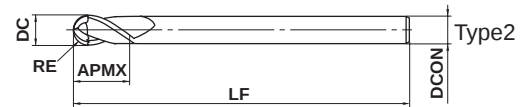
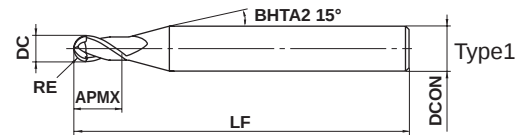
MP2SSB

Ball nose, Short cut length, 2 flute, Short shank



CARBIDE

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



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



$0.1 \leq RE \leq 6$				
± 0.005				
$4 \leq DCON \leq 6$	$8 \leq DCON \leq 10$	$DCON = 12$		
0 $- 0.005$	0 $- 0.006$	0 $- 0.008$		



- 2-flute ball nose end mills with short cutting edge length for general purpose. Excellent performance for a wide range of work materials such as carbon steel, alloy steel and hardened steel.

(mm)

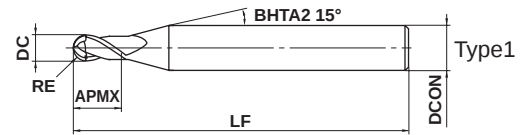
Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP2SSBR0010	0.1	0.2	0.2	40	4	2	●	1
MP2SSBR0020	0.2	0.4	0.4	40	4	2	●	1
MP2SSBR0030	0.3	0.6	0.6	40	4	2	●	1
MP2SSBR0040	0.4	0.8	0.8	40	4	2	●	1
MP2SSBR0050	0.5	1	1	40	4	2	●	1
MP2SSBR0050S06	0.5	1	1	40	6	2	●	1
MP2SSBR0075	0.75	1.5	1.5	40	4	2	●	1
MP2SSBR0075S06	0.75	1.5	1.5	40	6	2	●	1
MP2SSBR0100	1	2	2	45	6	2	●	1
MP2SSBR0150	1.5	3	3	45	6	2	●	1
MP2SSBR0200	2	4	4	45	6	2	●	1
MP2SSBR0250	2.5	5	5	50	6	2	●	1
MP2SSBR0300	3	6	6	50	6	2	●	2
MP2SSBR0400	4	8	8	60	8	2	●	2
MP2SSBR0500	5	10	10	70	10	2	●	2
MP2SSBR0600	6	12	12	75	12	2	●	2

MP2SB

Ball nose, Short cut length, 2 flute



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



0.1 ≤ RE ≤ 6				
±0.005				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.005	0 - 0.006	0 - 0.008		

- 2-flute ball nose end mills with short cutting edge length for general purpose. Excellent performance for a wide range of work materials such as carbon steel, alloy steel and hardened steel.

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP2SBR0010	0.1	0.2	0.3	45	4	2	●	1
MP2SBR0015	0.15	0.3	0.5	45	4	2	●	1
MP2SBR0020	0.2	0.4	0.6	45	4	2	●	1
MP2SBR0020S06	0.2	0.4	0.6	50	6	2	●	1
MP2SBR0025	0.25	0.5	0.8	45	4	2	●	1
MP2SBR0030	0.3	0.6	0.9	45	4	2	●	1
MP2SBR0030S06	0.3	0.6	0.9	50	6	2	●	1
MP2SBR0035	0.35	0.7	1.1	45	4	2	●	1
MP2SBR0040	0.4	0.8	1.2	45	4	2	●	1
MP2SBR0040S06	0.4	0.8	1.2	50	6	2	●	1
MP2SBR0045	0.45	0.9	1.4	45	4	2	●	1
MP2SBR0050	0.5	1	1.5	45	4	2	●	1
MP2SBR0050S06	0.5	1	1.5	50	6	2	●	1
MP2SBR0060	0.6	1.2	1.8	45	4	2	●	1
MP2SBR0070	0.7	1.4	2.1	45	4	2	●	1
MP2SBR0075	0.75	1.5	2.3	45	4	2	●	1
MP2SBR0075S06	0.75	1.5	2.3	50	6	2	●	1
MP2SBR0080	0.8	1.6	2.4	45	4	2	●	1
MP2SBR0090	0.9	1.8	2.7	45	4	2	●	1
MP2SBR0100	1	2	3	50	4	2	●	1
MP2SBR0100S06	1	2	3	50	6	2	●	1
MP2SBR0125	1.25	2.5	3.8	50	4	2	●	1
MP2SBR0150	1.5	3	4.5	70	6	2	●	1
MP2SBR0200	2	4	6	70	6	2	●	1
MP2SBR0250	2.5	5	7.5	80	6	2	●	1
MP2SBR0300	3	6	9	80	6	2	●	2
MP2SBR0400	4	8	12	90	8	2	●	2
MP2SBR0500	5	10	15	100	10	2	●	2
MP2SBR0600	6	12	18	110	12	2	●	2

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

MS PLUS END MILLS

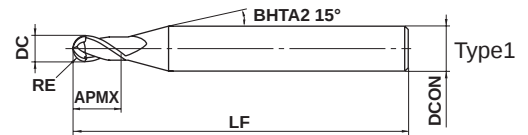
MP2MB

Ball nose, Medium cut length, 2 flute



CARBIDE

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



0.25 ≤ RE ≤ 6				
±0.005				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.005	0 - 0.006	0 - 0.008		

- 2-flute ball nose end mills with medium cutting edge length for general purpose. Excellent performance for a wide range of work materials such as carbon steel, alloy steel and hardened steel.

(mm)

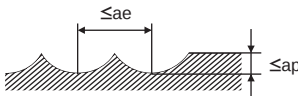
Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP2MBR0025	0.25	0.5	1	45	4	2	●	1
MP2MBR0030	0.3	0.6	1.2	45	4	2	●	1
MP2MBR0040	0.4	0.8	1.6	45	4	2	●	1
MP2MBR0050	0.5	1	2.5	45	4	2	●	1
MP2MBR0060	0.6	1.2	2.5	45	4	2	●	1
MP2MBR0070	0.7	1.4	3	45	4	2	●	1
MP2MBR0075	0.75	1.5	4	45	4	2	●	1
MP2MBR0080	0.8	1.6	4	45	4	2	●	1
MP2MBR0090	0.9	1.8	5	45	4	2	●	1
MP2MBR0100	1	2	6	50	4	2	●	1
MP2MBR0125	1.25	2.5	6	50	4	2	●	1
MP2MBR0150S03	1.5	3	8	70	3	2	●	2
MP2MBR0150	1.5	3	8	70	6	2	●	1
MP2MBR0175	1.75	3.5	8	70	6	2	●	1
MP2MBR0200S04	2	4	8	70	4	2	●	2
MP2MBR0200	2	4	8	70	6	2	●	1
MP2MBR0250	2.5	5	12	80	6	2	●	1
MP2MBR0300	3	6	12	80	6	2	●	2
MP2MBR0400	4	8	14	90	8	2	●	2
MP2MBR0500	5	10	18	100	10	2	●	2
MP2MBR0600	6	12	22	110	12	2	●	2

Ball nose, Short cut length, 2 flute, Short shank **MP2SSB**

Ball nose, Short cut length, 2 flute **MP2SB** Ball nose, Medium cut length, 2 flute **MP2MB**

CARBIDE

RECOMMENDED CUTTING CONDITIONS

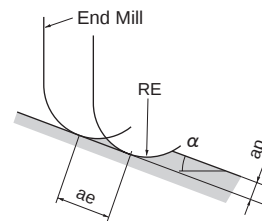
Work Material	Mild Steel, Carbon Steel (180—280HB), Alloy Steel, Pre-hardened Steel, Precipitation Hardening Stainless Steel (<450HB)						Austenitic Stainless Steel (≤200HB) Titanium Alloy					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)
	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)		
R0.1	40000	300	40000	250	0.003	0.02	40000	300	40000	250	0.003	0.02
R0.15	40000	500	40000	350	0.007	0.03	40000	500	40000	350	0.007	0.03
R0.2	40000	1600	40000	1200	0.02	0.04	40000	1500	40000	1000	0.015	0.04
R0.25	40000	2400	40000	1400	0.025	0.05	40000	2100	40000	1200	0.02	0.05
R0.3	40000	3200	40000	1600	0.03	0.06	40000	2800	40000	1400	0.03	0.06
R0.4	40000	4800	40000	2400	0.05	0.08	40000	4600	40000	2100	0.04	0.08
R0.5	40000	5600	40000	3200	0.06	0.1	40000	5600	40000	3400	0.05	0.1
R0.75	40000	6500	40000	4000	0.09	0.15	40000	6500	36000	3600	0.08	0.15
R1	40000	6500	39000	4700	0.11	0.2	40000	6500	35000	4000	0.11	0.2
R1.25	40000	7000	33000	4500	0.12	0.25	40000	7400	29000	4000	0.12	0.25
R1.5	40000	7500	27000	4300	0.13	0.3	36000	6900	24000	3900	0.13	0.3
R2	32000	7500	20000	3600	0.15	0.4	28000	6900	18000	3100	0.15	0.4
R2.5	25000	6000	16000	2900	0.2	0.5	22000	6200	14000	2600	0.2	0.5
R3	21000	5800	13000	2600	0.25	0.6	18000	5400	11000	2300	0.25	0.6
R4	16000	4500	10000	2000	0.3	0.8	14000	4100	9000	1700	0.3	0.8
R5	13000	3600	8000	1700	0.5	1.0	11000	3300	7200	1300	0.5	1.0
R6	9000	2500	6000	1300	0.5	1.2	8100	2300	5400	1100	0.5	1.2
Depth of Cut												

Note 1) α is the inclination angle of the machined surface.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 3) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

Note 4) Standard cutting conditions of austenitic stainless steel and titanium alloy, please reduce to 60% revolution and 45% feed rate.
(Hardened steel (45—55HRC) table above)



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

Ball nose, Short cut length, 2 flute, Short shank **MP2SSB**

Ball nose, Short cut length, 2 flute **MP2SB** Ball nose, Medium cut length, 2 flute **MP2MB**

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

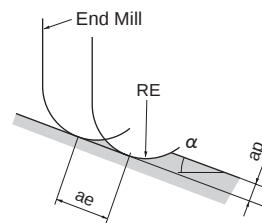
RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened Steel (45—55HRC)						Copper, Copper Alloy					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut	Depth of cut	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut	Depth of cut
	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)	ap (mm)	ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)	ap (mm)	ae (mm)
R0.1	40000	300	40000	250	0.003	0.02	40000	300	40000	250	0.003	0.02
R0.15	40000	500	40000	350	0.007	0.03	40000	500	40000	350	0.007	0.03
R0.2	40000	1300	40000	950	0.015	0.04	40000	1300	40000	950	0.015	0.04
R0.25	40000	1900	40000	1100	0.02	0.05	40000	1900	40000	1100	0.02	0.05
R0.3	40000	2500	40000	1300	0.025	0.06	40000	2500	40000	1300	0.025	0.06
R0.4	40000	4000	40000	1900	0.04	0.08	40000	4000	40000	1900	0.04	0.08
R0.5	40000	5600	40000	3000	0.05	0.1	40000	5600	40000	3000	0.05	0.1
R0.75	40000	6500	32000	3200	0.08	0.15	40000	6500	32000	3200	0.08	0.15
R1	40000	6500	31000	3500	0.11	0.2	40000	6500	31000	3500	0.11	0.2
R1.25	36000	6500	26000	3500	0.12	0.25	36000	6500	26000	3500	0.12	0.25
R1.5	32000	6000	22000	3400	0.13	0.3	32000	6000	22000	3400	0.13	0.3
R2	25000	6000	16000	2700	0.15	0.4	25000	6000	16000	2700	0.15	0.6
R2.5	20000	5400	13000	2300	0.2	0.5	20000	5400	13000	2300	0.2	0.8
R3	17000	4700	10000	2000	0.25	0.6	17000	4700	10000	2000	0.25	0.9
R4	13000	3600	8000	1500	0.3	0.8	13000	3600	8000	1500	0.3	1.6
R5	10000	2900	6400	1200	0.5	1.0	10000	2900	6400	1200	0.5	2.0
R6	7200	2000	4800	1000	0.5	1.2	8500	2300	5300	1100	0.5	2.4
Depth of Cut												

Note 1) α is the inclination angle of the machined surface.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 3) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

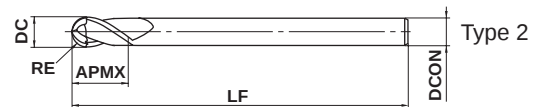
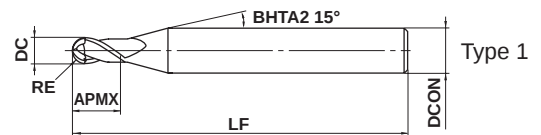


MP2MB - Inch sizes

Ball nose, Medium cut length, 2 flute



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



.0312" ≤ DCON ≤ .500"				
±.0002"				
DCON = .125"	.250" ≤ DCON ≤ .375"	DCON = .500"		
0 - .00020"	0 - .00024"	0 - .00031"		

- 2-flute ball nose end mills with medium cutting edge length for general purpose. Excellent performance for a wide range of work materials such as carbon steel, alloy steel and hardened steel.

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP2MBD1/32	.0156	.0312	.0630	1.50	.1250	2	●	1
MP2MBD1/16	.0312	.0625	.1250	1.50	.1250	2	●	1
MP2MBD1/8	.0625	.1250	.2500	1.50	.1250	2	●	2
MP2MBD3/16	.0938	.1875	.3750	2.00	.2500	2	●	1
MP2MBD1/4	.1250	.2500	.5000	2.50	.2500	2	●	2
MP2MBD5/16	.1562	.3125	.6250	3.25	.3125	2	●	2
MP2MBD3/8	.1875	.3750	.7500	3.50	.3750	2	●	2
MP2MBD1/2	.2500	.5000	1.0000	4.00	.5000	2	●	2

(inch)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MS PLUS END MILLS

MP2MB - Inch sizes

Ball nose, Medium cut length, 2 flute

CARBIDE

SQUARE

BALL

RADIUS

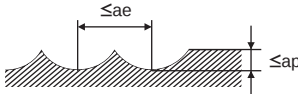
TAPER

BARREL

ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

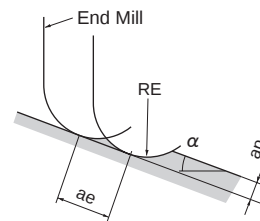
Work Material		Mild Steel, Carbon Steel (180-280HB) Alloy Steel, Pre-hardened Steel, Precipitation Hardening Stainless Steel (<450HB)						Austenitic Stainless Steel (≤200HB) Titanium Alloy					
DC (inch)	RE (inch)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (inch)	Depth of cut ae (inch)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (inch)	Depth of cut ae (inch)
		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/32	0.397	40000	189.0	40000	189.0	.002	.003	40000	157.5	40000	74.8	.002	.003
1/16	0.794	40000	255.9	40000	255.9	.004	.006	40000	255.9	32000	126.0	.004	.006
1/8	1.588	40000	295.3	40000	295.3	.005	.012	32000	236.2	22000	133.9	.005	.012
3/16	2.381	25000	236.2	25000	236.2	.008	.020	20000	212.6	13000	90.6	.008	.020
1/4	3.175	21000	228.3	21000	228.3	.010	.024	17000	185.0	10000	78.7	.010	.024
5/16	3.969	16000	177.2	16000	177.2	.012	.032	13000	141.7	8000	59.1	.012	.032
3/8	4.763	13000	141.7	13000	141.7	.020	.039	10000	114.2	6400	47.2	.020	.039
1/2	6.35	9000	98.4	9000	98.4	.020	.047	8500	90.6	5300	43.3	.020	.047
Depth of Cut													

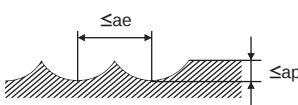
Note 1) α is the inclination angle of the machined surface.

Note 2) If the depth of cut is smaller, the revolution and the feed rate can be increased.

Note 3) If the rigidity of the work materials installation is very low, or chattering and noise are generated, reduce the revolution and the feed rate proportionately.

Note 4) Standard cutting conditions of austenitic stainless steel and titanium alloy, please reduce to 60% revolution and 45% feed rate.
(Hardened steel (45—55HRC) table above)



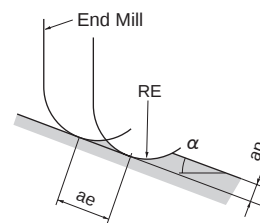
Work Material		Hardened Steel (40-55HRC)						Copper, Copper Alloy					
DC (inch)	RE (inch)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (inch)	Depth of cut ae (inch)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (inch)	Depth of cut ae (inch)
		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/32	.397	40000	126.0	40000	59.8	.002	.003	40000	189.0	40000	189.0	.002	.003
1/16	.794	40000	204.7	32000	100.8	.004	.006	40000	255.9	40000	255.9	.004	.006
1/8	1.588	32000	189.0	22000	107.1	.005	.012	40000	295.3	40000	295.3	.005	.012
3/16	2.381	20000	170.1	13000	72.5	.008	.020	25000	236.2	25000	236.2	.008	.020
1/4	3.175	17000	148.0	10000	63.0	.010	.024	21000	228.3	21000	228.3	.010	.024
5/16	3.969	13000	113.4	8000	47.3	.012	.032	16000	177.2	16000	177.2	.012	.032
3/8	4.763	10000	91.4	6400	37.8	.020	.039	13000	141.7	13000	141.7	.020	.039
1/2	6.35	8500	72.5	5300	34.6	.020	.047	9000	98.4	9000	98.4	.020	.047
Depth of Cut													

Note 1) α is the inclination angle of the machined surface.

Note 2) If the depth of cut is smaller, the revolution and the feed rate can be increased.

Note 3) If the rigidity of the work materials installation is very low, or chattering and noise are generated, reduce the revolution and the feed rate proportionately.

Note 4) Standard cutting conditions of austenitic stainless steel and titanium alloy, please reduce to 60% revolution and 45% feed rate.
(Hardened steel (45–55HRC) table above)



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

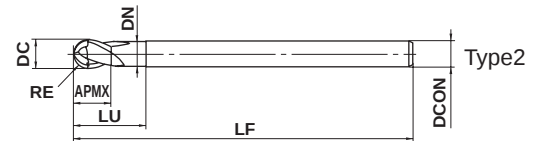
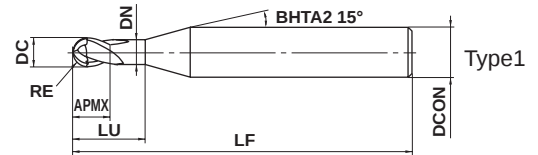
MP2SDB

Ball nose, Short cut length, 2 flute, High strength



CARBIDE

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



0.5 ≤ RE ≤ 6				
±0.01				



4 ≤ DCON ≤ 6	DCON=8			
0 - 0.005	0 - 0.006			



DCON=10	DCON=12			
0 - 0.009	0 - 0.011			

- Excellent chipping resistance with a strong S curve cutting edge. Ideal for semi-finish machining of forging dies.

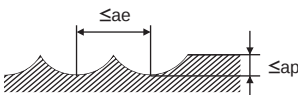
(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MP2SDBR0050	0.5	1	1	2	0.96	45	4	2	●	1
MP2SDBR0075S06	0.75	1.5	1.5	3	1.44	50	6	2	●	1
MP2SDBR0100	1	2	2	4	1.90	50	4	2	●	1
MP2SDBR0100S06	1	2	2	4	1.90	60	6	2	●	1
MP2SDBR0150	1.5	3	3	6	2.90	70	6	2	●	1
MP2SDBR0200	2	4	4	8	3.90	60	4	2	●	2
MP2SDBR0200S06	2	4	4	8	3.90	70	6	2	●	1
MP2SDBR0250	2.5	5	5	10	4.90	80	6	2	●	1
MP2SDBR0300	3	6	12	18	5.85	80	6	2	●	2
MP2SDBR0300A120	3	6	12	18	5.85	120	6	2	●	2
MP2SDBR0400	4	8	14	24	7.85	90	8	2	●	2
MP2SDBR0400A130	4	8	14	24	7.85	130	8	2	●	2
MP2SDBR0500	5	10	18	30	9.70	100	10	2	●	2
MP2SDBR0500A140	5	10	18	30	9.70	140	10	2	●	2
MP2SDBR0600	6	12	22	36	11.70	110	12	2	●	2
MP2SDBR0600A140	6	12	22	36	11.70	140	12	2	●	2

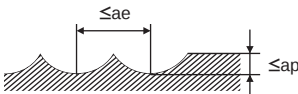
Note 1) MS plus end mills series MP2SB and MP2MB are recommended for finish surface processing.

RECOMMENDED CUTTING CONDITIONS

■ Overhang below DC x 5 (DC : Dia.)

Work Material	Carbon Steel, Alloy Steel (180–280HB) Alloy Tool Steel, Tool Steel, Pre-hardened Steel						Hardened Steel (45–55HRC)					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut		$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut	
	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)	ap (mm)	ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)	ap (mm)	ae (mm)
R 0.5	40000	3900	36000	2100	0.1	0.25	40000	4300	36000	2200	0.1	0.25
R 0.75	40000	4200	36000	2600	0.15	0.35	40000	4700	36000	2700	0.15	0.35
R 1	40000	4500	36000	3100	0.2	0.5	40000	5000	36000	3300	0.2	0.5
R 1.5	37000	5300	24000	2700	0.3	0.75	37000	5800	24000	2800	0.3	0.75
R 2X4	24000	3200	15000	2000	0.25	0.7	19000	2800	13000	1600	0.25	0.7
R 2	30000	4900	19000	2500	0.4	1	28000	5000	19000	2400	0.4	1
R 2.5	25000	4500	16000	2300	0.5	1.3	22000	4200	16000	2200	0.5	1.25
R 3	22000	4300	14000	2200	0.6	1.8	18000	3800	12000	1800	0.6	1.5
R 4	19000	3900	12000	2000	0.8	2.4	15000	3200	9500	1600	0.8	2
R 5	15000	3300	9500	1800	1	3	11000	2500	7000	1400	1	2.5
R 6	12000	2550	8000	1600	1.2	3.6	9000	2000	6000	1300	1.2	3
Depth of Cut												

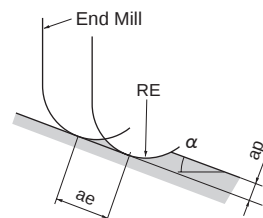
■ Overhang below DC x 7 (DC : Dia.)

Work Material	Carbon Steel, Alloy Steel (180–280HB) Alloy Tool Steel, Tool Steel, Pre-hardened Steel						Hardened Steel (45–55HRC)					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut		$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut	
	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)	ap (mm)	ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)	ap (mm)	ae (mm)
R 3	10000	1500	6900	1000	0.2	1	8000	1400	5300	770	0.2	0.8
R 4	8000	1400	5600	900	0.3	1.5	6400	1300	4000	650	0.3	1.2
R 5	6000	1200	4100	740	0.4	2	4800	1100	3200	580	0.4	1.6
R 6	5000	1000	3400	600	0.45	2.4	4000	900	2700	490	0.45	2
Depth of Cut												

Note 1) α is the inclination angle of the machined surface.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

MP2XLB

Ball nose, Short cut length, 2 flute, Long neck

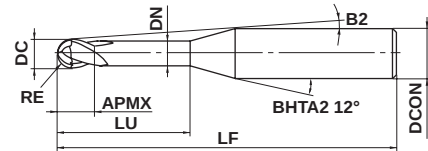
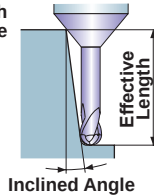


CARBIDE

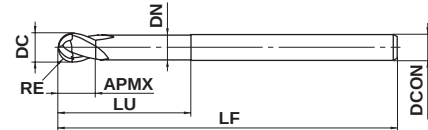
Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○	○		○	○	○	



Effective Length
for Inclined Angle



Type1



Type2



$0.05 \leq RE \leq 3$			
± 0.005			
$4 \leq DCON \leq 6$			
0 $- 0.005$			

- 2-flute long neck ball nose end mills. Excellent performance for a wide range of work materials such as carbon steel, alloy steel and hardened steel.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
												0.5°	1°	2°	3°
MP2XLBR0005N003	0.05	0.1	0.08	0.3	0.085	11.6°	50	4	2	●	1	0.3	0.3	0.4	0.4
MP2XLBR0005N005	0.05	0.1	0.08	0.5	0.085	11.4°	50	4	2	●	1	0.5	0.5	0.6	0.7
MP2XLBR0010N005	0.1	0.2	0.15	0.5	0.18	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.7
MP2XLBR0010N008	0.1	0.2	0.15	0.75	0.18	11.2°	50	4	2	●	1	0.8	0.8	0.9	1.0
MP2XLBR0010N010	0.1	0.2	0.15	1	0.18	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0010N013	0.1	0.2	0.15	1.25	0.18	10.6°	50	4	2	●	1	1.3	1.4	1.5	1.7
MP2XLBR0010N015	0.1	0.2	0.15	1.5	0.18	10.4°	50	4	2	●	1	1.6	1.6	1.8	2.0
MP2XLBR0010N018	0.1	0.2	0.15	1.75	0.18	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
MP2XLBR0010N020	0.1	0.2	0.15	2	0.18	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0010N025	0.1	0.2	0.15	2.5	0.18	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLBR0015N005	0.15	0.3	0.24	0.5	0.28	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.6
MP2XLBR0015N008	0.15	0.3	0.24	0.75	0.28	11.2°	50	4	2	●	1	0.8	0.8	0.9	1.0
MP2XLBR0015N010	0.15	0.3	0.24	1	0.28	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0015N010S06	0.15	0.3	0.24	1	0.28	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0015N013	0.15	0.3	0.24	1.25	0.28	10.7°	50	4	2	●	1	1.3	1.4	1.5	1.6
MP2XLBR0015N013S06	0.15	0.3	0.24	1.25	0.28	11.1°	50	6	2	●	1	1.3	1.4	1.5	1.6
MP2XLBR0015N015	0.15	0.3	0.24	1.5	0.28	10.4°	50	4	2	●	1	1.6	1.6	1.8	2.0
MP2XLBR0015N015S06	0.15	0.3	0.24	1.5	0.28	10.9°	50	6	2	●	1	1.6	1.6	1.8	2.0
MP2XLBR0015N018	0.15	0.3	0.24	1.75	0.28	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
MP2XLBR0015N020	0.15	0.3	0.24	2	0.28	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0015N025	0.15	0.3	0.24	2.5	0.28	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLBR0015N030	0.15	0.3	0.24	3	0.28	9.1°	50	4	2	●	1	3.1	3.3	3.6	4.0
MP2XLBR0015N035	0.15	0.3	0.24	3.5	0.28	8.7°	50	4	2	●	1	3.7	3.8	4.2	4.6
MP2XLBR0015N040	0.15	0.3	0.24	4	0.28	8.4°	50	4	2	●	1	4.2	4.4	4.8	5.3
MP2XLBR0020N005	0.2	0.4	0.3	0.5	0.37	11.6°	50	4	2	●	1	0.5	0.5	0.5	0.6
MP2XLBR0020N008	0.2	0.4	0.3	0.75	0.37	11.3°	50	4	2	●	1	0.7	0.8	0.9	0.9
MP2XLBR0020N010	0.2	0.4	0.3	1	0.37	11°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0020N010S06	0.2	0.4	0.3	1	0.37	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3

(mm)

CARBIDE

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
												0.5°	1°	2°	3°
MP2XLBR0020N015	0.2	0.4	0.3	1.5	0.37	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
MP2XLBR0020N020	0.2	0.4	0.3	2	0.37	9.9°	50	4	2	●	1	2.1	2.2	2.3	2.6
MP2XLBR0020N020S06	0.2	0.4	0.3	2	0.37	10.6°	50	6	2	●	1	2.1	2.2	2.3	2.6
MP2XLBR0020N025	0.2	0.4	0.3	2.5	0.37	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.3
MP2XLBR0020N030	0.2	0.4	0.3	3	0.37	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
MP2XLBR0020N035	0.2	0.4	0.3	3.5	0.37	8.7°	50	4	2	●	1	3.6	3.8	4.1	4.6
MP2XLBR0020N040	0.2	0.4	0.3	4	0.37	8.4°	50	4	2	●	1	4.2	4.3	4.7	5.2
MP2XLBR0020N045	0.2	0.4	0.3	4.5	0.37	8°	50	4	2	●	1	4.7	4.9	5.3	5.9
MP2XLBR0020N050	0.2	0.4	0.3	5	0.37	7.7°	50	4	2	●	1	5.2	5.4	5.9	6.6
MP2XLBR0020N055	0.2	0.4	0.3	5.5	0.37	7.5°	50	4	2	●	1	5.7	6.0	6.5	7.2
MP2XLBR0020N060	0.2	0.4	0.3	6	0.37	7.2°	50	4	2	●	1	6.2	6.5	7.1	7.9
MP2XLBR0025N010	0.25	0.5	0.37	1	0.47	11°	50	4	2	●	1	1.0	1.0	1.1	1.2
MP2XLBR0025N015	0.25	0.5	0.37	1.5	0.47	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
MP2XLBR0025N015S06	0.25	0.5	0.37	1.5	0.47	11°	50	6	2	●	1	1.5	1.6	1.7	1.9
MP2XLBR0025N020	0.25	0.5	0.37	2	0.47	9.9°	50	4	2	●	1	2.1	2.1	2.3	2.6
MP2XLBR0025N020S06	0.25	0.5	0.37	2	0.47	10.6°	50	6	2	●	1	2.1	2.1	2.3	2.6
MP2XLBR0025N025	0.25	0.5	0.37	2.5	0.47	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
MP2XLBR0025N025S06	0.25	0.5	0.37	2.5	0.47	10.3°	50	6	2	●	1	2.6	2.7	2.9	3.2
MP2XLBR0025N030	0.25	0.5	0.37	3	0.47	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
MP2XLBR0025N030S06	0.25	0.5	0.37	3	0.47	10°	50	6	2	●	1	3.1	3.2	3.5	3.9
MP2XLBR0025N035	0.25	0.5	0.37	3.5	0.47	8.7°	50	4	2	●	1	3.6	3.8	4.1	4.6
MP2XLBR0025N040	0.25	0.5	0.37	4	0.47	8.3°	50	4	2	●	1	4.1	4.3	4.7	5.2
MP2XLBR0025N045	0.25	0.5	0.37	4.5	0.47	8°	50	4	2	●	1	4.7	4.9	5.3	5.9
MP2XLBR0025N050	0.25	0.5	0.37	5	0.47	7.7°	50	4	2	●	1	5.2	5.4	5.9	6.6
MP2XLBR0025N055	0.25	0.5	0.37	5.5	0.47	7.4°	50	4	2	●	1	5.7	6.0	6.5	7.2
MP2XLBR0025N060	0.25	0.5	0.37	6	0.47	7.2°	50	4	2	●	1	6.2	6.5	7.1	7.9
MP2XLBR0025N070	0.25	0.5	0.37	7	0.47	6.7°	50	4	2	●	1	7.3	7.6	8.3	9.2
MP2XLBR0025N080	0.25	0.5	0.37	8	0.47	6.3°	50	4	2	●	1	8.3	8.7	9.5	10.5
MP2XLBR0025N090	0.25	0.5	0.37	9	0.47	5.9°	50	4	2	●	1	9.4	9.8	10.7	11.9
MP2XLBR0025N100	0.25	0.5	0.37	10	0.47	5.6°	50	4	2	●	1	10.4	10.9	11.9	13.2
MP2XLBR0030N015	0.3	0.6	0.45	1.5	0.57	10.4°	50	4	2	●	1	1.5	1.6	1.8	2.0
MP2XLBR0030N015S06	0.3	0.6	0.45	1.5	0.57	11°	50	6	2	●	1	1.5	1.6	1.8	2.0
MP2XLBR0030N020	0.3	0.6	0.45	2	0.57	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0030N020S06	0.3	0.6	0.45	2	0.57	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0030N025	0.3	0.6	0.45	2.5	0.57	9.4°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLBR0030N030	0.3	0.6	0.45	3	0.57	9°	50	4	2	●	1	3.1	3.3	3.6	4.0
MP2XLBR0030N030S06	0.3	0.6	0.45	3	0.57	9.9°	50	6	2	●	1	3.1	3.3	3.6	4.0
MP2XLBR0030N035	0.3	0.6	0.45	3.5	0.57	8.6°	50	4	2	●	1	3.7	3.8	4.2	4.6
MP2XLBR0030N040	0.3	0.6	0.45	4	0.57	8.2°	50	4	2	●	1	4.2	4.4	4.8	5.3
MP2XLBR0030N040S06	0.3	0.6	0.45	4	0.57	9.3°	50	6	2	●	1	4.2	4.4	4.8	5.3
MP2XLBR0030N045	0.3	0.6	0.45	4.5	0.57	7.9°	50	4	2	●	1	4.7	4.9	5.4	5.9
MP2XLBR0030N050	0.3	0.6	0.45	5	0.57	7.6°	50	4	2	●	1	5.2	5.5	6.0	6.6
MP2XLBR0030N050S06	0.3	0.6	0.45	5	0.57	8.8°	50	6	2	●	1	5.2	5.5	6.0	6.6
MP2XLBR0030N055	0.3	0.6	0.45	5.5	0.57	7.3°	50	4	2	●	1	5.8	6.0	6.6	7.3
MP2XLBR0030N060	0.3	0.6	0.45	6	0.57	7.1°	50	4	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0030N060S06	0.3	0.6	0.45	6	0.57	8.3°	50	6	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0030N065	0.3	0.6	0.45	6.5	0.57	6.8°	50	4	2	●	1	6.8	7.1	7.8	8.6
MP2XLBR0030N070	0.3	0.6	0.45	7	0.57	6.6°	50	4	2	●	1	7.3	7.6	8.4	9.3

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MS PLUS END MILLS

MP2XLB

Ball nose, Short cut length, 2 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
												0.5°	1°	2°	3°
MP2XLBR0030N080	0.3	0.6	0.45	8	0.57	6.2°	50	4	2	●	1	8.4	8.7	9.6	10.6
MP2XLBR0030N080S06	0.3	0.6	0.45	8	0.57	7.6°	50	6	2	●	1	8.4	8.7	9.6	10.6
MP2XLBR0030N085	0.3	0.6	0.45	8.5	0.57	6°	50	4	2	●	1	8.9	9.3	10.2	11.3
MP2XLBR0030N090	0.3	0.6	0.45	9	0.57	5.8°	50	4	2	●	1	9.4	9.8	10.8	11.9
MP2XLBR0030N095	0.3	0.6	0.45	9.5	0.57	5.7°	50	4	2	●	1	9.9	10.4	11.4	12.6
MP2XLBR0030N100	0.3	0.6	0.45	10	0.57	5.5°	50	4	2	●	1	10.5	10.9	12.0	13.2
MP2XLBR0030N110	0.3	0.6	0.45	11	0.57	5.2°	50	4	2	●	1	11.5	12.0	13.2	14.6
MP2XLBR0030N120	0.3	0.6	0.45	12	0.57	5°	50	4	2	●	1	12.5	13.1	14.4	15.9
MP2XLBR0040N020	0.4	0.8	0.6	2	0.77	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0040N020S06	0.4	0.8	0.6	2	0.77	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0040N024S06	0.4	0.8	0.6	2.4	0.77	10.3°	50	6	2	●	1	2.5	2.6	2.8	3.1
MP2XLBR0040N030	0.4	0.8	0.6	3	0.77	8.9°	50	4	2	●	1	3.1	3.3	3.6	3.9
MP2XLBR0040N030S06	0.4	0.8	0.6	3	0.77	9.9°	50	6	2	●	1	3.1	3.3	3.6	3.9
MP2XLBR0040N040	0.4	0.8	0.6	4	0.77	8.2°	50	4	2	●	1	4.2	4.4	4.8	5.2
MP2XLBR0040N040S06	0.4	0.8	0.6	4	0.77	9.3°	50	6	2	●	1	4.2	4.4	4.8	5.2
MP2XLBR0040N050	0.4	0.8	0.6	5	0.77	7.5°	50	4	2	●	1	5.2	5.5	6.0	6.6
MP2XLBR0040N060	0.4	0.8	0.6	6	0.77	6.9°	50	4	2	●	1	6.3	6.5	7.2	7.9
MP2XLBR0040N070	0.4	0.8	0.6	7	0.77	6.5°	50	4	2	●	1	7.3	7.6	8.4	9.2
MP2XLBR0040N080	0.4	0.8	0.6	8	0.77	6°	50	4	2	●	1	8.4	8.7	9.5	10.6
MP2XLBR0040N090	0.4	0.8	0.6	9	0.77	5.7°	50	4	2	●	1	9.4	9.8	10.7	11.9
MP2XLBR0040N100	0.4	0.8	0.6	10	0.77	5.4°	50	4	2	●	1	10.5	10.9	11.9	13.2
MP2XLBR0040N120	0.4	0.8	0.6	12	0.77	4.8°	50	4	2	●	1	12.5	13.1	14.3	15.9
MP2XLBR0050N030	0.5	1	0.75	3	0.96	8.7°	50	4	2	●	1	3.2	3.4	3.7	4.1
MP2XLBR0050N030S06	0.5	1	0.75	3	0.96	9.8°	50	6	2	●	1	3.2	3.4	3.7	4.1
MP2XLBR0050N040	0.5	1	0.75	4	0.96	7.9°	50	4	2	●	1	4.3	4.5	4.9	5.4
MP2XLBR0050N040S06	0.5	1	0.75	4	0.96	9.2°	50	6	2	●	1	4.3	4.5	4.9	5.4
MP2XLBR0050N050	0.5	1	0.75	5	0.96	7.3°	50	4	2	●	1	5.3	5.6	6.1	6.7
MP2XLBR0050N050S06	0.5	1	0.75	5	0.96	8.6°	50	6	2	●	1	5.3	5.6	6.1	6.7
MP2XLBR0050N060	0.5	1	0.75	6	0.96	6.7°	50	4	2	●	1	6.4	6.7	7.3	8.1
MP2XLBR0050N060S06	0.5	1	0.75	6	0.96	8.2°	50	6	2	●	1	6.4	6.7	7.3	8.1
MP2XLBR0050N070	0.5	1	0.75	7	0.96	6.2°	50	4	2	●	1	7.4	7.8	8.5	9.4
MP2XLBR0050N080	0.5	1	0.75	8	0.96	5.8°	50	4	2	●	1	8.5	8.9	9.7	10.7
MP2XLBR0050N080S06	0.5	1	0.75	8	0.96	7.3°	50	6	2	●	1	8.5	8.9	9.7	10.7
MP2XLBR0050N090	0.5	1	0.75	9	0.96	5.5°	50	4	2	●	1	9.5	10.0	10.9	12.0
MP2XLBR0050N100	0.5	1	0.75	10	0.96	5.1°	50	4	2	●	1	10.6	11.1	12.1	13.4
MP2XLBR0050N100S06	0.5	1	0.75	10	0.96	6.7°	60	6	2	●	1	10.6	11.1	12.1	13.4
MP2XLBR0050N120	0.5	1	0.75	12	0.96	4.6°	50	4	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0050N120S06	0.5	1	0.75	12	0.96	6.1°	60	6	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0050N140	0.5	1	0.75	14	0.96	4.2°	55	4	2	●	1	14.8	15.4	16.9	18.7
MP2XLBR0050N160	0.5	1	0.75	16	0.96	3.8°	55	4	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0050N160S06	0.5	1	0.75	16	0.96	5.2°	65	6	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0050N180	0.5	1	0.75	18	0.96	3.5°	55	4	2	●	1	18.9	19.8	21.7	24.0
MP2XLBR0050N200	0.5	1	0.75	20	0.96	3.3°	55	4	2	●	1	21.0	22.0	24.1	26.6
MP2XLBR0050N200S06	0.5	1	0.75	20	0.96	4.6°	65	6	2	●	1	21.0	22.0	24.1	26.6
MP2XLBR0060N060	0.6	1.2	0.9	6	1.16	6.6°	50	4	2	●	1	6.4	6.7	7.3	8.0
MP2XLBR0060N060S06	0.6	1.2	0.9	6	1.16	8.1°	55	6	2	●	1	6.4	6.7	7.3	8.0
MP2XLBR0060N080	0.6	1.2	0.9	8	1.16	5.7°	50	4	2	●	1	8.5	8.9	9.7	10.7
MP2XLBR0060N080S06	0.6	1.2	0.9	8	1.16	7.3°	55	6	2	●	1	8.5	8.9	9.7	10.7

(mm)

CARBIDE

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
												0.5°	1°	2°	3°
MP2XLBR0060N100	0.6	1.2	0.9	10	1.16	5°	50	4	2	●	1	10.6	11.0	12.1	13.3
MP2XLBR0060N100S06	0.6	1.2	0.9	10	1.16	6.6°	55	6	2	●	1	10.6	11.0	12.1	13.3
MP2XLBR0060N120	0.6	1.2	0.9	12	1.16	4.4°	50	4	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0060N120S06	0.6	1.2	0.9	12	1.16	6°	65	6	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0060N140	0.6	1.2	0.9	14	1.16	4°	55	4	2	●	1	14.8	15.4	16.9	18.7
MP2XLBR0060N160	0.6	1.2	0.9	16	1.16	3.7°	55	4	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0060N160S06	0.6	1.2	0.9	16	1.16	5.1°	65	6	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0060N180	0.6	1.2	0.9	18	1.16	3.4°	60	4	2	●	1	18.9	19.8	21.7	24.0
MP2XLBR0060N200	0.6	1.2	0.9	20	1.16	3.1°	60	4	2	●	1	21.0	21.9	24.0	26.6
MP2XLBR0060N240	0.6	1.2	0.9	24	1.16	2.7°	60	4	2	●	1	25.2	26.3	28.8	*
MP2XLBR0070N080	0.7	1.4	1.05	8	1.34	5.5°	50	4	2	●	1	8.4	8.8	9.6	10.6
MP2XLBR0070N120	0.7	1.4	1.05	12	1.34	4.3°	50	4	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0070N160	0.7	1.4	1.05	16	1.34	3.5°	50	4	2	●	1	16.8	17.5	19.2	21.2
MP2XLBR0075N030	0.75	1.5	1.1	3	1.44	8.6°	50	4	2	●	1	3.1	3.3	3.6	3.9
MP2XLBR0075N040	0.75	1.5	1.1	4	1.44	7.7°	50	4	2	●	1	4.2	4.4	4.8	5.2
MP2XLBR0075N060	0.75	1.5	1.1	6	1.44	6.3°	50	4	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0075N060S06	0.75	1.5	1.1	6	1.44	8°	50	6	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0075N080	0.75	1.5	1.1	8	1.44	5.4°	50	4	2	●	1	8.4	8.8	9.6	10.6
MP2XLBR0075N080S06	0.75	1.5	1.1	8	1.44	7.2°	60	6	2	●	1	8.4	8.8	9.6	10.6
MP2XLBR0075N100	0.75	1.5	1.1	10	1.44	4.7°	50	4	2	●	1	10.5	11.0	12.0	13.2
MP2XLBR0075N100S06	0.75	1.5	1.1	10	1.44	6.5°	60	6	2	●	1	10.5	11.0	12.0	13.2
MP2XLBR0075N120	0.75	1.5	1.1	12	1.44	4.2°	50	4	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0075N120S06	0.75	1.5	1.1	12	1.44	5.9°	60	6	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0075N140	0.75	1.5	1.1	14	1.44	3.8°	55	4	2	●	1	14.7	15.3	16.8	18.5
MP2XLBR0075N160	0.75	1.5	1.1	16	1.44	3.4°	55	4	2	●	1	16.8	17.5	19.2	21.2
MP2XLBR0075N160S06	0.75	1.5	1.1	16	1.44	5°	60	6	2	●	1	16.8	17.5	19.2	21.2
MP2XLBR0075N180	0.75	1.5	1.1	18	1.44	3.1°	60	4	2	●	1	18.9	19.7	21.6	23.8
MP2XLBR0075N200	0.75	1.5	1.1	20	1.44	2.9°	60	4	2	●	1	21.0	21.9	23.9	*
MP2XLBR0075N220	0.75	1.5	1.1	22	1.44	2.7°	60	4	2	●	1	23.0	24.0	26.3	*
MP2XLBR0080N080	0.8	1.6	1.2	8	1.54	5.3°	55	4	2	●	1	8.4	8.8	9.6	10.5
MP2XLBR0080N120	0.8	1.6	1.2	12	1.54	4.1°	55	4	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0080N160	0.8	1.6	1.2	16	1.54	3.3°	55	4	2	●	1	16.8	17.5	19.1	21.2
MP2XLBR0080N200	0.8	1.6	1.2	20	1.54	2.8°	55	4	2	●	1	21.0	21.9	23.9	*
MP2XLBR0090N080	0.9	1.8	1.4	8	1.74	5.1°	55	4	2	●	1	8.4	8.8	9.6	10.5
MP2XLBR0090N120	0.9	1.8	1.4	12	1.74	3.9°	55	4	2	●	1	12.6	13.1	14.3	15.8
MP2XLBR0090N160	0.9	1.8	1.4	16	1.74	3.1°	55	4	2	●	1	16.8	17.5	19.1	21.1
MP2XLBR0090N200	0.9	1.8	1.4	20	1.74	2.6°	55	4	2	●	1	20.9	21.8	23.9	*
MP2XLBR0100N040	1	2	1.5	4	1.94	7.2°	50	4	2	●	1	4.2	4.4	4.7	5.2
MP2XLBR0100N040S06	1	2	1.5	4	1.94	9°	50	6	2	●	1	4.2	4.4	4.7	5.2
MP2XLBR0100N060	1	2	1.5	6	1.94	5.8°	50	4	2	●	1	6.3	6.6	7.1	7.8
MP2XLBR0100N060S06	1	2	1.5	6	1.94	7.8°	50	6	2	●	1	6.3	6.6	7.1	7.8
MP2XLBR0100N080	1	2	1.5	8	1.94	4.8°	50	4	2	●	1	8.4	8.8	9.5	10.5
MP2XLBR0100N080S06	1	2	1.5	8	1.94	6.9°	50	6	2	●	1	8.4	8.8	9.5	10.5
MP2XLBR0100N100	1	2	1.5	10	1.94	4.2°	50	4	2	●	1	10.5	10.9	11.9	13.1
MP2XLBR0100N100S06	1	2	1.5	10	1.94	6.2°	50	6	2	●	1	10.5	10.9	11.9	13.1
MP2XLBR0100N120	1	2	1.5	12	1.94	3.6°	50	4	2	●	1	12.6	13.1	14.3	15.8
MP2XLBR0100N120S06	1	2	1.5	12	1.94	5.6°	60	6	2	●	1	12.6	13.1	14.3	15.8
MP2XLBR0100N140	1	2	1.5	14	1.94	3.2°	55	4	2	●	1	14.7	15.3	16.7	18.4

* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MS PLUS END MILLS

MP2XLB

Ball nose, Short cut length, 2 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
												0.5°	1°	2°	3°
MP2XLBR0100N140S06	1	2	1.5	14	1.94	5.1°	60	6	2	●	1	14.7	15.3	16.7	18.4
MP2XLBR0100N160	1	2	1.5	16	1.94	2.9°	55	4	2	●	1	16.8	17.5	19.1	*
MP2XLBR0100N160S06	1	2	1.5	16	1.94	4.7°	65	6	2	●	1	16.8	17.5	19.1	21.1
MP2XLBR0100N180	1	2	1.5	18	1.94	2.7°	55	4	2	●	1	18.9	19.7	21.5	*
MP2XLBR0100N180S06	1	2	1.5	18	1.94	4.3°	65	6	2	●	1	18.9	19.7	21.5	23.8
MP2XLBR0100N200	1	2	1.5	20	1.94	2.4°	65	4	2	●	1	20.9	21.8	23.9	*
MP2XLBR0100N200S06	1	2	1.5	20	1.94	4°	65	6	2	●	1	20.9	21.8	23.9	26.4
MP2XLBR0100N220	1	2	1.5	22	1.94	2.3°	65	4	2	●	1	23.0	24.0	26.3	*
MP2XLBR0100N250	1	2	1.5	25	1.94	2°	65	4	2	●	1	26.2	27.3	*	*
MP2XLBR0100N250S06	1	2	1.5	25	1.94	3.5°	90	6	2	●	1	26.2	27.3	29.9	33
MP2XLBR0100N300	1	2	1.5	30	1.94	1.7°	80	4	2	●	1	31.4	32.7	*	*
MP2XLBR0100N300S06	1	2	1.5	30	1.94	3°	90	6	2	●	1	31.4	32.7	35.9	*
MP2XLBR0100N350	1	2	1.5	35	1.94	1.5°	80	4	2	●	1	36.6	38.2	*	*
MP2XLBR0100N350S06	1	2	1.5	35	1.94	2.7°	90	6	2	●	1	36.6	38.2	41.8	*
MP2XLBR0100N400	1	2	1.5	40	1.94	1.4°	80	4	2	●	1	41.8	43.6	*	*
MP2XLBR0100N400S06	1	2	1.5	40	1.94	2.4°	90	6	2	●	1	41.8	43.6	47.8	*
MP2XLBR0125N100	1.25	2.5	1.9	10	2.4	3.5°	55	4	2	●	1	10.4	10.8	11.8	12.9
MP2XLBR0125N150	1.25	2.5	1.9	15	2.4	2.5°	55	4	2	●	1	15.6	16.3	17.8	*
MP2XLBR0125N200	1.25	2.5	1.9	20	2.4	2°	55	4	2	●	1	20.8	21.7	*	*
MP2XLBR0125N250	1.25	2.5	1.9	25	2.4	1.6°	70	4	2	●	1	26.1	27.2	*	*
MP2XLBR0125N300	1.25	2.5	1.9	30	2.4	1.4°	70	4	2	●	1	31.3	32.6	*	*
MP2XLBR0125N350	1.25	2.5	1.9	35	2.4	1.2°	70	4	2	●	1	36.5	38.1	*	*
MP2XLBR0150N060S03	1.5	3	2.3	6	2.9	—	60	3	2	●	1	*	*	*	*
MP2XLBR0150N080	1.5	3	2.3	8	2.9	6.3°	60	6	2	●	1	8.3	8.6	9.3	10.2
MP2XLBR0150N100	1.5	3	2.3	10	2.9	5.5°	60	6	2	●	1	10.4	10.8	11.7	12.9
MP2XLBR0150N120	1.5	3	2.3	12	2.9	4.9°	60	6	2	●	1	12.5	13.0	14.1	15.5
MP2XLBR0150N140	1.5	3	2.3	14	2.9	4.4°	60	6	2	●	1	14.6	15.2	16.5	18.2
MP2XLBR0150N160	1.5	3	2.3	16	2.9	4°	70	6	2	●	1	16.7	17.3	18.9	20.8
MP2XLBR0150N200	1.5	3	2.3	20	2.9	3.4°	70	6	2	●	1	20.8	21.7	23.7	26.1
MP2XLBR0150N250	1.5	3	2.3	25	2.9	2.8°	70	6	2	●	1	26.1	27.2	29.7	*
MP2XLBR0150N300	1.5	3	2.3	30	2.9	2.5°	70	6	2	●	1	31.3	32.6	35.7	*
MP2XLBR0150N350	1.5	3	2.3	35	2.9	2.2°	90	6	2	●	1	36.5	38.0	41.7	*
MP2XLBR0150N400	1.5	3	2.3	40	2.9	1.9°	90	6	2	●	1	41.7	43.5	*	*
MP2XLBR0175N150	1.75	3.5	2.6	15	3.4	3.8°	65	6	2	●	1	15.6	16.2	17.7	19.4
MP2XLBR0175N250	1.75	3.5	2.6	25	3.4	2.5°	65	6	2	●	1	26.0	27.1	29.6	*
MP2XLBR0175N350	1.75	3.5	2.6	35	3.4	1.9°	90	6	2	●	1	36.5	38.0	*	*
MP2XLBR0175N450	1.75	3.5	2.6	45	3.4	1.5°	90	6	2	●	1	46.9	48.9	*	*
MP2XLBR0200N080S04	2	4	3	8	3.9	—	65	4	2	●	2	*	*	*	*
MP2XLBR0200N100	2	4	3	10	3.9	4.5°	65	6	2	●	1	10.4	10.8	11.6	12.7
MP2XLBR0200N120	2	4	3	12	3.9	3.9°	65	6	2	●	1	12.5	12.9	14.0	15.4
MP2XLBR0200N140	2	4	3	14	3.9	3.4°	65	6	2	●	1	14.6	15.1	16.4	18.0
MP2XLBR0200N160	2	4	3	16	3.9	3.1°	70	6	2	●	1	16.6	17.3	18.8	20.7
MP2XLBR0200N200	2	4	3	20	3.9	2.6°	70	6	2	●	1	20.8	21.7	23.6	*
MP2XLBR0200N250	2	4	3	25	3.9	2.1°	70	6	2	●	1	26.0	27.1	29.6	*
MP2XLBR0200N300	2	4	3	30	3.9	1.8°	80	6	2	●	1	31.2	32.6	*	*
MP2XLBR0200N350	2	4	3	35	3.9	1.6°	80	6	2	●	1	36.5	38.0	*	*
MP2XLBR0200N400	2	4	3	40	3.9	1.4°	90	6	2	●	1	41.7	43.5	*	*
MP2XLBR0200N450	2	4	3	45	3.9	1.2°	90	6	2	●	1	46.9	48.9	*	*

* No interference

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
												0.5°	1°	2°	3°
MP2XLBR0200N500	2	4	3	50	3.9	1.1°	100	6	2	●	1	52.1	54.3	*	*
MP2XLBR0250N150	2.5	5	3.8	15	4.9	2°	70	6	2	●	1	15.6	16.2	*	*
MP2XLBR0250N200	2.5	5	3.8	20	4.9	1.5°	70	6	2	●	1	20.8	21.6	*	*
MP2XLBR0250N250	2.5	5	3.8	25	4.9	1.2°	70	6	2	●	1	26.0	27.1	*	*
MP2XLBR0250N300	2.5	5	3.8	30	4.9	1°	80	6	2	●	1	31.2	*	*	*
MP2XLBR0250N350	2.5	5	3.8	35	4.9	0.9°	80	6	2	●	1	36.4	*	*	*
MP2XLBR0250N400	2.5	5	3.8	40	4.9	0.8°	90	6	2	●	1	41.7	*	*	*
MP2XLBR0300N200	3	6	6	20	5.85	—	70	6	2	●	2	*	*	*	*
MP2XLBR0300N250	3	6	6	25	5.85	—	70	6	2	●	2	*	*	*	*
MP2XLBR0300N300	3	6	6	30	5.85	—	80	6	2	●	2	*	*	*	*
MP2XLBR0300N400	3	6	6	40	5.85	—	90	6	2	●	2	*	*	*	*
MP2XLBR0300N500	3	6	6	50	5.85	—	100	6	2	●	2	*	*	*	*

* No interference

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MS PLUS END MILLS

MP2XLB

Ball nose, Short cut length, 2 flute, Long neck

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

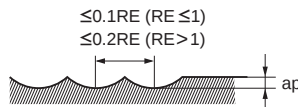
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SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Alloy steel (180—280HB) Alloy tool steel, Pre-hardened steel, Precipitation hardening stainless steel			Hardened steel (45—55HRC)			Copper, Copper alloy		
RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
0.05	0.3	50000	200	0.002	50000	200	0.002	50000	200	0.004
	0.5	50000	200	0.001	50000	200	0.002	50000	200	0.002
0.1	0.5	50000	400	0.003	50000	320	0.003	50000	320	0.006
	1	50000	400	0.002	50000	320	0.002	50000	320	0.004
	1.5	40000	300	0.001	40000	240	0.001	40000	240	0.002
	2	40000	200	0.001	40000	160	0.001	40000	160	0.002
	2.5	40000	100	0.001	40000	80	0.001	40000	80	0.002
0.15	1	50000	600	0.007	50000	480	0.007	50000	480	0.014
	1.5	50000	600	0.005	50000	480	0.005	50000	480	0.01
	2	50000	600	0.003	50000	480	0.003	50000	480	0.006
	2.5	40000	400	0.003	40000	320	0.003	40000	320	0.006
	3	40000	300	0.002	40000	240	0.002	40000	240	0.004
	3.5	30000	250	0.002	30000	200	0.002	30000	200	0.004
	4	30000	200	0.002	30000	160	0.002	30000	160	0.004
0.2	1	50000	1800	0.015	50000	1400	0.015	50000	1400	0.03
	2	50000	1300	0.01	50000	1000	0.01	50000	1000	0.02
	3	50000	900	0.005	50000	700	0.005	50000	700	0.01
	4	40000	600	0.004	40000	480	0.004	40000	480	0.008
	5	40000	400	0.003	40000	320	0.003	40000	320	0.006
	6	30000	200	0.002	30000	160	0.002	30000	160	0.004
0.25	2	50000	2500	0.02	50000	2000	0.02	50000	2000	0.04
	3	50000	1500	0.015	50000	1200	0.015	50000	1200	0.03
	4	45000	1200	0.01	45000	950	0.01	45000	950	0.02
	5	45000	900	0.007	45000	700	0.007	45000	700	0.014
	6	36000	600	0.006	36000	480	0.006	36000	480	0.012
	7	32000	400	0.005	32000	320	0.005	32000	320	0.01
	8	32000	300	0.003	32000	240	0.003	32000	240	0.006
	10	26000	200	0.002	26000	160	0.002	26000	160	0.004
0.3	2	50000	3500	0.03	50000	2800	0.03	50000	2800	0.06
	3	50000	3500	0.03	50000	2800	0.03	50000	2800	0.06
	4	44000	2500	0.02	44000	2000	0.02	44000	2000	0.04
	5	37000	1200	0.01	37000	950	0.01	37000	950	0.02
	6	37000	1000	0.008	37000	800	0.008	37000	800	0.016
	7	35000	750	0.008	35000	600	0.008	35000	600	0.016
	8	35000	600	0.006	35000	480	0.006	35000	480	0.012
	9	30000	500	0.004	30000	400	0.004	30000	400	0.008
	10	30000	500	0.003	30000	400	0.003	30000	400	0.006
	11	22000	300	0.002	22000	240	0.002	22000	240	0.004
	12	22000	200	0.002	22000	160	0.002	22000	160	0.004
0.4	2	50000	4400	0.04	50000	3500	0.04	50000	3500	0.08
	3	50000	4000	0.04	50000	3200	0.04	50000	3200	0.08
	4	50000	4000	0.02	50000	3200	0.02	50000	3200	0.04
	5	35000	2400	0.02	35000	1900	0.02	35000	1900	0.04
	6	35000	2400	0.02	35000	1900	0.02	35000	1900	0.04
	7	30000	1500	0.015	30000	1200	0.015	30000	1200	0.03
	8	30000	1500	0.01	30000	1200	0.01	30000	1200	0.02
	10	30000	700	0.008	30000	560	0.008	30000	560	0.016
	12	22000	500	0.006	22000	400	0.006	22000	400	0.012

Depth of cut

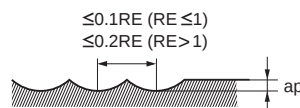


RE : Radius

- Note 1) When the inclination angle of machined surface is high, or when machining at high loads; such as in corners, reduce the revolution and feed rate.
 Note 2) The use of oil mist is recommended when machining with small diameter.
 Note 3) The revolution and feed rate can be increased at small depths of cut (ap).

Work Material		Carbon steel, Alloy steel (180—280HB) Alloy tool steel, Pre-hardened steel, Precipitation hardening stainless steel			Hardened steel (45—55HRC)			Copper, Copper alloy		
RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
0.5	3	40000	4000	0.05	40000	3200	0.05	40000	3200	0.1
	4	40000	4000	0.05	40000	3200	0.05	40000	3200	0.1
	6	35000	3000	0.03	35000	2400	0.03	35000	2400	0.06
	8	30000	2000	0.02	30000	1600	0.02	30000	1600	0.04
	10	20000	1000	0.01	20000	800	0.01	20000	800	0.02
	12	20000	1000	0.01	20000	800	0.01	20000	800	0.02
	14	18000	600	0.008	18000	480	0.008	18000	480	0.016
	16	18000	500	0.008	18000	400	0.008	18000	400	0.016
	18	13000	300	0.005	13000	240	0.005	13000	240	0.01
	20	13000	250	0.005	13000	200	0.005	13000	200	0.01
0.6	6	40000	4400	0.04	40000	3500	0.04	40000	3500	0.08
	8	40000	4000	0.04	40000	3200	0.04	40000	3200	0.08
	10	27000	1900	0.02	27000	1500	0.02	27000	1500	0.04
	12	16000	1400	0.02	16000	1100	0.02	16000	1100	0.04
	18	15000	700	0.008	15000	560	0.008	15000	560	0.016
	24	11000	300	0.006	11000	240	0.006	11000	240	0.012
0.7	8	40000	4000	0.05	40000	3200	0.05	40000	2560	0.1
	12	26000	2000	0.04	26000	1600	0.04	26000	1280	0.08
	16	17000	1400	0.03	17000	1120	0.03	17000	896	0.06
0.75	6	40000	6000	0.07	36000	4300	0.07	36000	4300	0.14
	8	40000	6000	0.07	36000	4300	0.07	36000	4300	0.14
	10	40000	5000	0.06	36000	3600	0.06	36000	3600	0.12
	12	32000	3400	0.04	29000	2400	0.04	29000	2400	0.08
	16	15000	1400	0.03	15000	1100	0.03	15000	1100	0.06
	20	12000	900	0.02	12000	720	0.02	12000	720	0.04
	22	9000	400	0.01	9000	320	0.01	9000	320	0.02
0.8	8	40000	6000	0.08	32000	3800	0.08	32000	3800	0.16
	12	36000	4500	0.06	29000	2800	0.06	29000	2800	0.12
	16	14000	1400	0.04	14000	1100	0.04	14000	1100	0.08
	20	12000	1000	0.03	12000	800	0.03	12000	800	0.06
0.9	8	40000	6600	0.09	32000	4200	0.09	32000	4200	0.18
	12	40000	5000	0.07	32000	3200	0.07	32000	3200	0.14
	16	28000	2800	0.04	22000	1800	0.04	22000	1800	0.08
	20	10000	800	0.03	10000	640	0.03	10000	640	0.06
1	4	40000	8000	0.1	32000	5000	0.1	32000	5000	0.2
	6	40000	8000	0.1	32000	5000	0.1	32000	5000	0.2
	8	40000	6000	0.1	32000	3800	0.1	32000	3800	0.2
	10	40000	5000	0.08	32000	3200	0.08	32000	3200	0.16
	12	40000	5000	0.08	32000	3200	0.08	32000	3200	0.16
	16	32000	3500	0.05	26000	2200	0.05	26000	2200	0.1
	20	10000	1000	0.04	10000	800	0.04	10000	800	0.08
	25	10000	1000	0.04	10000	800	0.04	10000	800	0.08
	30	10000	800	0.02	10000	640	0.02	10000	640	0.04
	35	10000	600	0.02	10000	480	0.02	10000	480	0.04
	40	8000	400	0.01	8000	320	0.01	8000	320	0.02

Depth of cut



RE : Radius

Note 4) Cutting conditions may differ considerably due to the overhang, depth of cut and machine tool condition. Please use the table above as a reference starting point.

Note 5) For hardened steel over 55 HRC, use VF2XLB.

Note 6) For cutting conditions for austenitic stainless steel and titanium alloy, use the high hardness steel (45-55 HRC) table but reduce the spindle speed by 40% and the feed rate by 55%.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MS PLUS END MILLS

MP2XLB

Ball nose, Short cut length, 2 flute, Long neck

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

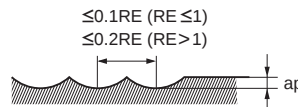
ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Alloy steel (180–280HB) Alloy tool steel, Pre-hardened steel, Precipitation hardening stainless steel			Hardened steel (45–55HRC)			Copper, Copper alloy		
RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
1.25	10	36000	6000	0.12	29000	3800	0.12	29000	3800	0.24
	15	32000	4500	0.1	26000	2900	0.1	26000	2900	0.2
	20	26000	3200	0.07	21000	2000	0.07	21000	2000	0.14
	25	12000	1400	0.06	8000	720	0.06	8000	720	0.12
	30	8000	900	0.04	8000	700	0.04	8000	700	0.08
	35	8000	800	0.02	8000	640	0.02	8000	510	0.04
1.5	6	32000	7000	0.15	26000	4500	0.15	22000	3800	0.3
	10	32000	7000	0.15	26000	4500	0.15	22000	3800	0.3
	16	32000	5000	0.1	26000	3200	0.1	22000	2700	0.2
	20	27000	3800	0.1	22000	2400	0.1	22000	2400	0.2
	25	21000	2700	0.08	17000	1700	0.08	17000	1700	0.16
	30	10000	700	0.08	6000	560	0.08	6000	560	0.16
	35	6000	700	0.06	6000	560	0.06	6000	560	0.12
	40	6000	600	0.04	6000	480	0.04	6000	480	0.08
1.75	15	27500	4400	0.13	22000	2800	0.13	18000	2300	0.26
	25	23000	3600	0.1	18000	2200	0.1	18000	2200	0.2
	35	10000	1400	0.08	10000	1100	0.08	10000	1100	0.16
	45	7500	900	0.04	7500	720	0.04	7500	720	0.08
2	10	24000	6000	0.2	19000	3800	0.2	16000	3200	0.4
	20	24000	3800	0.15	19000	2400	0.15	16000	2000	0.3
	30	20000	3000	0.1	16000	1900	0.1	16000	1900	0.2
	40	12000	1700	0.1	12000	1400	0.1	12000	1400	0.2
	50	8000	1000	0.05	8000	800	0.05	8000	800	0.1
2.5	20	22000	6000	0.2	18000	3800	0.2	13000	2800	0.4
	25	22000	4400	0.2	18000	2800	0.2	13000	2000	0.4
	30	22000	3800	0.15	18000	2400	0.15	13000	1700	0.3
	40	22000	3600	0.1	18000	2300	0.1	13000	1600	0.2
3	20	20000	6000	0.2	16000	3800	0.2	11000	2600	0.4
	30	20000	6000	0.2	16000	3800	0.2	11000	2600	0.4
	40	20000	4500	0.15	16000	2800	0.15	11000	2000	0.3
	50	20000	3000	0.15	16000	1900	0.15	11000	1300	0.3

Depth of cut



RE : Radius

Note 1) When the inclination angle of machined surface is high, or when machining at high loads; such as in corners, reduce the revolution and feed rate.

Note 2) The use of oil mist is recommended when machining with small diameter.

Note 3) The revolution and feed rate can be increased at small depths of cut (ap).

Note 4) Cutting conditions may differ considerably due to the overhang, depth of cut and machine tool condition. Please use the table above as a reference starting point.

Note 5) For hardened steel over 55 HRC, use VF2XLB.

Note 6) For cutting conditions for austenitic stainless steel and titanium alloy, use the high hardness steel (45-55 HRC) table but reduce the spindle speed by 40% and the feed rate by 55%.

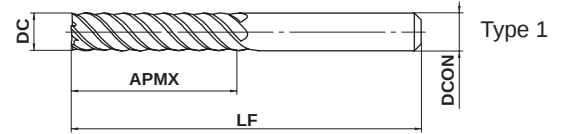
MIRACLE END MILLS

VCLD

End mill, Long cut length, 6 flute



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



DC≤12	DC>12			
0 - 0.020	0 - 0.030			
DCON=6	8≤DCON≤10	12≤DCON≤16	20≤DCON≤25	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● Ideal for tool steel and hardened materials machining

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VCLDD0600	6	26	70	6	6	★	1
VCLDD0800	8	36	90	8	6	★	1
VCLDD1000	10	46	100	10	6	★	1
VCLDD1200	12	56	110	12	6	★	1
VCLDD1600	16	66	130	16	6	★	1
VCLDD2000	20	76	140	20	6	★	1
VCLDD2500	25	92	180	25	6	★	1

RECOMMENDED CUTTING CONDITIONS

Work Material	Alloy steel, Tool steel, Pre-hardened steel			Hardened steel (45—55HRC)			Hardened steel (55—62HRC)			Hardened steel (62—70HRC)		
	AISI H13, AISI W1-10, AISI P21 etc.			AISI H13 etc.			AISI D2 etc.			AISI W1, AISI M2 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
6	2100	450	17.7	1600	330	13.0	1300	240	9.4	1100	190	7.5
8	1600	430	16.9	1200	310	12.2	1000	230	9.1	800	170	6.7
10	1300	420	16.5	960	290	11.4	800	220	8.7	640	150	5.9
12	1100	380	15.0	800	260	10.2	660	200	7.9	530	140	5.5
16	800	310	12.2	600	220	8.7	500	160	6.3	400	120	4.7
20	640	270	10.6	480	190	7.5	400	140	5.5	320	110	4.3
25	510	230	9.1	380	160	6.3	320	120	4.7	260	90	3.5
Depth of cut												

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

★ : Stocked in Japan

I113

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

CARBIDE

MIRACLE END MILLS

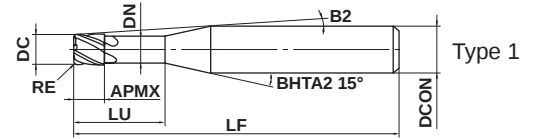
VCPSRB MIRACLE ORBIT

Corner radius, Short cut length, 2—4 flute, High precision



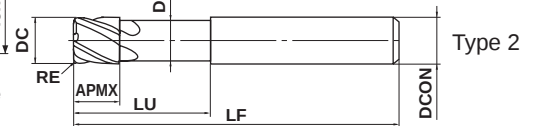
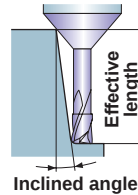
CARBIDE

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



Type 1

Effective length
for inclined angle



Type 2



$0.05 \leq RE \leq 5$			
± 0.01			



$0.6 \leq DC \leq 12$			
$0 - 0.01$			



DCON=6	$8 \leq DCON \leq 10$	DCON=12	
$0 - 0.005$	$0 - 0.006$	$0 - 0.008$	

- ± 0.01 mm corner radius tolerance, 0—0.01mm outer diameter tolerance.
End mill with corner radius for precise and efficient machining.

(mm)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VCPSRBD0060N02R005	0.6	0.05	0.6	2	0.56	12.6°	50	6	2	★	1	2.1	2.2	2.4	2.6
VCPSRBD0060N02R01	0.6	0.1	0.6	2	0.56	12.6°	50	6	2	★	1	2.1	2.2	2.3	2.6
VCPSRBD0060N02R02	0.6	0.2	0.6	2	0.56	12.7°	50	6	2	★	1	2.1	2.2	2.2	2.5
VCPSRBD0060N04R01	0.6	0.1	0.6	4	0.56	10.9°	50	6	2	★	1	4.2	4.4	4.7	5.1
VCPSRBD0060N04R02	0.6	0.2	0.6	4	0.56	11°	50	6	2	★	1	4.2	4.3	4.7	5
VCPSRBD0080N04R005	0.8	0.05	0.8	4	0.76	10.7°	50	6	2	★	1	4.2	4.4	4.7	5.1
VCPSRBD0080N04R01	0.8	0.1	0.8	4	0.76	10.8°	50	6	2	★	1	4.2	4.4	4.7	5.1
VCPSRBD0080N04R02	0.8	0.2	0.8	4	0.76	10.8°	50	6	2	★	1	4.2	4.3	4.7	5
VCPSRBD0080N04R03	0.8	0.3	0.8	4	0.76	10.9°	50	6	2	★	1	4.2	4.3	4.6	5
VCPSRBD0080N06R01	0.8	0.1	0.8	6	0.76	9.4°	50	6	2	★	1	6.3	6.5	7	7.5
VCPSRBD0080N06R02	0.8	0.2	0.8	6	0.76	9.5°	50	6	2	★	1	6.3	6.5	7	7.5
VCPSRBD0080N06R03	0.8	0.3	0.8	6	0.76	9.5°	50	6	2	★	1	6.3	6.5	6.9	7.5
VCPSRBD0080N08R03	0.8	0.3	0.8	8	0.76	8.5°	50	6	2	★	1	8.3	8.6	9.2	10
VCPSRBD0100N04R005	1	0.05	1	4	0.94	10.5°	50	6	2	★	1	4.2	4.5	4.8	5.3
VCPSRBD0100N04R01	1	0.1	1	4	0.94	10.5°	50	6	2	★	1	4.2	4.5	4.8	5.3
VCPSRBD0100N04R02	1	0.2	1	4	0.94	10.6°	50	6	2	★	1	4.2	4.5	4.7	5.3
VCPSRBD0100N04R03	1	0.3	1	4	0.94	10.6°	50	6	2	★	1	4.2	4.5	4.6	5.2
VCPSRBD0100N04R04	1	0.4	1	4	0.94	10.7°	50	6	2	★	1	4.2	4.5	4.4	5.2
VCPSRBD0100N06R01	1	0.1	1	6	0.94	9.2°	50	6	2	★	1	6.4	6.7	7.2	7.8
VCPSRBD0100N06R02	1	0.2	1	6	0.94	9.2°	50	6	2	★	1	6.4	6.7	7.2	7.7
VCPSRBD0100N06R03	1	0.3	1	6	0.94	9.3°	50	6	2	★	1	6.3	6.6	7.2	7.7
VCPSRBD0100N06R04	1	0.4	1	6	0.94	9.4°	50	6	2	★	1	6.3	6.6	7.1	7.7
VCPSRBD0100N10R03	1	0.3	1	10	0.94	7.4°	50	6	2	★	1	10.5	10.9	11.8	12.7
VCPSRBD0100N10R04	1	0.4	1	10	0.94	7.4°	50	6	2	★	1	10.5	10.9	11.7	12.7
VCPSRBD0120N06R05	1.2	0.5	1.2	6	1.14	9.3°	50	6	2	★	1	6.3	6.6	7.1	7.7
VCPSRBD0120N10R05	1.2	0.5	1.2	10	1.14	7.3°	50	6	2	★	1	10.5	10.9	11.7	12.6
VCPSRBD0120N15R05	1.2	0.5	1.2	15	1.14	5.8°	50	6	2	★	1	15.7	16.3	17.5	18.9
VCPSRBD0150N04R01	1.5	0.1	1.5	4	1.44	10.2°	50	6	2	★	1	4.2	4.5	4.8	5.3
VCPSRBD0150N04R02	1.5	0.2	1.5	4	1.44	10.2°	50	6	2	★	1	4.2	4.5	4.7	5.3
VCPSRBD0150N04R03	1.5	0.3	1.5	4	1.44	10.3°	50	6	2	★	1	4.2	4.5	4.6	5.2
VCPSRBD0150N04R05	1.5	0.5	1.5	4	1.44	10.5°	50	6	2	●	1	4.2	4.4	4.3	5.2

(mm)

CARBIDE

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VCPSRBD0150N06R01	1.5	0.1	1.5	6	1.44	8.8°	50	6	2	★	1	6.4	6.7	7.2	7.8
VCPSRBD0150N06R02	1.5	0.2	1.5	6	1.44	8.9°	50	6	2	★	1	6.4	6.7	7.2	7.7
VCPSRBD0150N06R03	1.5	0.3	1.5	6	1.44	8.9°	50	6	2	★	1	6.3	6.6	7.2	7.7
VCPSRBD0150N06R05	1.5	0.5	1.5	6	1.44	9°	50	6	2	●	1	6.3	6.6	7.1	7.7
VCPSRBD0150N10R01	1.5	0.1	1.5	10	1.44	6.9°	50	6	2	★	1	10.6	11	11.8	12.7
VCPSRBD0150N10R02	1.5	0.2	1.5	10	1.44	7°	50	6	2	★	1	10.5	11	11.8	12.7
VCPSRBD0150N10R03	1.5	0.3	1.5	10	1.44	7°	50	6	2	★	1	10.5	10.9	11.8	12.7
VCPSRBD0150N10R05	1.5	0.5	1.5	10	1.44	7.1°	50	6	2	●	1	10.5	10.9	11.7	12.6
VCPSRBD0150N15R01	1.5	0.1	1.5	15	1.44	5.5°	50	6	2	★	1	15.8	16.3	17.5	18.9
VCPSRBD0150N15R02	1.5	0.2	1.5	15	1.44	5.5°	50	6	2	★	1	15.8	16.3	17.5	18.9
VCPSRBD0150N15R03	1.5	0.3	1.5	15	1.44	5.5°	50	6	2	★	1	15.7	16.3	17.5	18.9
VCPSRBD0150N15R05	1.5	0.5	1.5	15	1.44	5.7°	50	6	2	★	1	15.7	16.3	17.4	18.6
VCPSRBD0150N20R03	1.5	0.3	1.5	20	1.44	4.7°	60	6	2	★	1	20.9	21.6	22.9	24.5
VCPSRBD0150N20R05	1.5	0.5	1.5	20	1.44	4.8°	60	6	2	★	1	20.9	21.5	22.8	24.2
VCPSRBD0200N06R01	2	0.1	2	6	1.9	9.4°	50	6	4	★	1	6.3	6.6	6.9	7.5
VCPSRBD0200N06R02	2	0.2	2	6	1.9	9.7°	50	6	4	★	1	6.3	6.6	6.8	7.4
VCPSRBD0200N06R03	2	0.3	2	6	1.9	10°	50	6	4	★	1	6.3	6.6	6.7	7.4
VCPSRBD0200N06R05	2	0.5	2	6	1.9	10.3°	50	6	4	●	1	6.3	6.5	6.5	7.4
VCPSRBD0200N10R01	2	0.1	2	10	1.9	7.6°	50	6	4	★	1	10.5	10.9	11.4	12
VCPSRBD0200N10R02	2	0.2	2	10	1.9	7.7°	50	6	4	★	1	10.5	10.8	11.2	12
VCPSRBD0200N10R03	2	0.3	2	10	1.9	7.8°	50	6	4	★	1	10.5	10.8	11.1	11.9
VCPSRBD0200N10R05	2	0.5	2	10	1.9	8°	50	6	4	●	1	10.5	10.8	10.9	11.9
VCPSRBD0200N15R01	2	0.1	2	15	1.9	5.9°	50	6	4	★	1	15.7	16.1	16.8	17.5
VCPSRBD0200N15R02	2	0.2	2	15	1.9	5.9°	50	6	4	★	1	15.7	16.1	16.7	17.5
VCPSRBD0200N15R03	2	0.3	2	15	1.9	6°	50	6	4	★	1	15.7	16.1	16.6	17.4
VCPSRBD0200N15R05	2	0.5	2	15	1.9	6.1°	50	6	4	●	1	15.6	16.1	16.3	17.4
VCPSRBD0200N20R03	2	0.3	2	20	1.9	4.8°	60	6	4	★	1	20.8	21.4	21.9	22.9
VCPSRBD0200N20R05	2	0.5	2	20	1.9	4.9°	60	6	4	★	1	20.8	21.4	21.7	22.9
VCPSRBD0200N25R03	2	0.3	2	25	1.9	4°	60	6	4	★	1	26	26.6	27.5	28.3
VCPSRBD0200N25R05	2	0.5	2	25	1.9	4°	60	6	4	★	1	26	26.6	27	28.2
VCPSRBD0250N08R01	2.5	0.1	2.5	8	2.4	8.6°	50	6	4	★	1	8.4	8.7	9.2	9.9
VCPSRBD0250N08R02	2.5	0.2	2.5	8	2.4	8.7°	50	6	4	★	1	8.4	8.7	9	9.9
VCPSRBD0250N08R03	2.5	0.3	2.5	8	2.4	8.8°	50	6	4	★	1	8.4	8.7	8.9	9.9
VCPSRBD0250N08R05	2.5	0.5	2.5	8	2.4	9°	50	6	4	★	1	8.4	8.7	8.7	9.9
VCPSRBD0250N08R10	2.5	1	2.5	8	2.4	9.4°	50	6	4	●	1	8.3	8.7	8.2	9.9
VCPSRBD0250N15R03	2.5	0.3	2.5	15	2.4	5.5°	50	6	4	★	1	15.7	16.1	16.6	17.5
VCPSRBD0250N15R05	2.5	0.5	2.5	15	2.4	5.6°	50	6	4	★	1	15.6	16.1	16.3	17.5
VCPSRBD0250N15R10	2.5	1	2.5	15	2.4	5.7°	50	6	4	●	1	15.6	16.1	15.8	17.5
VCPSRBD0300N10R01	3	0.1	3	10	2.9	6.6°	60	6	4	★	1	10.5	10.9	11.4	12.3
VCPSRBD0300N10R02	3	0.2	3	10	2.9	6.6°	60	6	4	★	1	10.5	10.8	11.2	12.3
VCPSRBD0300N10R03	3	0.3	3	10	2.9	6.6°	60	6	4	★	1	10.5	10.8	11.1	12.3
VCPSRBD0300N10R05	3	0.5	3	10	2.9	6.7°	60	6	4	●	1	10.5	10.8	10.9	12.4
VCPSRBD0300N10R10	3	1	3	10	2.9	7°	60	6	4	●	1	10.4	10.8	10.4	12.4
VCPSRBD0300N15R01	3	0.1	3	15	2.9	4.8°	60	6	4	★	1	15.7	16.1	16.8	17.7
VCPSRBD0300N15R02	3	0.2	3	15	2.9	4.8°	60	6	4	★	1	15.7	16.1	16.7	17.8
VCPSRBD0300N15R03	3	0.3	3	15	2.9	4.8°	60	6	4	★	1	15.7	16.1	16.6	17.8
VCPSRBD0300N15R05	3	0.5	3	15	2.9	4.8°	60	6	4	●	1	15.6	16.1	16.3	17.8
VCPSRBD0300N15R10	3	1	3	15	2.9	5°	60	6	4	●	1	15.6	16.1	15.8	17.8
VCPSRBD0300N20R01	3	0.1	3	20	2.9	3.7°	60	6	4	★	1	20.8	21.4	22.1	23.1
VCPSRBD0300N20R02	3	0.2	3	20	2.9	3.7°	60	6	4	★	1	20.8	21.4	22	23.1
VCPSRBD0300N20R03	3	0.3	3	20	2.9	3.8°	60	6	4	★	1	20.8	21.4	21.9	23.2
VCPSRBD0300N20R05	3	0.5	3	20	2.9	3.8°	60	6	4	●	1	20.8	21.4	21.7	23.2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

MIRACLE END MILLS

VCPSRB MIRACLE ORBIT

Corner radius, Short cut length, 2—4 flute, High precision

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

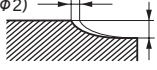
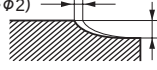
SOLID END MILLS

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VCPSRBD0300N20R10	3	1	3	20	2.9	3.9°	60	6	4	●	1	20.8	21.3	21.2	23.2
VCPSRBD0300N30R03	3	0.3	3	30	2.9	2.6°	70	6	4	★	1	31.1	31.8	32.5	★
VCPSRBD0300N30R05	3	0.5	3	30	2.9	2.6°	70	6	4	★	1	31.1	31.8	32.2	★
VCPSRBD0400N12R01	4	0.1	4	12	3.9	3.8°	60	6	4	★	1	12.5	13	13.5	15.1
VCPSRBD0400N12R02	4	0.2	4	12	3.9	3.8°	60	6	4	★	1	12.5	13	13.4	15.2
VCPSRBD0400N12R03	4	0.3	4	12	3.9	3.8°	60	6	4	★	1	12.5	13	13.3	15.2
VCPSRBD0400N12R05	4	0.5	4	12	3.9	3.9°	60	6	4	●	1	12.5	13	13.1	15.3
VCPSRBD0400N12R10	4	1	4	12	3.9	4°	60	6	4	●	1	12.5	12.9	12.6	15.3
VCPSRBD0400N20R01	4	0.1	4	20	3.9	2.5°	60	6	4	★	1	20.8	21.4	22.1	★
VCPSRBD0400N20R02	4	0.2	4	20	3.9	2.5°	60	6	4	★	1	20.8	21.4	22	★
VCPSRBD0400N20R03	4	0.3	4	20	3.9	2.5°	60	6	4	★	1	20.8	21.4	21.9	★
VCPSRBD0400N20R05	4	0.5	4	20	3.9	2.5°	60	6	4	●	1	20.8	21.4	21.7	★
VCPSRBD0400N20R10	4	1	4	20	3.9	2.6°	60	6	4	●	1	20.8	21.3	21.2	★
VCPSRBD0400N30R03	4	0.3	4	30	3.9	1.8°	70	6	4	★	1	31.1	31.8	★	★
VCPSRBD0400N30R05	4	0.5	4	30	3.9	1.8°	70	6	4	●	1	31.1	31.8	★	★
VCPSRBD0400N30R10	4	1	4	30	3.9	1.8°	70	6	4	●	1	31.1	31.8	★	★
VCPSRBD0500N15R05	5	0.5	5	15	4.9	1.6°	60	6	4	★	1	15.6	16.1	★	★
VCPSRBD0500N15R10	5	1	5	15	4.9	1.6°	60	6	4	★	1	15.6	16.1	★	★
VCPSRBD0500N30R05	5	0.5	5	30	4.9	0.9°	70	6	4	★	1	31.1	★	★	★
VCPSRBD0500N30R10	5	1	5	30	4.9	0.9°	70	6	4	★	1	31.1	★	★	★
VCPSRBD0600N18R01	6	0.1	6	18	5.85	—	70	6	4	★	2	★	★	★	★
VCPSRBD0600N18R02	6	0.2	6	18	5.85	—	70	6	4	★	2	★	★	★	★
VCPSRBD0600N18R03	6	0.3	6	18	5.85	—	70	6	4	★	2	★	★	★	★
VCPSRBD0600N18R05	6	0.5	6	18	5.85	—	70	6	4	●	2	★	★	★	★
VCPSRBD0600N18R10	6	1	6	18	5.85	—	70	6	4	●	2	★	★	★	★
VCPSRBD0600N18R20	6	2	6	18	5.85	—	70	6	4	●	2	★	★	★	★
VCPSRBD0600N41R05	6	0.5	6	41	5.85	—	90	6	4	★	2	★	★	★	★
VCPSRBD0600N50R10	6	1	6	50	5.85	—	90	6	4	★	2	★	★	★	★
VCPSRBD0800N24R01	8	0.1	8	24	7.85	—	90	8	4	★	2	★	★	★	★
VCPSRBD0800N24R02	8	0.2	8	24	7.85	—	90	8	4	★	2	★	★	★	★
VCPSRBD0800N24R03	8	0.3	8	24	7.85	—	90	8	4	★	2	★	★	★	★
VCPSRBD0800N24R05	8	0.5	8	24	7.85	—	90	8	4	●	2	★	★	★	★
VCPSRBD0800N24R10	8	1	8	24	7.85	—	90	8	4	●	2	★	★	★	★
VCPSRBD0800N24R20	8	2	8	24	7.85	—	90	8	4	●	2	★	★	★	★
VCPSRBD0800N24R30	8	3	8	24	7.85	—	90	8	4	●	2	★	★	★	★
VCPSRBD0800N50R10	8	1	8	50	7.85	—	90	8	4	★	2	★	★	★	★
VCPSRBD0800N50R30	8	3	8	50	7.85	—	90	8	4	★	2	★	★	★	★
VCPSRBD1000N30R03	10	0.3	10	30	9.7	—	100	10	4	★	2	★	★	★	★
VCPSRBD1000N30R05	10	0.5	10	30	9.7	—	100	10	4	●	2	★	★	★	★
VCPSRBD1000N30R10	10	1	10	30	9.7	—	100	10	4	●	2	★	★	★	★
VCPSRBD1000N30R20	10	2	10	30	9.7	—	100	10	4	●	2	★	★	★	★
VCPSRBD1000N30R30	10	3	10	30	9.7	—	100	10	4	●	2	★	★	★	★
VCPSRBD1000N30R40	10	4	10	30	9.7	—	100	10	4	●	2	★	★	★	★
VCPSRBD1000N50R10	10	1	10	50	9.7	—	100	10	4	★	2	★	★	★	★
VCPSRBD1000N50R30	10	3	10	50	9.7	—	100	10	4	★	2	★	★	★	★
VCPSRBD1200N36R03	12	0.3	12	36	11.7	—	110	12	4	★	2	★	★	★	★
VCPSRBD1200N36R05	12	0.5	12	36	11.7	—	110	12	4	●	2	★	★	★	★
VCPSRBD1200N36R10	12	1	12	36	11.7	—	110	12	4	●	2	★	★	★	★
VCPSRBD1200N36R20	12	2	12	36	11.7	—	110	12	4	●	2	★	★	★	★
VCPSRBD1200N36R30	12	3	12	36	11.7	—	110	12	4	●	2	★	★	★	★
VCPSRBD1200N36R40	12	4	12	36	11.7	—	110	12	4	●	2	★	★	★	★
VCPSRBD1200N36R50	12	5	12	36	11.7	—	110	12	4	●	2	★	★	★	★

★ No interference

RECOMMENDED CUTTING CONDITIONS

Work Material		Alloy steel, Tool steel, Pre-hardened steel			Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
		AISI H13, AISI W1-10, AISI P21 etc.			AISI H13 etc.			AISI D2 etc.		
DC (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
			(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
0.6	2	48000	200—600	7.9— 23.6	40000	160—500	6.3— 19.7	22000	80—250	3.1— 9.8
	4	48000	160—500	6.3— 19.7	40000	100—300	3.9— 11.8	22000	50—150	2.0— 5.9
0.8	4	48000	240—750	9.4— 29.5	32000	160—500	6.3— 19.7	19000	80—250	3.1— 9.8
	6	38000	190—600	7.5— 23.6	26000	130—400	5.1— 15.7	16000	70—200	2.8— 7.9
	8	29000	150—450	5.9— 17.7	19000	100—300	3.9— 11.8	12000	50—150	2.0— 5.9
1	4	48000	270—900	10.6— 35.4	32000	180—600	7.1— 23.6	19000	90—300	3.5—11.8
	6	38000	220—720	8.7— 28.3	26000	150—480	5.9— 18.9	16000	70—240	2.8— 9.4
	10	29000	160—540	6.3— 21.3	19000	110—360	4.3— 14.2	12000	60—180	2.4— 7.1
1.2	6	48000	300—900	11.8— 35.4	32000	200—600	7.9— 23.6	19000	100—300	3.9—11.8
	10	38000	240—720	9.4— 28.3	26000	160—480	6.3— 18.9	15000	80—240	3.1— 9.4
	15	29000	180—540	7.1— 21.3	19000	120—360	4.7— 14.2	12000	60—180	2.4— 7.1
1.5	4	41000	300—900	11.8— 35.4	27000	200—600	7.9— 23.6	16000	100—300	3.9—11.8
	6	32000	240—720	9.4— 28.3	22000	160—480	6.3— 18.9	13000	80—240	3.1— 9.4
	10	24000	180—540	7.1— 21.3	16000	120—360	4.7— 14.2	10000	60—180	2.4— 7.1
2	6	36000	600—2000	23.6— 78.7	24000	400—1300	15.7— 51.2	14000	200—650	7.9—25.6
	10	29000	480—1600	18.9— 63.0	19000	320—1000	12.6— 39.4	12000	160—520	6.3—20.5
	15	22000	360—1200	14.2— 47.2	14000	240—780	9.4— 30.7	9000	120—390	4.7—15.4
2.5	8	33000	750—2400	29.5— 94.5	22000	500—1600	19.7— 63.0	13000	250—800	9.8—31.5
	15	20000	450—1400	17.7— 55.1	13000	300—960	11.8— 37.8	8000	150—480	5.9—18.9
3	10	30000	900—3000	35.4—118.1	20000	600—2000	23.6— 78.7	12000	300—1000	11.8—39.4
	15	24000	720—2400	28.3— 94.5	16000	480—1600	18.9— 63.0	10000	240—800	9.4—31.5
	20	18000	540—1800	21.3— 70.9	12000	360—1200	14.2— 47.2	7000	180—600	7.1—23.6
4	12	26000	1200—4500	47.2—177.2	17000	800—3000	31.5—118.1	10000	400—1500	15.7—59.1
	20	20000	960—2000	37.8— 78.7	14000	640—2000	25.2— 78.7	8000	320—2000	12.6—78.7
	30	15000	720—1000	28.3— 39.4	10000	480—1000	18.9— 39.4	6000	240—1000	9.4—39.4
5	15	20000	1200—4800	47.2—189.0	13000	780—3120	30.7—122.8	10000	520—2000	20.5—78.7
	30	12000	720—1900	28.3— 74.8	8000	480—1600	18.9— 63.0	7000	360—1120	14.2—44.1
6	18	20000	1600—7500	63.0—295.3	13000	1100—5000	43.3—196.9	8000	550—2500	21.7—98.4
	41	15000	900—2400	35.4— 94.5	12000	720—1600	28.3— 63.0	10000	600—1200	23.6—47.2
	50	10000	600—1200	23.6— 47.2	8000	480—800	18.9— 31.5	6000	360—530	14.2—20.9
8	24	15000	1900—7500	74.8—295.3	10000	1300—5000	51.2—196.9	6000	650—2500	25.6—98.4
	50	10000	1300—2400	51.2— 94.5	8000	1000—2200	39.4— 86.6	3000	320—600	12.6—23.6
10	30	12000	1600—7500	63.0—295.3	8000	1100—5000	43.3—196.9	5000	550—2500	21.7—98.4
	50	10000	1300—3200	51.2—126.0	7000	950—2200	37.4— 86.6	2500	280—600	11.0—23.6
12	36	10000	1500—7500	59.1—295.3	7000	1000—5000	39.4—196.9	4000	500—2500	19.7—98.4

Depth of cut	$\leq 0.2RE$ ($DC \leq \phi 2$) $\leq 0.4RE$ ($DC > \phi 2$)		$\leq 0.1mm$ ($DC \leq \phi 1.5$) $\leq 0.2mm$ ($DC = \phi 2$ to $\phi 5$) $\leq 0.5mm$ ($DC \geq \phi 6$)	$\leq 0.1RE$ ($DC \leq \phi 2$) $\leq 0.2RE$ ($DC > \phi 2$)		$\leq 0.05mm$ ($DC \leq \phi 1.5$) $\leq 0.1mm$ ($DC = \phi 2$ to $\phi 5$) $\leq 0.3mm$ ($DC \geq \phi 6$)

DC : Dia., RE : Radius

Note 1) The cutting conditions above are a guide only to machining with cutting edges with a corner radius. When machining with peripheral cutting edges, use the minimum feed rate as a guide.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the work material and depth of cut.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

MIRACLE END MILLS

VCPSRB MIRACLE ORBIT

Corner radius, Short cut length, 2–4 flute, High precision



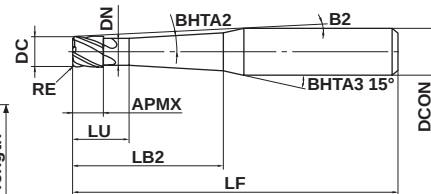
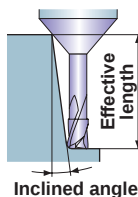
CARBIDE

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

Taper neck type



Effective length
for inclined angle



Type 1



0.5 ≤ RE ≤ 3

±0.01



1.5 ≤ DC ≤ 12

0
- 0.01



DCON=6 8 ≤ DCON ≤ 10 12 ≤ DCON ≤ 16

0
- 0.005

0
- 0.006

0
- 0.008

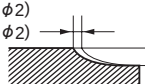
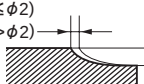
- ±0.01mm corner radius tolerance, 0—0.01mm outer diameter tolerance.
- End mill with corner radius for precise and efficient machining.

(mm)

Order Number	DC	RE	BHTA2	APMX	LB2	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle		
														1°	2°	3°
VCPSRBD0150N03L06R05	1.5	0.5	1.5°	1.5	6	3	1.44	9°	50	6	2	●	1	—	7.1	7.7
VCPSRBD0150N03L10R05	1.5	0.5	1.5°	1.5	10	3	1.44	7.2°	50	6	2	●	1	—	11.3	12.2
VCPSRBD0200N04L10R05	2	0.5	1.5°	2	10	4	1.9	6.7°	60	6	4	●	1	—	11.5	12.4
VCPSRBD0200N04L15R05	2	0.5	1.5°	2	15	4	1.9	5.3°	60	6	4	●	1	—	16.7	18
VCPSRBD0250N05L12R10	2.5	1	1.5°	2.5	12	5	2.4	5.6°	60	6	4	●	1	—	14.2	15.3
VCPSRBD0250N05L20R10	2.5	1	1.5°	2.5	20	5	2.4	4°	60	6	4	●	1	—	22.5	24.2
VCPSRBD0300N06L15R05	3	0.5	1.5°	3	15	6	2.9	4.4°	60	6	4	●	1	—	16.9	18.2
VCPSRBD0300N06L20R05	3	0.5	1.5°	3	20	6	2.9	3.6°	60	6	4	●	1	—	22.1	23.8
VCPSRBD0300N06L15R10	3	1	1.5°	3	15	6	2.9	4.4°	60	6	4	●	1	—	17.4	18.7
VCPSRBD0300N06L20R10	3	1	1.5°	3	20	6	2.9	3.6°	60	6	4	●	1	—	22.6	24.4
VCPSRBD0400N08L20R10	4	1	1.5°	4	20	8	3.9	2.6°	60	6	4	●	1	—	22.8	*
VCPSRBD0400N08L30R10	4	1	1.5°	4	30	8	3.9	1.9°	70	6	4	●	1	—	*	*
VCPSRBD0500N08L40R05	5	0.5	1°	5	40	8	4.9	2°	90	8	4	★	1	41.2	*	*
VCPSRBD0500N08L60R05	5	0.5	1°	5	60	8	4.9	1.4°	110	8	4	★	1	61.2	*	*
VCPSRBD0500N08L40R10	5	1	1°	5	40	8	4.9	2°	90	8	4	★	1	41.7	*	*
VCPSRBD0500N08L60R10	5	1	1°	5	60	8	4.9	1.4°	110	8	4	★	1	61.7	*	*
VCPSRBD0600N08L40R20	6	2	1°	6	40	8	5.85	1.4°	70	8	4	●	1	42.8	*	*
VCPSRBD0600N08L60R20	6	2	1°	6	60	8	5.85	1°	100	8	4	★	1	*	*	*
VCPSRBD0800N10L53R20	8	2	1°	8	53	10	7.85	1.1°	90	10	4	●	1	55.9	*	*
VCPSRBD0800N10L70R20	8	2	1°	8	70	10	7.85	1.6°	130	12	4	★	1	72.9	*	*
VCPSRBD1000N12L55R30	10	3	1°	10	55	12	9.7	1.1°	100	12	4	●	1	59.4	*	*
VCPSRBD1000N12L70R30	10	3	1°	10	70	12	9.7	0.9°	130	12	4	★	1	*	*	*
VCPSRBD1200N24L70R30	12	3	1°	12	70	24	11.7	1.6°	130	16	4	★	1	75.2	*	*

* No interference

RECOMMENDED CUTTING CONDITIONS

Work Material			Alloy steel, Tool steel, Pre-hardened steel			Hardened steel (45—55HRC)			Hardened steel (55—62HRC)			
			AISI H13, AISI W1 -10, AISI P21 etc.			AISI H13 etc.			AISI D2 etc.			
DC (mm)	BHTA	LB2 (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		
				(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)	
1.5	1.5°	6	36000	270—810	10.6— 31.9	24000	180—540	7.1— 21.3	15000	90—270	3.5— 10.6	
	1.5°	10	28000	210—630	8.3— 24.8	19000	140—420	5.5— 16.5	11000	70—210	2.8— 8.3	
2	1.5°	10	32000	540—1800	21.3— 70.9	22000	360—1200	14.2— 47.2	13000	180—590	7.1— 23.2	
	1.5°	15	25000	420—1400	16.5— 55.1	17000	280—910	11.0— 35.8	10000	140—460	5.5— 18.1	
2.5	1.5°	12	26000	600—1900	23.6— 74.8	18000	400—1300	15.7— 51.2	11000	200—640	7.9— 25.2	
	1.5°	20	20000	450—140	17.7— 5.5	13000	300—960	11.8— 37.8	8000	150—480	5.9— 18.9	
3	1.5°	15	27000	810—2700	31.9—106.3	18000	540—1800	21.3— 70.9	11000	270—900	10.6— 35.4	
	1.5°	20	21000	630—2100	24.8— 82.7	14000	420—1400	16.5— 55.1	8000	210—700	8.3— 27.6	
4	1.5°	20	23000	1080—3000	42.5—118.1	15000	720—3000	28.3—118.1	9000	360—3000	14.2—118.1	
	1.5°	30	18000	840—1500	33.1— 59.1	12000	560—1500	22.0— 59.1	7000	280—1500	11.0— 59.1	
5	1°	40	10000	520—1400	20.5— 55.1	7000	420—840	16.5— 33.1	5000	260—600	10.2— 23.6	
	1°	60	7000	360—840	14.2— 33.1	5000	300—500	11.8— 19.7	4000	210—400	8.3— 15.7	
6	1°	40	20000	1650—4500	65.0—177.2	13000	1100—3000	43.3—118.1	8000	550—1500	21.7— 59.1	
8	1°	53	15000	1950—4500	76.8—177.2	10000	1300—3000	51.2—118.1	6000	650—1500	25.6— 59.1	
10	1°	55	12000	1650—4500	65.0—177.2	8000	1100—3000	43.3—118.1	5000	550—1500	21.7— 59.1	
Depth of cut			≤0.2RE (DC≤φ2) ≤0.4RE (DC>φ2)  ≤0.1mm (DC≤φ1.5) ≤0.2mm (DC=φ2 to φ5) ≤0.5mm (DC≥φ6)					≤0.1RE (DC≤φ2) ≤0.2RE (DC>φ2)  ≤0.05mm (DC≤φ1.5) ≤0.1mm (DC=φ2 to φ5) ≤0.3mm (DC≥φ6)				

DC : Dia., RE : Radius

Note 1) The cutting conditions above are a guide only to machining with cutting edges with a corner radius. When machining with peripheral cutting edges, use the minimum feed rate as a guide.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the work material and depth of cut.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MIRACLE END MILLS

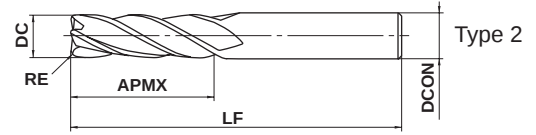
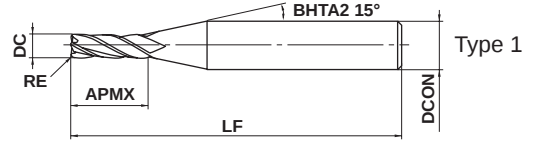
VC4JRB

Corner radius, Semi long cut length, 4 flute



CARBIDE

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



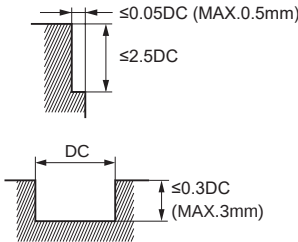
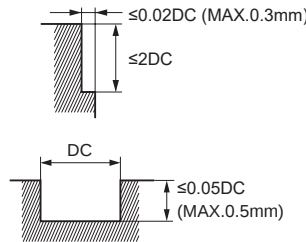
DC≤12	DC>12			
0 - 0.020	0 - 0.030			
DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

- 4 flute corner radius end mill for general use.
- 4 flute corner radius end mill for longer reach applications.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VC4JRBD0300R0030	3	0.3	12	50	6	4	★	1
VC4JRBD0400R0030	4	0.3	15	50	6	4	★	1
VC4JRBD0400R0050	4	0.5	15	50	6	4	★	1
VC4JRBD0500R0030	5	0.3	20	60	6	4	★	1
VC4JRBD0500R0050	5	0.5	20	60	6	4	★	1
VC4JRBD0600R0030	6	0.3	20	60	6	4	★	2
VC4JRBD0600R0050	6	0.5	20	60	6	4	★	2
VC4JRBD0600R0100	6	1	20	60	6	4	★	2
VC4JRBD0800R0030	8	0.3	25	70	8	4	★	2
VC4JRBD0800R0050	8	0.5	25	70	8	4	★	2
VC4JRBD0800R0100	8	1	25	70	8	4	★	2
VC4JRBD0800R0150	8	1.5	25	70	8	4	★	2
VC4JRBD0800R0200	8	2	25	70	8	4	★	2
VC4JRBD1000R0030	10	0.3	30	90	10	4	★	2
VC4JRBD1000R0050	10	0.5	30	90	10	4	★	2
VC4JRBD1000R0100	10	1	30	90	10	4	★	2
VC4JRBD1000R0150	10	1.5	30	90	10	4	★	2
VC4JRBD1000R0200	10	2	30	90	10	4	★	2
VC4JRBD1200R0050	12	0.5	30	90	12	4	★	2
VC4JRBD1200R0100	12	1	30	90	12	4	★	2
VC4JRBD1200R0150	12	1.5	30	90	12	4	★	2
VC4JRBD1200R0200	12	2	30	90	12	4	★	2
VC4JRBD1600R0050	16	0.5	50	110	16	4	★	2
VC4JRBD1600R0100	16	1	50	110	16	4	★	2
VC4JRBD1600R0150	16	1.5	50	110	16	4	★	2
VC4JRBD1600R0200	16	2	50	110	16	4	★	2
VC4JRBD2000R0050	20	0.5	55	110	20	4	★	2
VC4JRBD2000R0100	20	1	55	110	20	4	★	2
VC4JRBD2000R0150	20	1.5	55	110	20	4	★	2
VC4JRBD2000R0200	20	2	55	110	20	4	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
3	4200	110	4.3	3400	95	3.7	2600	70	2.8	2100	50	2.0
4	3400	140	5.5	2700	110	4.3	2100	85	3.3	1700	60	2.4
5	2900	170	6.7	2300	140	5.5	1800	100	3.9	1500	70	2.8
6	2500	200	7.9	2000	170	6.7	1500	130	5.1	1300	85	3.3
8	1900	220	8.7	1500	170	6.7	1200	150	5.9	1000	85	3.3
10	1600	220	8.7	1300	170	6.7	950	130	5.1	800	85	3.3
12	1300	170	6.7	1100	150	5.9	800	100	3.9	670	70	2.8
16	1000	140	5.5	820	110	4.3	600	80	3.1	500	50	2.0
20	800	110	4.3	650	85	3.3	480	70	2.8	400	40	1.6
Depth of cut												

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) The above table shows cutting conditions for shoulder milling. For slotting, please reduce the feed rate only to 50% of the table figure. Please set the revolution rate at 60% and the feed rate at 40% when slotting austenitic stainless steel.

Note 4) When drilling, please set the feed rate at 1/3 or below of the above value.

Note 5) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MIRACLE END MILLS

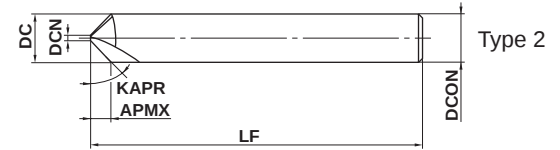
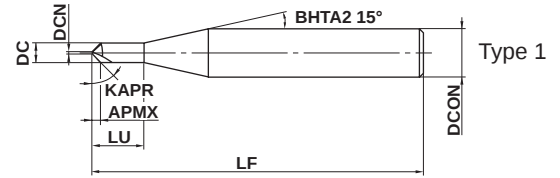
VC2C

Chamfer cutter, 2 flute



CARBIDE

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



DCN				
±0.02				
DCON=6	8≤DCON≤10	DCON=12		
$\begin{smallmatrix} 0 \\ -0.008 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.009 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.011 \end{smallmatrix}$		

● Chamfering cutters for machining of hardened steel and difficult-to-cut materials.

(mm)

Order Number	DC	DCN	APMX	KAPR	LU	LF	DCON	No. of Flutes	Stock	Type
VC2CD0200	2	0.3	0.85	45°	6	50	6	2	★	1
VC2CD0400	4	0.3	1.85	45°	12	50	6	2	★	1
VC2CD0600	6	0.3	2.85	45°	—	50	6	2	★	2
VC2CD0800	8	0.4	3.8	45°	—	60	8	2	★	2
VC2CD1000	10	0.5	4.75	45°	—	70	10	2	★	2
VC2CD1200	12	0.5	5.75	45°	—	75	12	2	★	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			AISI H13 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
2	16000	960	37.8	11000	590	23.2	9500	460	18.1	8000	320	12.6
4	8000	480	18.9	5600	300	11.8	4800	230	9.1	4000	160	6.3
6	5300	320	12.6	3700	200	7.9	3200	150	5.9	2700	110	4.3
8	4000	240	9.4	2800	150	5.9	2400	120	4.7	2000	80	3.1
10	3200	190	7.5	2200	120	4.7	1900	90	3.5	1600	60	2.4
12	2700	160	6.3	1900	100	3.9	1600	80	3.1	1300	50	2.0
Depth of cut	Chamfering $\leq 0.3DC$ (MAX. 2.5mm) Chamfering of hole $\leq 0.2DC$											
	DC : Dia.											

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SMART MIRACLE END MILLS

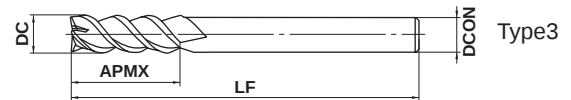
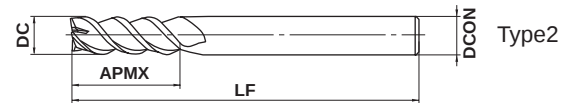
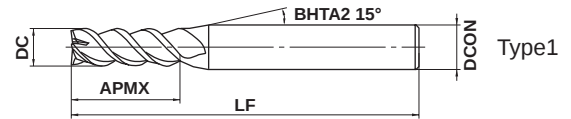
VQMHZV

End mill, Medium cutting length, 3 flute for drilling and slotting



CARBIDE

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



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

- A single end mill for both plunging and slotting.
- Irregular helical geometry controls the vibration.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHZVD0100	1	2	45	4	3	●	1
VQMHZVD0110	1.1	2.2	45	4	3	●	1
VQMHZVD0120	1.2	2.4	45	4	3	●	1
VQMHZVD0130	1.3	2.6	45	4	3	●	1
VQMHZVD0140	1.4	2.8	45	4	3	●	1
VQMHZVD0150	1.5	3	45	4	3	●	1
VQMHZVD0160	1.6	3.2	45	4	3	●	1
VQMHZVD0170	1.7	3.4	45	4	3	●	1
VQMHZVD0180	1.8	3.6	45	4	3	●	1
VQMHZVD0190	1.9	3.8	45	4	3	●	1
VQMHZVD0200	2	4	50	6	3	●	1
VQMHZVD0210	2.1	4.2	50	6	3	●	1
VQMHZVD0220	2.2	4.4	50	6	3	●	1
VQMHZVD0230	2.3	4.6	50	6	3	●	1
VQMHZVD0240	2.4	4.8	50	6	3	●	1
VQMHZVD0250	2.5	5	50	6	3	●	1
VQMHZVD0260	2.6	5.2	50	6	3	●	1
VQMHZVD0270	2.7	5.4	50	6	3	●	1
VQMHZVD0280	2.8	5.6	50	6	3	●	1
VQMHZVD0290	2.9	5.8	50	6	3	●	1
VQMHZVD0300	3	6	50	6	3	●	1
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

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

							(mm)
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
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

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHZV

End mill, Medium cutting length, 3 flute for drilling and slotting

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

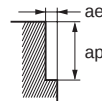
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	100	32000	720	1.5	0.2	80	25000	530	1.5	0.2	60	19000	430	1.5	0.2	50	16000	340	1.5	0.1
1.5	130	28000	1300	2.25	0.3	100	21000	630	2.25	0.3	85	18000	540	2.25	0.3	65	14000	420	2.25	0.15
2	150	24000	1800	3	0.6	120	19000	860	3	0.6	100	16000	620	3	0.6	75	12000	540	3	0.4
3	150	16000	1900	4.5	0.9	120	13000	940	4.5	0.9	100	11000	660	4.5	0.9	75	8000	580	4.5	0.6
4	150	12000	2000	6	1.2	120	9500	940	6	1.2	100	8000	670	6	1.2	75	6000	590	6	0.8
5	150	9500	1900	7.5	1.5	120	7600	960	7.5	1.5	100	6400	670	7.5	1.5	75	4800	600	7.5	1
6	150	8000	1900	9	1.8	120	6400	960	9	1.8	100	5300	830	9	1.8	75	4000	600	9	1.2
8	150	6000	1900	12	2.4	120	4800	1000	12	2.4	100	4000	900	12	2.4	75	3000	630	12	1.6
10	150	4800	1700	15	3	120	3800	910	15	3	100	3200	960	15	3	75	2400	580	15	2
12	150	4000	1400	18	3.6	120	3200	860	18	3.6	100	2700	890	18	3.6	75	2000	540	18	2.4
16	150	3000	1200	24	4.8	120	2400	720	24	4.8	100	2000	720	24	4.8	75	1500	450	24	3.2
20	150	2400	970	30	6	120	1900	570	30	6	100	1600	580	30	6	75	1200	360	30	4

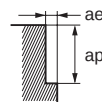
Depth of cut



General purpose cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	100	32000	480	1.5	0.2	80	25000	350	1.5	0.2	60	19000	280	1.5	0.2	50	16000	220	1.5	0.1
1.5	120	25000	740	2.25	0.3	100	21000	420	2.25	0.3	80	17000	340	2.25	0.3	65	14000	280	2.25	0.15
2	120	19000	940	3	0.6	100	16000	480	3	0.6	80	13000	340	3	0.6	70	11000	330	3	0.4
3	120	13000	1000	4.5	0.9	100	11000	520	4.5	0.9	80	8500	340	4.5	0.9	70	7400	350	4.5	0.6
4	120	9500	1000	6	1.2	100	8000	520	6	1.2	80	6400	350	6	1.2	70	5600	370	6	0.8
5	120	7600	980	7.5	1.5	100	6400	530	7.5	1.5	80	5100	350	7.5	1.5	70	4500	370	7.5	1
6	120	6400	1000	9	1.8	100	5300	540	9	1.8	80	4200	400	9	1.8	70	3700	370	9	1.2
8	120	4800	1000	12	2.4	100	4000	550	12	2.4	80	3200	430	12	2.4	70	2800	390	12	1.6
10	120	3800	900	15	3	100	3200	510	15	3	80	2500	450	15	3	70	2200	350	15	2
12	120	3200	760	18	3.6	100	2700	480	18	3.6	80	2100	420	18	3.6	70	1900	340	18	2.4
16	120	2400	640	24	4.8	100	2000	400	24	4.8	80	1600	340	24	4.8	70	1400	280	24	3.2
20	120	1900	510	30	6	100	1600	320	30	6	80	1300	270	30	6	70	1100	220	30	4

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

Shoulder milling

When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.
When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency cutting conditions

Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	120	38000	860	1.5	0.2	40	13000	160	1.5	0.05
1.5	150	32000	1400	2.25	0.3	40	8500	170	2.25	0.08
2	180	29000	2200	3	0.6	40	6400	170	3	0.2
3	180	19000	2300	4.5	0.9	40	4200	180	4.5	0.3
4	180	14000	2300	6	1.2	40	3200	180	6	0.4
5	180	11000	2300	7.5	1.5	40	2500	180	7.5	0.5
6	180	9500	2300	9	1.8	40	2100	190	9	0.6
8	180	7200	2300	12	2.4	40	1600	190	12	0.8
10	180	5700	2100	15	3	40	1300	220	15	1
12	180	4800	1700	18	3.6	40	1100	210	18	1.2
16	180	3600	1500	24	4.8	40	800	150	24	1.6
20	180	2900	1200	30	6	40	640	120	30	2

Depth of cut

General purpose cutting conditions

Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	120	38000	560	1.5	0.2	30	9500	75	1.5	0.05
1.5	140	30000	890	2.25	0.3	30	6400	82	2.25	0.07
2	140	22000	1100	3	0.6	30	4800	86	3	0.2
3	140	15000	1200	4.5	0.9	30	3200	89	4.5	0.3
4	140	11000	1200	6	1.2	30	2400	90	6	0.4
5	140	8900	1200	7.5	1.5	30	1900	90	7.5	0.5
6	140	7400	1200	9	1.8	30	1600	95	9	0.6
8	140	5600	1200	12	2.4	30	1200	95	12	0.8
10	140	4500	1100	15	3	30	950	110	15	1
12	140	3700	880	18	3.6	30	800	100	18	1.2
16	140	2800	750	24	4.8	30	600	76	24	1.6
20	140	2200	590	30	6	30	480	61	30	2

Depth of cut

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SMART MIRACLE END MILLS

VQMHZV

End mill, Medium cutting length, 3 flute for drilling and slotting

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■ Slotting

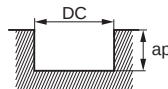
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
1	100	32000	380	0.5	80	25000	150	0.5	60	19000	100	0.5	45	14000	80	0.3	120	38000	460	0.5	30	9500	60	0.2
1.5	130	28000	590	0.75	100	21000	250	0.75	85	18000	220	0.75	60	12000	140	0.4	150	32000	670	0.75	30	6400	80	0.3
2	150	24000	940	2	120	19000	460	2	100	16000	480	2	60	9500	230	1	180	29000	1100	2	30	4800	100	0.6
3	150	16000	1100	3	120	13000	550	3	100	11000	500	3	60	6400	270	1.5	180	19000	1300	3	30	3200	120	0.9
4	150	12000	1400	4	120	9500	680	4	100	8000	530	4	60	4800	350	2	180	14000	1700	4	30	2400	130	1.2
5	150	9500	1400	5	120	7600	680	5	100	6400	540	5	60	3800	350	2.5	180	11000	1700	5	30	1900	130	1.5
6	150	8000	1400	6	120	6400	770	6	100	5300	560	6	60	3200	380	3	180	9500	1700	6	30	1600	130	1.8
8	150	6000	1300	8	120	4800	720	8	100	4000	600	8	60	2400	360	4	180	7200	1500	8	30	1200	140	2.4
10	150	4800	1200	10	120	3800	630	10	100	3200	670	10	60	1900	310	5	180	5700	1400	10	30	950	160	3
12	150	4000	960	12	120	3200	580	12	100	2700	650	12	60	1600	290	6	180	4800	1200	12	30	800	150	3.6
16	150	3000	810	12	120	2400	500	12	100	2000	480	12	60	1200	250	8	180	3600	970	12	30	600	120	4.8
20	150	2400	650	12	120	1900	400	12	100	1600	380	12	60	950	200	10	180	2900	780	12	30	480	90	6

Depth of cut

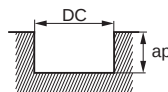


DC: Dia.

General purpose cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
1	100	32000	250	0.5	80	25000	99	0.5	60	19000	80	0.5	45	14000	60	0.3	120	38000	300	0.5	25	8000	30	0.2
1.5	100	21000	290	0.75	80	17000	130	0.75	60	13000	100	0.75	50	11000	87	0.4	120	25000	350	0.75	25	5300	40	0.3
2	100	16000	410	2	80	13000	210	2	60	9500	190	2	50	8000	130	1	120	19000	490	2	25	4000	55	0.6
3	100	11000	500	3	80	8500	240	3	60	6400	190	3	50	5300	150	1.5	120	13000	590	3	25	2700	64	0.9
4	100	8000	630	4	80	6400	300	4	60	4800	210	4	50	4000	190	2	120	9500	750	4	25	2000	70	1.2
5	100	6400	630	5	80	5100	300	5	60	3800	210	5	50	3200	190	2.5	120	7600	750	5	25	1600	71	1.5
6	100	5300	630	6	80	4200	330	6	60	3200	220	6	50	2700	210	3	120	6400	760	6	25	1300	72	1.8
8	100	4000	550	8	80	3200	320	8	60	2400	240	8	50	2000	200	4	120	4800	670	8	25	990	78	2.4
10	100	3200	510	10	80	2500	270	10	60	1900	260	10	50	1600	170	5	120	3800	600	10	25	800	89	3
12	100	2700	430	12	80	2100	250	12	60	1600	250	12	50	1300	150	6	120	3200	510	12	25	660	84	3.6
16	100	2000	360	12	80	1600	220	12	60	1200	190	12	50	990	140	8	120	2400	430	12	25	500	63	4.8
20	100	1600	290	12	80	1300	180	12	60	950	150	12	50	800	110	10	120	1900	340	12	25	400	50	6

Depth of cut



DC: Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

Plunging

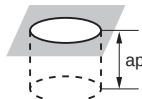
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy					Copper, Copper alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH									
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)
1	65	20000	160	0.5	0.1	50	16000	100	0.5	0.1	50	16000	50	0.5	0.05	30	9500	30	0.5	0.05	75	24000	190	0.5	0.1
1.5	85	18000	270	0.75	0.3	60	13000	120	0.75	0.3	60	13000	80	0.75	0.1	35	7400	40	0.75	0.1	100	21000	320	0.75	0.3
2	100	16000	480	2	0.5	70	11000	200	2	0.4	60	9500	90	1	0.15	40	6400	60	1	0.1	120	19000	570	2	0.5
3	100	11000	660	3	1	70	7400	270	3	0.6	60	6400	100	1.5	0.2	40	4200	60	1.5	0.2	120	13000	780	3	1.0
4	100	8000	800	4	2	70	5600	340	4	0.8	60	4800	100	2	0.4	40	3200	60	2	0.4	120	9500	950	4	2
5	100	6400	960	5	2.5	70	4500	410	5	1	60	3800	100	2.5	0.5	40	2500	60	2.5	0.5	120	7600	1100	5	2.5
6	100	5300	950	6	3	70	3700	440	6	1.2	60	3200	100	3	0.6	40	2100	60	3	0.6	120	6400	1200	6	3
8	100	4000	720	8	4	70	2800	340	8	1.6	60	2400	70	4	0.6	40	1600	50	4	0.6	120	4800	860	8	4
10	100	3200	580	10	5	70	2200	260	10	2.5	60	1900	60	5	0.6	40	1300	40	5	0.6	120	3800	680	10	5
12	100	2700	490	12	5	70	1900	230	12	3	60	1600	50	6	0.6	40	1100	30	6	0.6	120	3200	580	12	5
16	100	2000	360	16	5	70	1400	170	16	4	60	1200	40	8	0.6	40	800	20	8	0.6	120	2400	430	16	5
20	100	1600	290	20	5	70	1100	130	20	5	60	950	30	10	0.6	40	640	20	10	0.6	120	1900	340	20	5

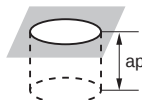
Depth of cut



General purpose cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy					Copper, Copper alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH									
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Step (mm)
1	65	20000	160	0.5	0.05	50	16000	100	0.5	0.05	50	16000	50	0.5	0.05	30	9500	30	0.5	0.05	75	24000	190	0.5	0.05
1.5	85	18000	270	0.75	0.15	60	13000	120	0.75	0.1	60	13000	80	0.75	0.05	35	7400	40	0.75	0.05	100	21000	320	0.75	0.15
2	100	16000	480	2	0.25	70	11000	200	2	0.2	60	9500	90	1	0.05	40	6400	60	1	0.05	120	19000	570	2	0.25
3	100	11000	660	3	0.3	70	7400	270	3	0.3	60	6400	100	1.5	0.1	40	4200	60	1.5	0.1	120	13000	780	3	0.3
4	100	8000	800	4	0.4	70	5600	340	4	0.4	60	4800	100	2	0.2	40	3200	60	2	0.2	120	9500	950	4	0.4
5	100	6400	960	5	0.5	70	4500	410	5	0.5	60	3800	100	2.5	0.25	40	2500	60	2.5	0.25	120	7600	1100	5	0.5
6	100	5300	950	6	0.6	70	3700	440	6	0.6	60	3200	100	3	0.3	40	2100	60	3	0.3	120	6400	1200	6	0.6
8	100	4000	720	8	0.7	70	2800	340	8	0.7	60	2400	70	4	0.3	40	1600	50	4	0.3	120	4800	860	8	0.7
10	100	3200	580	10	0.75	70	2200	260	10	0.75	60	1900	60	5	0.3	40	1300	40	5	0.3	120	3800	680	10	0.75
12	100	2700	490	12	0.75	70	1900	230	12	0.75	60	1600	50	6	0.3	40	1100	30	6	0.3	120	3200	580	12	0.75
16	100	2000	360	16	0.75	70	1400	170	16	0.75	60	1200	40	8	0.3	40	800	20	8	0.3	120	2400	430	16	0.75
20	100	1600	290	20	0.75	70	1100	130	20	0.75	60	950	30	10	0.3	40	640	20	10	0.3	120	1900	340	20	0.75

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

SMART MIRACLE END MILLS

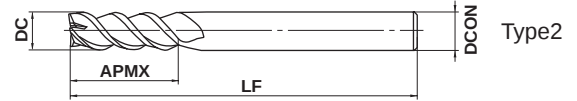
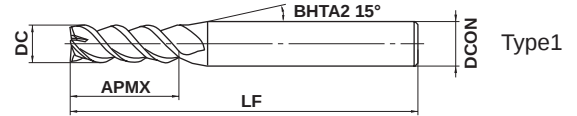
VQMHZV – Inch sizes

End mill, Medium cutting length, 3 flute for drilling and slotting



CARBIDE

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



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

DC < .5000"	DC = .5000"			
0 - .0008"	0 - .0012"			
.2500" ≤ DCON ≤ .3750"	DCON = .5000"			
0 - .00035"	0 - .00043"			

- A single end mill for both plunging and slotting.
- Irregular helical geometry controls the vibration.

(inch)							
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHZVD1/16	.0625	.1250	2.0	.2500	3	●	1
VQMHZVD5/64	.0781	.1560	2.0	.2500	3	●	1
VQMHZVD3/32	.0938	.1880	2.0	.2500	3	●	1
VQMHZVD7/64	.1094	.2500	2.0	.2500	3	●	1
VQMHZVD1/8	.1250	.3130	2.0	.2500	3	●	1
VQMHZVD5/32	.1563	.3750	2.0	.2500	3	●	1
VQMHZVD3/16	.1875	.4375	2.0	.2500	3	●	1
VQMHZVD1/4	.2500	.6250	2.5	.2500	3	●	2
VQMHZVD5/16	.3125	.7500	2.75	.3125	3	●	2
VQMHZVD11/32	.3438	.7500	3.0	.3750	3	●	1
VQMHZVD3/8	.3750	.8750	3.0	.3750	3	●	2
VQMHZVD1/2	.5000	1.1250	3.5	.5000	3	●	2

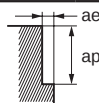
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

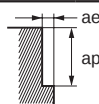
Work Material	Carbon steel (—30HRC)						Alloy steel, Pre-hardened steel						Austenitic stainless steel, Titanium alloy					
	AISI 1035, AISI 1050, ASTM 283						AISI H13, AISI 4140, AISI P21						AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.					
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/16	26000	55.3	24000	33.9	.094	.013	20000	26.0	20000	17.3	.094	.013	18000	23.4	16000	13.8	.094	.013
5/64	24000	70.9	19000	37.0	.12	.023	19000	33.7	16000	18.9	.12	.023	16000	24.6	13000	13.0	.12	.023
3/32	20000	70.9	16000	37.4	.14	.028	16000	34.0	13000	18.1	.14	.028	13000	24.6	11000	13.8	.14	.028
7/64	17000	72.3	14000	39.4	.16	.033	14000	34.7	11000	18.1	.16	.033	11000	24.7	9200	13.8	.16	.033
1/8	15000	76.2	12000	39.4	.19	.038	12000	36.9	10000	20.1	.19	.038	10000	26.0	8000	13.8	.19	.038
5/32	12000	78.0	9600	39.4	.23	.047	9600	37.4	8000	20.5	.23	.047	8000	26.5	6400	13.8	.23	.047
3/16	10000	74.4	8000	39.4	.28	.056	8000	37.8	6700	20.9	.28	.056	6700	26.5	5300	13.8	.28	.056
1/4	7500	74.4	6000	39.4	.38	.075	6000	39.0	5000	21.3	.38	.075	5000	35.4	4000	18.9	.38	.075
5/16	6000	74.4	4800	39.4	.47	.094	4800	39.7	4000	21.7	.47	.094	4000	35.4	3200	18.9	.47	.094
11/32	5500	71.5	4400	37.8	.52	.10	4400	37.9	3600	20.5	.52	.10	3600	36.1	2900	19.3	.52	.10
3/8	5000	67.9	4000	35.8	.56	.11	4000	36.9	3300	20.1	.56	.11	3300	37.0	2700	20.1	.56	.11
1/2	3800	56.1	3000	29.1	.75	.15	3000	32.6	2500	18.1	.75	.15	2500	32.5	2000	17.3	.75	.15

Depth of cut



Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy						Copper, Copper alloy						Heat resistant alloy					
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.												Inconel718 etc.					
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/16	13000	16.9	13000	11.0	.094	.0063	30000	63.8	28000	39.4	.094	.013	8000	3.3	6000	13.8	.094	.0031
5/64	12000	21.3	11000	13.0	.12	.016	29000	85.6	22000	43.3	.12	.023	6400	3.4	4800	13.0	.12	.0078
3/32	10000	21.3	9400	13.4	.14	.019	24000	85.0	19000	43.3	.14	.028	5300	3.4	4000	13.8	.14	.0094
7/64	8600	21.3	8000	13.0	.16	.022	21000	89.3	16000	43.3	.16	.033	4600	3.5	3400	13.8	.16	.011
1/8	7500	23.0	7000	14.2	.19	.025	18000	91.4	14000	47.2	.19	.038	4000	3.5	3000	13.8	.19	.013
5/32	6000	23.4	5600	14.6	.23	.031	14000	90.9	11000	47.2	.23	.047	3200	3.5	2400	13.8	.23	.016
3/16	5000	23.6	4700	14.6	.28	.038	12000	89.3	9400	47.2	.28	.056	2700	3.6	2000	13.8	.28	.019
1/4	3800	24.7	3500	15.0	.38	.050	9000	89.3	7000	47.2	.38	.075	2000	3.7	1500	18.9	.38	.025
5/16	3000	24.8	2800	15.4	.47	.063	7200	89.3	5600	47.2	.47	.094	1600	3.7	1200	18.9	.47	.031
11/32	2700	23.3	2600	15.0	.52	.069	6600	85.7	5100	43.3	.52	.10	1500	3.9	1100	19.3	.52	.034
3/8	2500	23.0	2300	14.2	.56	.075	6000	81.5	4700	43.3	.56	.11	1300	3.9	1000	20.1	.56	.038
1/2	1900	20.6	1800	13.0	.75	.10	4500	66.4	3500	34.3	.75	.15	1000	3.7	750	17.3	.75	.050

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, and titanium alloy can be achieved with the use of water-soluble cutting fluid.

Note 3) Higher feeds and speeds can be used for smaller depth of cut.

Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHZV - Inch sizes

End mill, Medium cutting length, 3 flute for drilling and slotting

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

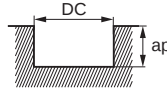
SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Slotting

Work Material	Carbon steel (—30HRC)					Alloy steel, Pre-hardened steel					Austenitic stainless steel, Titanium alloy				
	AISI 1035, AISI 1050, ASTM 283					AISI H13, AISI 4140, AISI P21					AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.				
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	
1/16	26000	27.6	20000	14.2	.031	20000	11.8	16000	6.3	.031	18000	10.6	12000	4.7	.031
5/64	24000	36.9	16000	16.1	.078	19000	18.0	13000	8.3	.078	16000	18.9	9600	7.5	.078
3/32	20000	37.8	13000	16.1	.094	16000	18.9	11000	8.7	.094	13000	19.2	8000	7.9	.094
7/64	17000	40.2	11000	17.3	.11	14000	19.8	9200	8.7	.11	11000	19.5	6900	7.9	.11
1/8	15000	44.3	10000	19.7	.13	12000	22.7	8000	9.8	.13	10000	20.1	6000	7.9	.13
5/32	12000	56.7	8000	24.8	.16	9600	26.1	6400	11.4	.16	8000	20.8	4800	8.3	.16
3/16	10000	56.7	6700	25.2	.19	8000	26.9	5300	11.8	.19	6700	21.4	4000	8.3	.19
1/4	7500	55.8	5000	24.4	.25	6000	29.8	4000	13.0	.25	5000	21.9	3000	8.7	.25
5/16	6000	49.6	4000	21.7	.31	4800	28.3	3200	12.6	.31	4000	23.6	2400	9.4	.31
11/32	5500	48.7	3600	20.9	.34	4400	27.0	2900	11.8	.34	3600	24.2	2200	9.8	.34
3/8	5000	46.1	3300	20.1	.38	4000	25.5	2700	11.4	.38	3300	25.3	2000	10.2	.38
1/2	3800	35.9	2500	15.7	.50	3000	22.3	2000	9.8	.50	2500	23.6	1500	9.4	.50

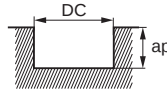
Depth of cut



DC : Dia.

Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy					Copper, Copper alloy					Heat resistant alloy				
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.										Inconel718 etc.				
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	
1/16	11000	6.5	10000	3.9	.019	30000	31.9	24000	16.9	.031	6000	3.5	5000	2.0	.013
5/64	9600	9.1	8000	5.1	.039	29000	44.5	19000	19.3	.078	4800	4.0	4000	2.2	.023
3/32	8000	9.5	6700	5.1	.047	24000	45.4	16000	20.1	.094	4000	4.3	3300	2.3	.028
7/64	6900	9.8	5700	5.5	.055	21000	49.6	14000	21.7	.11	3400	4.4	2900	2.5	.033
1/8	6000	11.3	5000	6.3	.063	18000	53.1	12000	23.2	.13	3000	4.6	2500	2.5	.038
5/32	4800	13.0	4000	7.1	.078	14000	66.1	9600	29.9	.16	2400	5.0	2000	2.8	.047
3/16	4000	13.7	3300	7.5	.094	12000	68.0	8000	29.9	.19	2000	5.1	1700	2.9	.056
1/4	3000	14.9	2500	8.3	.13	9000	67.0	6000	29.5	.25	1500	5.3	1300	3.0	.075
5/16	2400	14.2	2000	7.9	.16	7200	59.5	4800	26.4	.31	1200	5.7	1000	3.1	.094
11/32	2200	13.5	1800	7.5	.17	6600	58.5	4400	25.6	.34	1100	5.9	910	3.2	.10
3/8	2000	12.8	1700	7.1	.19	6000	55.3	4000	24.4	.38	1000	6.1	840	3.4	.11
1/2	1500	11.2	1300	6.3	.25	4500	42.5	3000	18.9	.50	750	5.7	630	3.1	.15

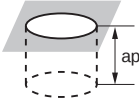
Depth of cut

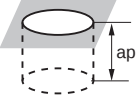


DC : Dia.

- Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
- Note 2) Effective cutting of stainless steel, titanium alloy, and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.
- Note 3) Higher feeds and speeds can be used for smaller depth of cut.
- Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

Drilling

Work Material	Carbon steel (—30HRC)							Alloy steel, Pre-hardened steel							Austenitic stainless steel, Titanium alloy						
	AISI 1035, AISI 1050, ASTM 283							AISI H13, AISI 4140, AISI P21							AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.						
DC (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)		Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)		Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	
1/16	18000	12.8	.013	18000	12.6	.006	.031	12000	5.2	.013	12000	5.2	.006	.031	12000	3.3	.004	12000	3.3	.002	.031
5/64	16000	18.9	.020	16000	18.9	.006	.078	11000	7.8	.016	11000	7.8	.006	.078	9600	3.5	.004	9600	3.5	.002	.039
3/32	13000	20.5	.023	13000	20.5	.010	.094	9400	8.8	.019	9400	8.8	.010	.094	8000	3.5	.006	8000	3.5	.002	.047
7/64	11000	21.7	.033	11000	21.7	.010	.11	8000	9.4	.022	8000	9.4	.010	.11	6900	3.5	.008	6900	3.5	.002	.055
1/8	10000	27.6	.044	10000	27.6	.012	.13	7000	11.0	.025	7000	11.0	.012	.13	6000	4.0	.008	6000	4.0	.004	.063
5/32	8000	31.5	.078	8000	31.5	.012	.16	5600	13.2	.031	5600	13.2	.012	.16	4800	3.8	.016	4800	3.8	.004	.078
3/16	6700	34.3	.094	6700	34.3	.016	.19	4700	15.0	.038	4700	15.0	.016	.19	4000	3.8	.020	4000	3.8	.008	.094
1/4	5000	35.4	.13	5000	35.4	.024	.25	3500	16.5	.050	3500	16.5	.024	.25	3000	3.5	.024	3000	3.5	.012	.13
5/16	4000	28.3	.16	4000	28.3	.028	.31	2800	13.2	.063	2800	13.2	.028	.31	2400	2.8	.024	2400	2.8	.012	.16
11/32	3600	25.5	.17	3600	25.5	.028	.34	2600	12.3	.069	2600	12.3	.028	.34	2200	2.6	.024	2200	2.6	.012	.17
3/8	3300	23.4	.19	3300	23.4	.030	.38	2300	11.0	.094	2300	11.0	.030	.38	2000	2.3	.024	2000	2.3	.012	.19
1/2	2500	17.7	.20	2500	17.7	.030	.50	1800	8.5	.13	1800	8.5	.030	.50	1500	2.0	.024	1500	2.0	.012	.25
Hole depth																					

Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy							Copper, Copper alloy						
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.													
	High speed cutting			General purpose cutting			Hole Depth ap (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)		Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	
1/16	7000	2.0	.004	7000	2.0	.002	.031	22000	15.6	.013	22000	15.6	.006	.031
5/64	6400	2.4	.004	6400	2.4	.002	.039	19000	22.4	.020	19000	22.4	.006	.039
3/32	5300	2.4	.006	5300	2.4	.002	.047	16000	25.2	.023	16000	25.2	.010	.047
7/64	4600	2.4	.008	4600	2.4	.002	.055	14000	27.6	.033	14000	27.6	.010	.055
1/8	4000	2.8	.008	4000	2.8	.004	.063	12000	33.1	.044	12000	33.1	.012	.063
5/32	3200	2.4	.016	3200	2.4	.004	.078	9600	37.8	.078	9600	37.8	.012	.078
3/16	2700	2.4	.020	2700	2.4	.008	.094	8000	39.4	.094	8000	39.4	.016	.094
1/4	2000	2.4	.024	2000	2.4	.012	.13	6000	43.3	.130	6000	43.3	.024	.13
5/16	1600	2.0	.024	1600	2.0	.012	.16	4800	33.9	.160	4800	33.9	.028	.16
11/32	1500	1.8	.024	1500	1.8	.012	.17	4400	31.1	.17	4400	31.1	.028	.17
3/8	1300	1.5	.024	1300	1.5	.012	.19	4000	28.3	.19	4000	28.3	.030	.19
1/2	1000	1.2	.024	1000	1.2	.012	.25	3000	21.3	.20	3000	21.3	.030	.25
Hole depth														

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, and titanium alloy can be achieved with the use of water-soluble cutting fluid.

Note 3) Higher feeds and speeds can be used for smaller depth of cut.

Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

SMART MIRACLE END MILLS

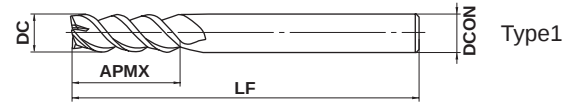
VQMHZVOH

End mill, Medium cutting length, 3 flute for drilling and slotting with thru-coolant



CARBIDE

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



Type1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS



DC≤12	DC=16			
0 - 0.02	0 - 0.03			
DCON=6	8≤DCON≤10	12≤DCON≤16		
0 - 0.008	0 - 0.009	0 - 0.011		

- A single end mill for both plunging and slotting.
- Excellent performance in slotting and pocketing with oil supply from the end cutting edge.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHZVOHD0600	6	13	60	6	3	●	1
VQMHZVOHD0800	8	19	70	8	3	●	1
VQMHZVOHD1000	10	22	80	10	3	●	1
VQMHZVOHD1200	12	26	90	12	3	●	1
VQMHZVOHD1600	16	30	110	16	3	★	1

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

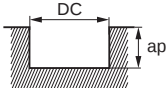
RECOMMENDED CUTTING CONDITIONS

■ Slotting

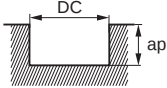
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
6	150	8000	1400	6	120	6400	770	6	100	5300	560	6	60	3200	380	3	180	9500	1700	6	30	1600	130	1.8
8	150	6000	1300	8	120	4800	720	8	100	4000	600	8	60	2400	360	4	180	7200	1500	8	30	1200	140	2.4
10	150	4800	1200	10	120	3800	630	10	100	3200	670	10	60	1900	310	5	180	5700	1400	10	30	950	160	3
12	150	4000	960	12	120	3200	580	12	100	2700	650	12	60	1600	290	6	180	4800	1200	12	30	800	150	3.6
16	150	3000	810	12	120	2400	500	12	100	2000	480	12	60	1200	250	8	180	3600	970	12	30	600	120	4.8
Depth of cut																								DC : Dia.

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
6	100	5300	630	6	80	4200	330	6	60	3200	220	6	50	2700	210	3	120	6400	760	6	25	1300	72	1.8
8	100	4000	550	8	80	3200	320	8	60	2400	240	8	50	2000	200	4	120	4800	670	8	25	990	78	2.4
10	100	3200	510	10	80	2500	270	10	60	1900	260	10	50	1600	170	5	120	3800	600	10	25	800	89	3
12	100	2700	430	12	80	2100	250	12	60	1600	250	12	50	1300	150	6	120	3200	510	12	25	660	84	3.6
16	100	2000	360	12	80	1600	220	12	60	1200	190	12	50	990	140	8	120	2400	430	12	25	500	63	4.8
Depth of cut																								DC : Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SMART MIRACLE END MILLS

VQMHZVOH

End mill, Medium cutting length, 3 flute for drilling and slotting with thru-coolant

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

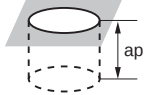
■ Plunging

The rigidity of the machine or work material and chip discharge are sufficient at high efficiency conditions.

The rigidity of the machine or work material or chip discharge is insufficient at general-purpose conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	100	5300	950	9	3	70	3700	440	9	1.2	60	3200	100	6	0.6	40	2100	60	6	0.6
8	100	4000	720	12	4	70	2800	340	12	1.6	60	2400	70	8	0.6	40	1600	50	8	0.6
10	100	3200	580	15	5	70	2200	260	15	2.5	60	1900	60	10	0.6	40	1300	40	10	0.6
12	100	2700	490	18	5	70	1900	230	18	3	60	1600	50	12	0.6	40	1100	30	12	0.6
16	100	2000	360	24	5	70	1400	170	24	4	60	1200	40	16	0.6	40	800	20	16	0.6
Depth of cut																				

Copper, Copper alloy					
Work Material					
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	120	6400	1200	9	3
8	120	4800	860	12	4
10	120	3800	680	15	5
12	120	3200	580	18	5
16	120	2400	430	24	5
Depth of cut					

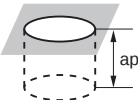
Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.

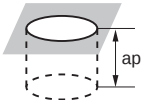
Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	100	5300	950	9	0.6	70	3700	440	9	0.6	60	3200	100	6	0.3	40	2100	60	6	0.3
8	100	4000	720	12	0.7	70	2800	340	12	0.7	60	2400	70	8	0.3	40	1600	50	8	0.3
10	100	3200	580	15	0.75	70	2200	260	15	0.75	60	1900	60	10	0.3	40	1300	40	10	0.3
12	100	2700	490	18	0.75	70	1900	230	18	0.75	60	1600	50	12	0.3	40	1100	30	12	0.3
16	100	2000	360	24	0.75	70	1400	170	24	0.75	60	1200	40	16	0.3	40	800	20	16	0.3
Depth of cut																				

Work Material					
Copper, Copper alloy					
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
6	120	6400	1200	9	0.6
8	120	4800	860	12	0.7
10	120	3800	680	15	0.75
12	120	3200	580	18	0.75
16	120	2400	430	24	0.75
Depth of cut					

Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

SMART MIRACLE END MILLS

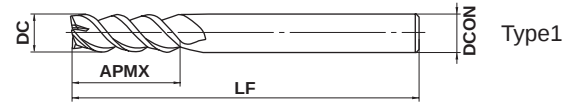
VQMHZVOH – Inch sizes

End mill, Medium cutting length, 3 flute for drilling and slotting with thru-coolant



CARBIDE

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



Type1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
.250"≤DCON≤.375"	DCON=.500"			
0 - .00035"	0 - .00043"			

- A single end mill for both plunging and slotting.
- Excellent performance in slotting and pocketing with oil supply from the end cutting edge.

(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHZVOHD1/4	.2500	.6252	2.5	.2500	3	●	1
VQMHZVOHD5/16	.3125	.7500	2.75	.3125	3	●	1
VQMHZVOHD3/8	.3750	.8752	3.0	.3750	3	●	1
VQMHZVOHD1/2	.5000	1.1252	3.5	.5000	3	●	1

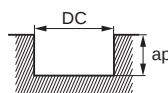
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

RECOMMENDED CUTTING CONDITIONS

Slotting

Work Material	Carbon steel (–30HRC)					Alloy steel, Pre-hardened steel					Austenitic stainless steel, Titanium alloy				
	AISI 1035, AISI 1050, ASTM 283					AISI H13, AISI 4140, AISI P21					AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.				
DC (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	
1/4	7500	55.8	5000	24.4	.25	6000	29.8	5000	16.5	.25	5000	21.9	3000	8.7	.25
5/16	6000	49.6	4000	21.7	.31	4800	28.3	4000	15.7	.31	4000	23.6	2400	9.4	.31
3/8	5000	46.1	3300	20.1	.38	4000	25.5	3300	13.8	.38	3300	25.3	2000	10.2	.38
1/2	3800	35.9	2500	15.7	.50	3000	22.3	2500	12.2	.50	2500	23.6	1500	9.4	.50

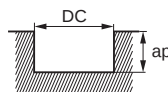
Depth of cut



DC : Dia.

Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy					Copper, Copper alloy					Heat resistant alloy				
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.										Inconel718 etc.				
DC (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	
1/4	3000	14.9	2500	8.3	.25	9000	67.0	6000	29.5	.25	1500	5.3	1300	3.0	.075
5/16	2400	14.2	2000	7.9	.31	7200	59.5	4800	26.4	.31	1200	5.7	1000	3.1	.094
3/8	2000	12.8	1700	7.1	.38	6000	55.3	4000	24.4	.38	1000	6.1	840	3.4	.11
1/2	1500	11.2	1300	6.3	.50	4500	42.5	3000	18.9	.50	750	5.7	630	3.1	.15

Depth of cut



DC : Dia.

- Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
- Note 2) Effective cutting of stainless steel, titanium alloy, and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.
- Note 3) Higher feeds and speeds can be used for smaller depth of cut.
- Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

SMART MIRACLE END MILLS

VQMHZVOH – Inch sizes

End mill, Medium cutting length, 3 flute for drilling and slotting with thru-coolant

CARBIDE

SQUARE

BALL

RADIUS

TAPER

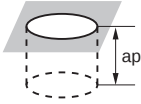
BARREL

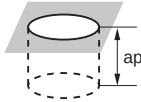
ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Plunging

Work Material	Carbon steel (–30HRC)							Alloy steel, Pre-hardened steel							Austenitic stainless steel, Titanium alloy						
	AISI 1035, AISI 1050, ASTM 283							AISI H13, AISI 4140, AISI P21							AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.						
	High speed cutting			General purpose cutting			Hole Depth ap (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)		Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)		Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	
1/4	5000	35.4	.13	5000	35.4	.024	.38	3500	16.5	.050	3500	16.5	.024	.38	3000	3.5	.024	3000	3.5	.012	.38
5/16	4000	28.3	.16	4000	28.3	.028	.47	2800	13.2	.063	2800	13.2	.028	.47	2400	2.8	.024	2400	2.8	.012	.47
3/8	3300	23.4	.19	3300	23.4	.030	.56	2300	11.0	.094	2300	11.0	.030	.56	2000	2.3	.024	2000	2.3	.012	.56
1/2	2500	17.7	.20	2500	17.7	.030	.75	1800	8.5	.13	1800	8.5	.030	.75	1500	2.0	.024	1500	2.0	.012	.75
Hole depth																					

Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy							Copper, Copper alloy						
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.													
	High speed cutting			General purpose cutting			Hole Depth ap (inch)	High speed cutting			General purpose cutting			Hole Depth ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)		Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Step (inch)	
1/4	2000	2.3	.024	2000	2.3	.012	.38	6000	42.5	.13	6000	42.5	.0024	.38
5/16	1600	2.0	.024	1600	2.0	.012	.47	4800	34.0	.16	4800	34.0	.0028	.47
3/8	1300	1.5	.024	1300	1.5	.012	.56	4000	28.3	.19	4000	28.3	.003	.56
1/2	1000	1.2	.024	1000	1.2	.012	.75	3000	21.3	.20	3000	21.3	.003	.75
Hole depth														

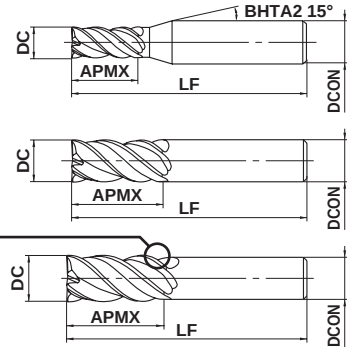
- Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
- Note 2) Effective cutting of stainless steel, titanium alloy, and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.
- Note 3) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

VQMHV

End mill, Medium cutting length, 4 flute, Irregular helix flutes



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



Type1

Type2

Type3



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

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials and for long overhang applications.

								(mm)
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type	
NEW VQMHVD0100	1	2	45	4	4	●	1	
NEW VQMHVD0150	1.5	3	45	4	4	●	1	
VQMHVD0200	2	4	45	4	4	●	1	
VQMHVD0250	2.5	5	45	4	4	●	1	
VQMHVD0300	3	8	45	6	4	●	1	
VQMHVD0350	3.5	8	45	6	4	●	1	
VQMHVD0400	4	11	45	6	4	●	1	
VQMHVD0500	5	13	50	6	4	●	1	
VQMHVD0600	6	13	50	6	4	●	2	
VQMHVD0700	7	19	60	8	4	●	1	
VQMHVD0800	8	19	60	8	4	●	2	
VQMHVD0900	9	22	70	10	4	●	1	
VQMHVD0900S08	9	22	75	8	4	●	3	
VQMHVD1000	10	22	70	10	4	●	2	
VQMHVD1000S08	10	22	100	8	4	●	3	
VQMHVD1100	11	26	75	12	4	●	1	
VQMHVD1100S10	11	26	100	10	4	●	3	
VQMHVD1200	12	26	75	12	4	●	2	
VQMHVD1200S10	12	26	110	10	4	●	3	
VQMHVD1300	13	26	75	12	4	★	3	
VQMHVD1300S12	13	26	110	12	4	★	3	
VQMHVD1400	14	30	90	16	4	★	1	
VQMHVD1400S12	14	32	130	12	4	★	3	
VQMHVD1600	16	35	90	16	4	★	2	
VQMHVD1800	18	40	100	16	4	★	3	
VQMHVD1800S16	18	42	150	16	4	★	3	
VQMHVD2000	20	45	110	20	4	★	2	
VQMHVD2500	25	55	125	25	4	★	2	

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

● : USA Stock ★ : Stocked in Japan

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHV

End mill, Medium cutting length, 4 flute, Irregular helix flutes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■ Shoulder milling

When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	130	40000	1800	1.5	0.3	120	38000	910	1.5	0.3	80	25000	500	1.5	0.2	75	24000	580	1.5	0.2
2	150	24000	2400	3	0.6	120	19000	1100	3	0.6	100	16000	830	3	0.6	75	12000	720	3	0.4
3	150	16000	2600	4.5	0.9	120	13000	1200	4.5	0.9	100	11000	880	4.5	0.9	75	8000	770	4.5	0.6
4	150	12000	2600	6	1.2	120	9500	1300	6	1.2	100	8000	900	6	1.2	75	6000	790	6	0.8
5	150	9500	2600	7.5	1.5	120	7600	1300	7.5	1.5	100	6400	900	7.5	1.5	75	4800	810	7.5	1
6	150	8000	2600	9	1.8	120	6400	1300	9	1.8	100	5300	1100	9	1.8	75	4000	810	9	1.2
8	150	6000	2500	12	2.4	120	4800	1300	12	2.4	100	4000	1200	12	2.4	75	3000	840	12	1.6
10	150	4800	2300	15	3	120	3800	1200	15	3	100	3200	1300	15	3	75	2400	770	15	2
12	150	4000	1900	18	3.6	120	3200	1200	18	3.6	100	2700	1200	18	3.6	75	2000	720	18	2.4
16	150	3000	1600	24	4.8	120	2400	960	24	4.8	100	2000	960	24	4.8	75	1500	600	24	3.2
20	150	2400	1300	30	6	120	1900	760	30	6	100	1600	770	30	6	75	1200	480	30	4
25	150	1900	1100	37.5	7.5	120	1500	600	37.5	7.5	100	1300	620	37.5	7.5	75	950	380	37.5	5
Depth of cut																				

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	120	38000	1000	1.5	0.3	100	32000	560	1.5	0.3	80	25000	400	0.75	0.1	70	22000	390	1.5	0.2
2	120	19000	1300	3	0.6	100	16000	630	3	0.6	80	13000	450	1.5	0.2	70	11000	440	3	0.4
3	120	13000	1400	4.5	0.9	100	11000	700	4.5	0.9	80	8500	450	2.2	0.3	70	7400	470	4.5	0.6
4	120	9500	1400	6	1.2	100	8000	700	6	1.2	80	6400	470	3	0.6	70	5600	490	6	0.8
5	120	7600	1400	7.5	1.5	100	6400	710	7.5	1.5	80	5100	470	4.5	0.9	70	4500	500	7.5	1
6	120	6400	1400	9	1.8	100	5300	710	9	1.8	80	4200	580	6	1.2	70	3700	500	9	1.2
8	120	4800	1300	12	2.4	100	4000	740	12	2.4	80	3200	630	7.5	1.5	70	2800	520	12	1.6
10	120	3800	1200	15	3	100	3200	680	15	3	80	2500	660	9	1.8	70	2200	460	15	2
12	120	3200	1000	18	3.6	100	2700	640	18	3.6	80	2100	610	12	2.4	70	1900	450	18	2.4
16	120	2400	860	24	4.8	100	2000	530	24	4.8	80	1600	510	15	3	70	1400	370	24	3.2
20	120	1900	680	30	6	100	1600	420	30	6	80	1300	410	18	3.6	70	1100	290	30	4
25	120	1500	390	37.5	7.5	100	1300	340	37.5	7.5	80	1000	210	24	4.8	70	890	230	37.5	5
Depth of cut																				

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

Shoulder milling

When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	130	40000	1800	1.5	0.3	40	13000	210	1.5	0.1
2	180	29000	2900	3	0.6	40	6400	230	3	0.2
3	180	19000	3000	4.5	0.9	40	4200	240	4.5	0.3
4	180	14000	3000	6	1.2	40	3200	240	6	0.4
5	180	11000	3000	7.5	1.5	40	2500	240	7.5	0.5
6	180	9500	3000	9	1.8	40	2100	250	9	0.6
8	180	7200	3000	12	2.4	40	1600	260	12	0.8
10	180	5700	2700	15	3	40	1300	290	15	1
12	180	4800	2300	18	3.6	40	1100	280	18	1.2
16	180	3600	1900	24	4.8	40	800	200	24	1.6
20	180	2900	1600	30	6	40	640	160	30	2
25	180	2300	1300	37.5	7.5	40	510	130	37.5	2.5

Depth of cut
 

General-purpose conditions

Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	130	40000	1300	1.5	0.3	30	9600	92	1.5	0.1
2	140	22000	1500	3	0.6	30	4800	110	3	0.2
3	140	15000	1600	4.5	0.9	30	3200	120	4.5	0.3
4	140	11000	1600	6	1.2	30	2400	120	6	0.4
5	140	8900	1600	7.5	1.5	30	1900	120	7.5	0.5
6	140	7400	1600	9	1.8	30	1600	130	9	0.6
8	140	5600	1600	12	2.4	30	1200	130	12	0.8
10	140	4500	1400	15	3	30	950	140	15	1
12	140	3700	1200	18	3.6	30	800	140	18	1.2
16	140	2800	1000	24	4.8	30	600	100	24	1.6
20	140	2200	780	30	6	30	480	81	30	2
25	140	1800	670	37.5	7.5	30	380	64	37.5	2.5

Depth of cut
 

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SMART MIRACLE END MILLS

VQMHV

End mill, Medium cutting length, 4 flute, Irregular helix flutes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■ Slotting

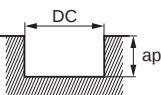
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
2	150	24000	1200	2	120	19000	610	2	100	16000	640	2	60	9500	300	1	180	29000	1500	2	30	4800	130	0.6
3	150	16000	1500	3	120	13000	730	3	100	11000	660	3	60	6400	360	1.5	180	19000	1700	3	30	3200	150	0.9
4	150	12000	1900	4	120	9500	910	4	100	8000	700	4	60	4800	460	2	180	14000	2200	4	30	2400	170	1.2
5	150	9500	1900	5	120	7600	910	5	100	6400	720	5	60	3800	460	2.5	180	11000	2200	5	30	1900	170	1.5
6	150	8000	1900	6	120	6400	1000	6	100	5300	740	6	60	3200	510	3	180	9500	2300	6	30	1600	180	1.8
8	150	6000	1700	8	120	4800	960	8	100	4000	800	8	60	2400	480	4	180	7200	2000	8	30	1200	190	2.4
10	150	4800	1500	10	120	3800	840	10	100	3200	900	10	60	1900	420	5	180	5700	1800	10	30	950	210	3
12	150	4000	1300	12	120	3200	770	12	100	2700	860	12	60	1600	380	6	180	4800	1500	12	30	800	200	3.6
16	150	3000	1100	12	120	2400	670	12	100	2000	640	12	60	1200	340	8	180	3600	1300	12	30	600	150	4.8
20	150	2400	860	12	120	1900	530	12	100	1600	510	12	60	950	270	10	180	2900	1000	12	30	480	120	6
25	150	1900	760	12	120	1500	420	12	100	1300	420	12	60	760	210	12	180	2300	920	12	30	380	100	7.5

Depth of cut

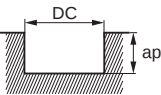


DC : Dia.

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
1	100	32000	500	1	80	25000	250	1	80	25000	300	1	50	16000	150	0.5	120	38000	590	1	25	8000	67	0.3
2	100	16000	550	2	80	13000	270	2	60	9500	250	2	50	8000	170	1	120	19000	650	2	25	4000	74	0.6
3	100	11000	670	3	80	8500	310	3	60	6400	250	3	50	5300	200	1.5	120	13000	790	3	25	2700	86	0.9
4	100	8000	840	4	80	6400	410	4	60	4800	280	4	50	4000	250	2	120	9500	1000	4	25	2000	93	1.2
5	100	6400	840	5	80	5100	410	5	60	3800	280	5	50	3200	250	2.5	120	7600	1000	5	25	1600	95	1.5
6	100	5300	840	6	80	4200	440	6	60	3200	300	6	50	2700	290	3	120	6400	1000	6	25	1300	96	1.8
8	100	4000	740	8	80	3200	420	8	60	2400	320	8	50	2000	260	4	120	4800	890	8	25	990	100	2.4
10	100	3200	680	10	80	2500	360	10	60	1900	350	10	50	1600	230	5	120	3800	800	10	25	800	120	3
12	100	2700	570	12	80	2100	330	12	60	1600	340	12	50	1300	210	6	120	3200	680	12	25	660	110	3.6
16	100	2000	480	12	80	1600	300	12	60	1200	250	12	50	990	180	8	120	2400	570	12	25	500	84	4.8
20	100	1600	380	12	80	1300	240	12	60	950	200	12	50	800	150	10	120	1900	450	12	25	400	68	6
25	100	1300	340	12	80	1000	180	12	60	760	160	12	50	640	120	12	120	1500	400	12	25	320	50	7.5

Depth of cut



DC : Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

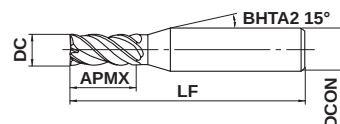
Note 4) When the depth of cut is smaller than shown the feed rate can be increased.

VQMHV – Inch sizes

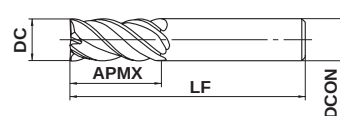
End mill, Medium cutting length, 4 flute, Irregular helix flutes



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



Type1



Type2



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
.2500"≤DCON≤.3750"	DCON=.5000"			
0 - .00035"	0 - .00043"			

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials and for long overhang applications.

(inch)							
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVD1/8	.1250	.3130	2.0	.2500	4	●	1
VQMHVD3/16	.1875	.4375	2.0	.2500	4	●	1
VQMHVD1/4	.2500	.6250	2.5	.2500	4	●	2
VQMHVD5/16	.3125	.7500	2.75	.3125	4	●	2
VQMHVD3/8	.3750	.8750	3.0	.3750	4	●	2
VQMHVD1/2	.5000	1.1250	3.5	.5000	4	●	2

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHV – Inch sizes

End mill, Medium cutting length, 4 flute, Irregular helix flutes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

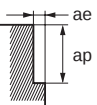
BARREL

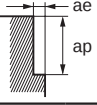
ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

DC (inch)	Carbon steel (—30HRC)						Alloy steel, Pre-hardened steel						Austenitic stainless steel, Titanium alloy					
	AISI 1035, AISI 1050, ASTM 283						AISI H13, AISI 4140, AISI P21						AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.					
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/8	15000	102.0	12000	55.1	.19	.038	12000	49.1	10000	27.2	.19	.038	10000	34.6	8000	18.1	.19	.038
3/16	10000	99.2	8000	51.2	.28	.056	8000	50.4	6700	28.0	.28	.056	6700	35.3	5300	18.5	.28	.056
1/4	7500	99.2	6000	51.2	.38	.075	6000	52.0	5000	28.7	.38	.075	5000	47.2	4000	24.8	.38	.075
5/16	6000	99.2	4800	51.2	.47	.094	4800	52.9	4000	29.1	.47	.094	4000	47.2	3200	24.8	.47	.094
3/8	5000	90.6	4000	47.2	.56	.11	4000	49.1	3300	26.8	.56	.11	3300	49.4	2700	26.8	.56	.11
1/2	3800	74.8	3000	39.0	.75	.15	3000	43.5	2500	24.0	.75	.15	2500	43.3	2000	22.8	.75	.15
Depth of cut																		

DC (inch)	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy						Copper, Copper alloy						Heat resistant alloy					
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.												Inconel718 etc.					
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/8	7500	30.7	7000	18.9	.19	.025	18000	122.0	14000	63.0	.19	.038	4000	9.5	3000	4.7	.19	.013
3/16	5000	31.5	4700	19.7	.28	.038	12000	119.0	9400	63.0	.28	.056	2700	9.8	2000	4.7	.28	.019
1/4	3800	32.9	3500	20.1	.38	.050	9000	119.0	7000	63.0	.38	.075	2000	10.1	1500	5.1	.38	.025
5/16	3000	33.1	2800	20.5	.47	.063	7200	119.0	5600	63.0	.47	.094	1600	10.1	1200	5.1	.47	.031
3/8	2500	30.7	2300	18.5	.56	.075	6000	109.0	4700	55.1	.56	.11	1300	10.6	1000	5.5	.56	.038
1/2	1900	27.5	1800	17.3	.75	.10	4500	88.6	3500	47.2	.75	.15	1000	10.1	750	5.1	.75	.050
Depth of cut																		

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

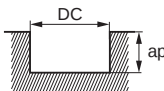
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

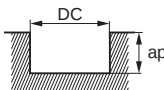
Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.

Note 3) Higher feeds and speeds can be used for smaller depth of cut.

Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

Slotting

Work Material	Carbon steel (−30HRC)					Alloy steel, Pre-hardened steel					Austenitic stainless steel, Titanium alloy				
	AISI 1035, AISI 1050, ASTM 283					AISI H13, AISI 4140, AISI P21					AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.				
DC (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
	Revolution (min ^{−1})	Table feed (IPM)	Revolution (min ^{−1})	Table feed (IPM)		Revolution (min ^{−1})	Table feed (IPM)	Revolution (min ^{−1})	Table feed (IPM)		Revolution (min ^{−1})	Table feed (IPM)	Revolution (min ^{−1})	Table feed (IPM)	
1/8	15000	59.1	10000	26.0	.13	12000	30.2	8000	13.4	.13	10000	26.8	6000	10.6	.13
3/16	10000	75.6	6700	33.5	.19	8000	35.9	5300	15.7	.19	6700	28.5	4000	11.4	.19
1/4	7500	74.4	5000	32.7	.25	6000	39.7	4000	17.3	.25	5000	29.1	3000	11.4	.25
5/16	6000	66.1	4000	29.1	.31	4800	37.8	3200	16.5	.31	4000	31.5	2400	12.6	.31
3/8	5000	61.4	3300	26.8	.38	4000	34.0	2700	15.0	.38	3300	33.8	2000	13.4	.38
1/2	3800	47.9	2500	20.9	.50	3000	29.8	2000	13.0	.50	2500	31.5	1500	12.6	.50
Depth of cut	 DC : Dia.														

Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy					Copper, Copper alloy					Heat resistant alloy				
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.										Inconel718 etc.				
DC (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
	Revolution (min ^{−1})	Table feed (IPM)	Revolution (min ^{−1})	Table feed (IPM)		Revolution (min ^{−1})	Table feed (IPM)	Revolution (min ^{−1})	Table feed (IPM)		Revolution (min ^{−1})	Table feed (IPM)	Revolution (min ^{−1})	Table feed (IPM)	
1/8	6000	15.1	5000	8.3	.063	18000	70.9	12000	31.1	.13	3000	6.14	2500	3.4	.038
3/16	4000	18.3	3300	9.8	.094	12000	90.7	8000	39.4	.19	2000	6.80	1700	3.8	.056
1/4	3000	19.8	2500	11.0	.13	9000	89.3	6000	39.4	.25	1500	7.09	1300	3.9	.075
5/16	2400	18.9	2000	10.2	.16	7200	79.4	4800	35.0	.31	1200	7.56	1000	4.3	.094
3/8	2000	17.0	1700	9.4	.19	6000	73.7	4000	32.3	.38	1000	8.19	840	4.7	.11
1/2	1500	14.9	1300	8.7	.25	4500	56.7	3000	24.8	.50	750	7.56	630	4.3	.15
Depth of cut	 DC : Dia.														

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.

Note 3) Higher feeds and speeds can be used for smaller depth of cut.

Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

SMART MIRACLE END MILLS

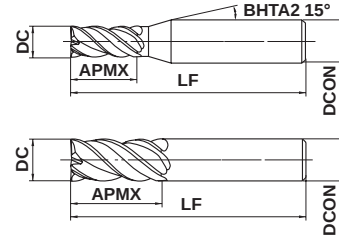
VQJHV

End mill, Semi long cut length, 4 flute, Irregular helix flutes



CARBIDE

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



Type1

Type2



DC≤12	DC>12			
0 - 0.020	0 - 0.030			
DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials and for long overhang applications.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
NEW VQJHVD0100	1	4	45	4	4	●	1
NEW VQJHVD0150	1.5	6	45	4	4	●	1
VQJHVD0200	2	8	60	6	4	●	1
VQJHVD0250	2.5	10	60	6	4	●	1
VQJHVD0300	3	12	60	6	4	●	1
VQJHVD0350	3.5	14	60	6	4	●	1
VQJHVD0400	4	16	60	6	4	●	1
VQJHVD0450	4.5	18	60	6	4	●	1
VQJHVD0500	5	20	60	6	4	●	1
VQJHVD0600	6	24	60	6	4	●	2
VQJHVD0700	7	25	80	8	4	●	1
VQJHVD0800	8	28	80	8	4	●	2
VQJHVD0900	9	32	90	10	4	●	1
VQJHVD1000	10	35	90	10	4	●	2
VQJHVD1200	12	40	100	12	4	●	2
VQJHVD1600	16	55	125	16	4	★	2
VQJHVD2000	20	70	140	20	4	★	2

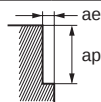
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

RECOMMENDED CUTTING CONDITIONS

■ Shoulder milling

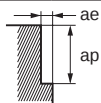
Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340					AISI 304, AISI 306, Ti-6Al-4V					SUS630, SUS631, 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	130	40000	530	2.5	0.1	100	32000	410	2.5	0.1	80	25000	300	2.5	0.05	75	24000	290	2.5	0.05
2	130	21000	700	5	0.2	100	16000	510	5	0.2	80	13000	390	5	0.1	75	12000	360	5	0.1
3	130	14000	960	7.5	0.3	100	11000	680	7.5	0.3	80	8500	490	7.5	0.15	75	8000	460	7.5	0.15
4	130	10000	1000	10	0.4	100	8000	690	10	0.4	80	6400	540	10	0.2	75	6000	510	10	0.2
5	130	8300	1100	12.5	0.5	100	6400	730	12.5	0.5	80	5100	570	12.5	0.25	75	4800	540	12.5	0.25
6	130	6900	1200	15	0.6	100	5300	810	15	0.6	80	4200	630	15	0.3	75	4000	600	15	0.3
8	130	5200	1200	20	0.8	100	4000	840	20	0.8	80	3200	640	20	0.4	75	3000	600	20	0.4
10	130	4100	1100	25	1	100	3200	810	25	1	80	2500	590	25	0.5	75	2400	570	25	0.5
12	130	3400	1100	30	1.2	100	2700	780	30	1.2	80	2100	550	30	0.6	75	2000	520	30	0.6
16	130	2600	920	40	1.6	100	2000	640	40	1.6	80	1600	450	40	0.8	75	1500	420	40	0.8
20	130	2100	820	50	2	100	1600	570	50	2	80	1300	420	50	1	75	1200	390	50	1

Depth of cut



Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	130	40000	530	2.5	0.1	40	13000	73	2.5	0.02
2	160	25000	830	5	0.2	40	6400	90	5	0.04
3	160	17000	1200	7.5	0.3	40	4200	130	7.5	0.06
4	160	13000	1300	10	0.4	40	3200	190	10	0.08
5	160	10000	1300	12.5	0.5	40	2500	180	12.5	0.1
6	160	8500	1500	15	0.6	40	2100	180	15	0.12
8	160	6400	1500	20	0.8	40	1600	170	20	0.16
10	160	5100	1300	25	1	40	1300	170	25	0.2
12	160	4200	1300	30	1.2	40	1100	140	30	0.24
16	160	3200	1100	40	1.6	40	800	110	40	0.32
20	160	2500	970	50	2	40	640	80	50	0.4

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

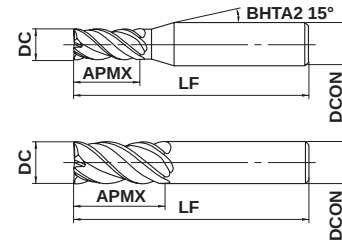
VQJHV - Inch sizes

End mill, Semi long cut length, 4 flute, Irregular helix flutes



CARBIDE

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



Type1

Type2



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			
.2500"≤DCON≤.3750"	DCON=.5000"			
0 - .00035"	0 - .00043"			

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials and for long overhang applications.

(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQJHVD1/8	.1250	.5000	2.5	.2500	4	●	1
VQJHVD3/16	.1875	.7500	2.5	.2500	4	●	1
VQJHVD1/4	.2500	1.0000	2.5	.2500	4	●	2
VQJHVD5/16	.3125	1.0900	3.25	.3125	4	●	2
VQJHVD3/8	.3750	1.3100	3.5	.3750	4	●	2
VQJHVD1/2	.5000	1.6500	4.0	.5000	4	●	2

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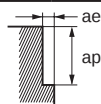
SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

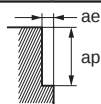
Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy			
	AISI 1035, AISI 1050, ASTM 283				AISI H13, AISI 4140, AISI P21				AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.				ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.			
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)
1/8	13000	39	.313	.013	10000	26.8	.313	.013	8000	2.1	.313	.006	7500	18.9	.313	.006
3/16	8700	39.4	.469	.019	6700	27.6	.469	.019	5300	21.7	.469	.009	5000	20.5	.469	.009
1/4	6500	47.2	.625	.025	5000	32.3	.625	.025	4000	25.2	.625	.013	3800	24	.625	.013
5/16	5200	47.2	.781	.031	4000	33.5	.781	.031	3200	25.2	.781	.016	3000	23.6	.781	.016
3/8	4300	43.3	.938	.038	3300	31.9	.938	.038	2700	23.2	.938	.019	2500	22.4	.938	.019
1/2	3300	43.3	1.25	.05	2500	29.1	1.25	.05	2000	2.9	1.25	.025	1900	20.1	1.25	.025

Depth of cut



Work Material	Copper, Copper alloy				Heat resistant alloy			
					Inconel718 etc.			
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)
1/8	16000	48	.013	.013	4000	5.1	.313	.003
3/16	11000	51.9	.019	.019	2700	7.1	.469	.004
1/4	8000	57.9	.025	.025	2000	6.7	.625	.005
5/16	6400	59.4	.031	.031	1600	6.7	.781	.006
3/8	5300	51.7	.038	.038	1300	6.7	.938	.008
1/2	4000	50.4	.05	.05	1000	5.1	1.25	.01

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

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Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

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

SQUARE

BALL

RADIUS

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BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

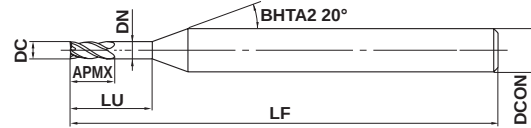
VQXL

End mill, Short cut length, 3—4 flute, Long neck



CARBIDE

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



Type1



DC≤1
0
- 0.010



DCON=4
0
- 0.005

- The use of SMART MIRACLE Coating improves chip discharge dramatically.
- Multi-cutters at a small diameter of $\phi 1$ is realized.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQXLD0020N006	0.2	0.3	0.6	0.18	40	4	3	●	1
VQXLD0030N009	0.3	0.5	0.9	0.28	40	4	3	●	1
VQXLD0030N015	0.3	0.5	1.5	0.28	40	4	3	●	1
VQXLD0040N010	0.4	0.6	1	0.37	40	4	4	●	1
VQXLD0040N018	0.4	0.6	1.8	0.37	40	4	4	●	1
VQXLD0050N015	0.5	0.7	1.5	0.46	40	4	4	●	1
VQXLD0050N025	0.5	0.7	2.5	0.46	40	4	4	●	1
VQXLD0050N030	0.5	0.7	3	0.46	40	4	4	●	1
VQXLD0060N030	0.6	0.9	3	0.57	40	4	4	●	1
VQXLD0070N035	0.7	1	3.5	0.67	40	4	4	●	1
VQXLD0080N024	0.8	1.2	2.4	0.77	40	4	4	●	1
VQXLD0080N030	0.8	1.2	3	0.77	40	4	4	●	1
VQXLD0080N040	0.8	1.2	4	0.77	40	4	4	●	1
VQXLD0100N050	1	1.5	5	0.96	40	4	4	●	1

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

TORX Chart

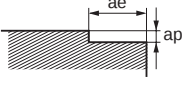
Order Number	ISO 10664
	TORX Type
VQXLD0020N006	T4
VQXLD0030N009	T6
VQXLD0030N015	T6
VQXLD0040N010	T8
VQXLD0040N018	T8
VQXLD0050N015	T15
VQXLD0050N025	T15
VQXLD0050N030	T15
VQXLD0080N024	T25
VQXLD0080N040	T25
VQXLD0100N050	T40

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material		Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steel, Titanium alloy Cobalt chromium alloy, Copper, Copper alloy					Heat resistant alloy, Pre-hardened steel, Hardened steel				
		AISI 1045, AISI 4140, AISI 4340, AISI 304, AISI 316, AISI 304LN, AISI 316LN, Ti-6Al-4V					Inconel718, AISI P21, AISI P20, AISI H13, AISI L6, AISI 431, AISI 420				
DC (mm)	LU (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	0.6	25	40000	360	0.03	0.01	20	32000	290	0.03	0.01
0.3	0.9	40	40000	480	0.045	0.015	20	21000	250	0.045	0.015
0.3	1.5	40	40000	360	0.045	0.015	20	21000	190	0.045	0.015
0.4	1	50	40000	800	0.06	0.02	20	16000	320	0.06	0.02
0.4	1.8	50	40000	560	0.06	0.02	20	16000	220	0.06	0.025
0.5	1.5	60	38000	910	0.075	0.025	20	13000	310	0.075	0.025
0.5	2.5	60	38000	610	0.075	0.025	20	13000	210	0.075	0.025
0.5	3	60	38000	550	0.075	0.025	20	13000	180	0.075	0.025
0.6	3	60	32000	640	0.09	0.03	20	10500	210	0.09	0.03
0.7	3.5	60	27000	650	0.11	0.035	20	9100	200	0.11	0.035
0.8	2.4	60	24000	960	0.12	0.04	20	8000	260	0.12	0.04
0.8	3	60	24000	860	0.12	0.04	20	8000	230	0.12	0.04
0.8	4	60	24000	670	0.12	0.04	20	8000	190	0.12	0.04
1	5	60	20000	800	0.15	0.05	20	6500	210	0.15	0.05
Depth of cut											

Bottom face milling

Work Material		Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steel, Titanium alloy Cobalt chromium alloy, Copper, Copper alloy					Heat resistant alloy, Pre-hardened steel, Hardened steel				
		AISI 1045, AISI 4140, AISI 4340, AISI 304, AISI 316, AISI 304LN, AISI 316LN, Ti-6Al-4V					Inconel718, AISI P21, AISI P20, AISI H13, AISI L6, AISI 431, AISI 420				
DC (mm)	LU (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	0.6	25	40000	360	0.015	≤0.2	20	32000	290	0.015	≤0.1
0.3	0.9	40	40000	480	0.025	≤0.3	20	21000	250	0.025	≤0.15
0.3	1.5	40	40000	360	0.02	≤0.3	20	21000	190	0.02	≤0.15
0.4	1	50	40000	800	0.03	≤0.4	20	16000	320	0.03	≤0.2
0.4	1.8	50	40000	560	0.02	≤0.4	20	16000	220	0.02	≤0.2
0.5	1.5	60	38000	910	0.04	≤0.5	20	13000	310	0.04	≤0.25
0.5	2.5	60	38000	610	0.03	≤0.5	20	13000	210	0.03	≤0.25
0.5	3	60	38000	550	0.03	≤0.5	20	13000	180	0.03	≤0.25
0.6	3	60	32000	640	0.035	≤0.6	20	10500	210	0.035	≤0.3
0.7	3.5	60	27000	640	0.035	≤0.7	20	9100	190	0.035	≤0.35
0.8	2.4	60	24000	960	0.06	≤0.8	20	8000	260	0.06	≤0.4
0.8	3	60	24000	840	0.05	≤0.8	20	8000	230	0.05	≤0.4
0.8	4	60	24000	670	0.04	≤0.8	20	8000	190	0.04	≤0.4
1	5	60	20000	800	0.05	≤1	20	6500	210	0.05	≤0.5
Depth of cut											

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 3) When the depth of cut is smaller than shown the revolution and feed rate can be increased.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

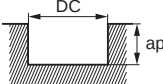
VQXL

End mill, Short cut length, 3—4 flute, Long neck

CARBIDE

RECOMMENDED CUTTING CONDITIONS

■ Slotting

Work Material		Carbon steel, Alloy steel, Mild steel, Alloy tool steel, Austenitic stainless steel, Titanium alloy Cobalt chromium alloy, Copper, Copper alloy				Heat resistant alloy, Pre-hardened steel, Hardened steel			
		AISI 1045, AISI 4140, AISI 4340, AISI 304, AISI 306, AISI 304LN, AISI 316LN, Ti-6Al-4V				Inconel718, AISI P21, AISI P20, AISI H13, AISI L6, AISI 431, AISI 420			
DC (mm)	LU (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
0.2	0.6	20	30000	270	0.03	15	24000	220	0.03
0.3	0.9	30	30000	360	0.045	14	15000	180	0.045
0.3	1.5	30	30000	270	0.045	14	15000	140	0.045
0.4	1	40	30000	600	0.06	15	12000	240	0.06
0.4	1.8	40	30000	420	0.06	15	12000	170	0.06
0.5	1.5	45	28000	670	0.075	15	9500	230	0.075
0.5	2.5	45	28000	450	0.075	15	9500	150	0.075
0.5	3	45	28000	390	0.075	15	9500	130	0.075
0.6	3	45	24000	480	0.09	15	7800	160	0.09
0.7	3.5	45	20000	480	0.11	15	6800	140	0.11
0.8	2.4	45	18000	720	0.12	15	6000	190	0.12
0.8	3	45	18000	650	0.12	15	6000	170	0.12
0.8	4	45	18000	500	0.12	15	6000	140	0.12
1	5	45	15000	600	0.15	15	4800	150	0.15
Depth of cut									

DC : Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 3) When the depth of cut is smaller than shown the feed rate can be increased.

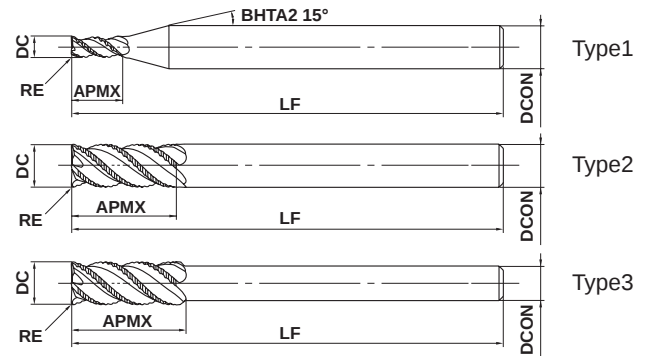
SOLID END MILLS

VQSVR

Roughing end mill, Short cut length, 3—4 flute, Irregular helix flutes



Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○			○	○	○	



DCON=6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON=20
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

- Achieving an excellent vibration resistance due to the adoption of irregular helix.
- Use of an asymmetric chip breaker improves fracture resistance substantially. (Compared to a conventional roughing end mill)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQSVRD0300	3	0.2	6	60	6	3	●	1
VQSVRD0400	4	0.2	8	60	6	3	●	1
VQSVRD0500	5	0.3	10	60	6	3	●	1
VQSVRD0600	6	0.3	12	70	6	3	●	2
VQSVRD0700	7	0.3	17	80	8	3	●	1
VQSVRD0800	8	0.5	17	80	8	4	●	2
VQSVRD0900	9	0.5	22	90	10	4	●	1
VQSVRD1000S08	10	0.5	22	90	8	4	●	3
VQSVRD1000	10	0.5	22	90	10	4	●	2
VQSVRD1200S10	12	0.5	27	100	10	4	●	3
VQSVRD1200	12	0.5	27	100	12	4	●	2
VQSVRD1400	14	0.5	27	130	12	4	★	3
VQSVRD1600	16	0.5	33	125	16	4	★	2
VQSVRD1800	18	0.5	33	150	16	4	★	3
VQSVRD2000	20	0.5	38	140	20	4	★	2

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

SMART MIRACLE END MILLS

VQSVR

Roughing end mill, Short cut length, 3—4 flute, Irregular helix flutes

CARBIDE

RECOMMENDED CUTTING CONDITIONS

■ Shoulder milling

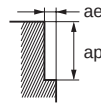
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy					Copper, Copper alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631, 15-5PH, 17-4PH									
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)
3	150	16000	960	4.5	1.5	120	13000	640	4.5	1.5	100	11000	450	4.5	1.5	75	8000	330	4.5	0.9	180	19000	1100	4.5	1.5
4	150	12000	960	6	2	120	9500	640	6	2	100	8000	430	6	2	75	6000	330	6	1.2	180	14000	1100	6	2
5	150	9500	960	7.5	2.5	120	7600	640	7.5	2.5	100	6400	440	7.5	2.5	75	4800	330	7.5	1.5	180	11000	1100	7.5	2.5
6	150	8000	960	9	3	120	6400	680	9	3	100	5300	480	9	3	75	4000	360	9	1.8	180	9500	1100	9	3
7	150	6800	950	10.5	3.5	120	5500	700	10.5	3.5	100	4500	500	10.5	3.5	75	3400	380	10.5	2.1	180	8200	1100	10.5	3.5
8	150	6000	1100	12	4	120	4800	800	12	4	100	4000	570	12	4	75	3000	430	12	2.4	180	7200	1300	12	4
9	150	5300	1100	13.5	4.5	120	4200	760	13.5	4.5	100	3500	570	13.5	4.5	75	2700	430	13.5	2.7	180	6400	1300	13.5	4.5
10	150	4800	1100	15	5	120	3800	760	15	5	100	3200	570	15	5	75	2400	430	15	3	180	5700	1200	15	5
12	150	4000	960	18	6	120	3200	700	18	6	100	2700	540	18	6	75	2000	400	18	3.6	180	4800	1200	18	6
14	150	3400	880	21	7	120	2700	650	21	7	100	2300	510	21	7	75	1700	380	21	4.2	180	4100	1100	21	7
16	150	3000	840	24	8	120	2400	620	24	8	100	2000	500	24	8	75	1500	380	24	4.8	180	3600	1000	24	8
18	150	2700	810	27	9	120	2100	590	27	9	100	1800	500	27	9	75	1300	360	27	5.4	180	3200	960	27	9
20	150	2400	760	30	10	120	1900	560	30	10	100	1600	500	30	10	75	1200	360	30	6	180	2900	920	30	10

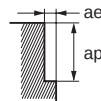
Depth of cut



General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy					Copper, Copper alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631, 15-5PH, 17-4PH									
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)
3	120	13000	610	4.5	1.5	100	11000	430	4.5	1.5	80	8500	280	4.5	1.5	70	7400	240	4.5	0.9	140	15000	700	4.5	1.5
4	120	9500	610	6	2	100	8000	430	6	2	80	6400	280	6	2	70	5600	240	6	1.2	140	11000	700	6	2
5	120	7600	610	7.5	2.5	100	6400	430	7.5	2.5	80	5100	280	7.5	2.5	70	4500	250	7.5	1.5	140	8900	720	7.5	2.5
6	120	6400	610	9	3	100	5300	450	9	3	80	4200	300	9	3	70	3700	270	9	1.8	140	7400	720	9	3
7	120	5500	620	10.5	3.5	100	4500	480	10.5	3.5	80	3600	320	10.5	3.5	70	3200	290	10.5	2.1	140	6400	720	10.5	3.5
8	120	4800	720	12	4	100	4000	570	12	4	80	3200	380	12	4	70	2800	340	12	2.4	140	5600	840	12	4
9	120	4200	670	13.5	4.5	100	3500	510	13.5	4.5	80	2800	360	13.5	4.5	70	2500	320	13.5	2.7	140	5000	800	13.5	4.5
10	120	3800	670	15	5	100	3200	510	15	5	80	2500	360	15	5	70	2200	310	15	3	140	4500	790	15	5
12	120	3200	610	18	6	100	2700	470	18	6	80	2100	340	18	6	70	1900	300	18	3.6	140	3700	710	18	6
14	120	2700	560	21	7	100	2300	440	21	7	80	1800	320	21	7	70	1600	280	21	4.2	140	3200	670	21	7
16	120	2400	540	24	8	100	2000	410	24	8	80	1600	320	24	8	70	1400	280	24	4.8	140	2800	630	24	8
18	120	2100	500	27	9	100	1800	400	27	9	80	1400	310	27	9	70	1200	270	27	5.4	140	2500	600	27	9
20	120	1900	480	30	10	100	1600	380	30	10	80	1300	310	30	10	70	1100	270	30	6	140	2200	560	30	10

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

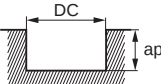
Note 4) When the depth of cut is smaller than shown the revolution and feed rate can be increased.

Slotting

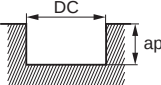
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340				AISI 304, AISI 306, Ti-6Al-4V				AISI 630, AISI 631, 15-5PH, 17-4PH							
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
3	120	13000	720	3	100	11000	440	3	80	8500	340	3	60	6400	250	1.5	150	16000	890	3
4	120	9500	720	4	100	8000	450	4	80	6400	340	4	60	4800	250	2	150	12000	900	4
5	120	7600	720	5	100	6400	460	5	80	5100	300	5	60	3800	230	2.5	150	9500	900	5
6	120	6400	720	6	100	5300	460	6	80	4200	310	6	60	3200	240	3	150	8000	900	6
7	120	5500	730	7	100	4500	470	7	80	3600	330	7	60	2700	250	3.5	150	6800	950	7
8	120	4800	840	8	100	4000	560	8	80	3200	400	8	60	2400	300	4	150	6000	1100	8
9	120	4200	810	9	100	3500	540	9	80	2800	350	9	60	2100	260	4.5	150	5300	1000	9
10	120	3800	800	10	100	3200	520	10	80	2500	340	10	60	1900	260	5	150	4800	1000	10
12	120	3200	750	12	100	2700	480	12	80	2100	340	12	60	1600	260	6	150	4000	940	12
14	120	2700	670	14	100	2300	420	14	80	1800	300	14	60	1400	240	7	150	3400	840	14
16	120	2400	620	16	100	2000	380	16	80	1600	290	16	60	1200	220	8	150	3000	780	16
18	120	2100	570	18	100	1800	380	18	80	1400	260	18	60	1100	210	9	150	2700	730	18
20	120	1900	540	20	100	1600	350	20	80	1300	260	20	60	950	190	10	150	2400	680	20
Depth of cut																				
	DC : Dia.																			

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340				AISI 304, AISI 306, Ti-6Al-4V				AISI 630, AISI 631, 15-5PH, 17-4PH							
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
3	100	11000	490	3	80	8500	300	3	60	6400	200	3	50	5300	170	1.5	120	13000	580	3
4	100	8000	490	4	80	6400	310	4	60	4800	200	4	50	4000	170	2	120	9500	580	4
5	100	6400	490	5	80	5100	310	5	60	3800	200	5	50	3200	170	2.5	120	7600	580	5
6	100	5300	490	6	80	4200	310	6	60	3200	200	6	50	2700	170	3	120	6400	580	6
7	100	4500	500	7	80	3600	320	7	60	2700	200	7	50	2300	170	3.5	120	5500	620	7
8	100	4000	600	8	80	3200	380	8	60	2400	240	8	50	2000	200	4	120	4800	720	8
9	100	3500	540	9	80	2800	330	9	60	2100	210	9	50	1800	180	4.5	120	4200	650	9
10	100	3200	540	10	80	2500	330	10	60	1900	210	10	50	1600	180	5	120	3800	640	10
12	100	2700	510	12	80	2100	320	12	60	1600	210	12	50	1300	170	6	120	3200	600	12
14	100	2300	460	14	80	1800	300	14	60	1400	190	14	50	1100	150	7	120	2700	540	14
16	100	2000	410	16	80	1600	290	16	60	1200	170	16	50	990	140	8	120	2400	500	16
18	100	1800	390	18	80	1400	260	18	60	1100	170	18	50	880	130	9	120	2100	460	18
20	100	1600	360	20	80	1300	260	20	60	950	150	20	50	800	130	10	120	1900	430	20
Depth of cut																				
	DC : Dia.																			

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

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SMART MIRACLE END MILLS

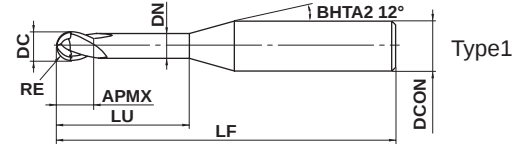
VQ4SVB

Ball nose, Medium cutting length, 4 flute

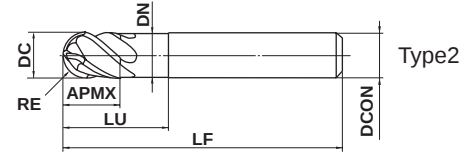


CARBIDE

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



Type1



Type2



1≤RE≤6



±0.01



DC≤12

0
- 0.02

DCON=6 8≤DCON≤10 DCON=12

0
- 0.008 0
- 0.009 0
- 0.011

- 4 flute ball nose end mill
- With the special substrate, suitable for finishing of heat resistance alloy, etc.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQ4SVBR0100	1	2	3	5	1.9	50	6	4	●	1
VQ4SVBR0150	1.5	3	4.5	7.5	2.9	50	6	4	●	1
VQ4SVBR0200	2	4	6	10	3.9	50	6	4	●	1
VQ4SVBR0250	2.5	5	7.5	12.5	4.9	50	6	4	●	1
VQ4SVBR0300	3	6	9	15	5.85	50	6	4	●	2
VQ4SVBR0400	4	8	12	20	7.85	60	8	4	●	2
VQ4SVBR0500	5	10	15	25	9.7	70	10	4	●	2
VQ4SVBR0600	6	12	18	30	11.7	75	12	4	●	2

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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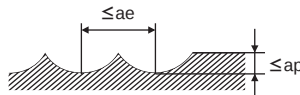
SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Shoulder milling (slotting)

Work Material	Carbon steel, Alloy steel, Mild steel, Pre-hardened steel								Austenitic stainless steel, Titanium alloy, Hardened stainless steel, Cobalt chromium alloy, Ferritic and Martensitic stainless steel							
	AISI 1045, AISI 4140, ASTM A36, AISI 1010, AISI P21, AISI P20, AISI 4340								AISI 304, AISI 316, Ti-6Al-4V, AISI 630, AISI 631, 15-5PH, 17-4PH, AISI 431, AISI 420							
RE (mm)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (mm)	Depth of cut ae (mm)
	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)		
R 1	250	40000	8000	200	32000	3800	0.17	0.5	230	36000	6500	150	24000	2900	0.17	0.5
R 1.5	300	32000	7700	200	21000	3200	0.25	0.75	230	24000	4800	150	16000	1900	0.25	0.75
R 2	300	24000	5800	200	16000	2800	0.33	1	230	18000	4000	150	12000	1700	0.33	1
R 2.5	300	19000	5300	200	12700	2600	0.42	1.25	230	14400	3500	150	9600	1500	0.42	1.25
R 3	300	16000	4800	200	10600	2100	0.5	1.5	230	12000	3200	150	8000	1400	0.5	1.5
R 4	300	12000	4300	200	8000	1900	0.8	2	230	9000	3200	150	6000	1400	0.8	2
R 5	300	9600	4100	200	6400	1800	1	2.5	230	7200	3000	150	4800	1300	1	2.5
R 6	300	8000	4000	200	5300	1800	1.2	3	230	6000	3000	150	4000	1300	1.2	3

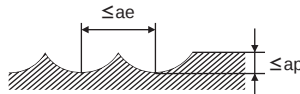
Depth of cut



RE : Radius

Work Material	Copper, Copper alloy								Heat resistant alloy Inconel etc.							
RE (mm)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (mm)	Depth of cut ae (mm)
	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)		
R 1	250	40000	8000	240	38000	4500	0.17	0.5	60	9600	960	40	6400	510	0.08	0.2
R 1.5	360	38000	9100	240	25000	3800	0.25	0.7	60	6400	640	40	4200	340	0.13	0.3
R 2	360	29000	7000	240	19000	3300	0.33	1	60	4800	580	40	3200	260	0.17	0.4
R 2.5	360	23000	6400	240	15000	3100	0.42	1.2	60	3800	530	39	2500	250	0.21	0.5
R 3	360	19000	5700	240	13000	2600	0.5	1.5	60	3200	500	40	2100	210	0.25	0.6
R 4	360	14000	5000	240	9600	2300	0.8	2	60	2400	430	40	1600	190	0.4	0.8
R 5	360	12000	5100	240	7700	2200	1	2.5	63	2000	420	41	1300	180	0.5	1
R 6	360	9600	4800	240	6400	2200	1.2	3	64	1700	350	41	1100	150	0.6	1.2

Depth of cut



RE : Radius

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

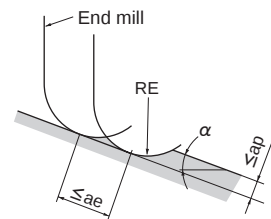
Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

Note 5) α is the inclination angle of the machined surface.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

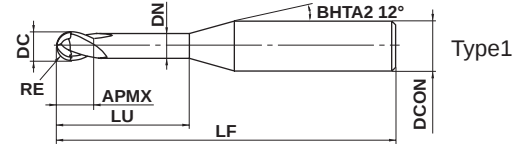
VQ4SVB - Inch sizes

Ball nose, Medium cutting length, 4 flute



CARBIDE

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



Type1



.0625" ≤ RE ≤ .2500"



±.0004"



DC < .5000" DC = .5000"



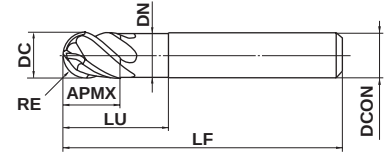
0 - .0008" 0 - .0012"



.250" ≤ DCON ≤ .375" DCON = .500"



0 - .00035" 0 - .00043"



Type2

- 4 flute ball nose end mill
- With the special substrate, suitable for finishing of heat resistance alloy, etc.

(inch)

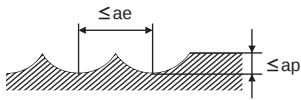
Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQ4SVBD1/8	.0625	.1250	.188	.3126	.1213	2.0	.2500	4	●	1
VQ4SVBD3/16	.0938	.1875	.281	.4689	.1835	2.0	.2500	4	●	1
VQ4SVBD1/4	.1250	.2500	.375	.6252	.2441	2.0	.2500	4	●	2
VQ4SVBD5/16	.1563	.3125	.469	.7811	.3067	2.5	.3125	4	●	2
VQ4SVBD3/8	.1875	.3750	.563	.9374	.3693	2.75	.3750	4	●	2
VQ4SVBD1/2	.2500	.5000	.750	1.2500	.4882	3.0	.5000	4	●	2

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

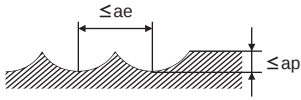
SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Shoulder milling (Slotting)

Work Material	Carbon steel, Alloy steel, Mild Steel, Pre-hardened steel						Austenitic stainless steel, Titanium alloy, Hardened stainless steel, Cobalt chromium alloy, Ferritic and Martensitic stainless steel					
	AISI 1010, AISI 1035, AISI 1050, ASTM 283, AISI H13, AISI 4140, AISI P21						AISI 304, AISI 316, AISI S17400, AISI S17700, AISI 430, AISI 420					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p (inch)	Depth of cut a_e (inch)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p (inch)	Depth of cut a_e (inch)
RE (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
.0625	30000	283.5	20000	118.1	.0098	.0313	22500	189.0	15000	74.8	.0098	.0313
.0938	20000	220.5	13400	102.4	.0165	.0469	15000	137.8	10000	59.1	.0165	.0469
.1250	15000	177.2	10000	82.7	.0197	.0626	11200	126.0	7500	55.1	.0197	.0626
.1563	12000	169.3	8000	74.8	.0315	.0781	9000	126.0	6000	55.1	.0315	.0781
.1875	10000	161.4	6700	70.9	.0394	.0937	7500	118.1	5000	51.2	.0394	.0937
.2500	7600	149.6	5000	70.9	.0472	.125	5600	118.1	3800	51.2	.0472	.125
Depth of cut												

RE : Radius

Work Material	Copper, Copper alloy						Heat resistant alloy Inconel718 etc.					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p (inch)	Depth of cut a_e (inch)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p (inch)	Depth of cut a_e (inch)
RE (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
.0625	36000	338.6	24000	141.7	.0098	.0313	6000	25.2	4000	13.4	.0051	.0313
.0938	24000	263.8	16000	122.0	.0165	.0469	4000	20.9	2700	9.8	.0083	.0469
.1250	18000	212.6	12000	98.4	.0197	.0626	3000	19.7	2000	8.3	.0098	.0626
.1563	14000	196.9	9600	90.6	.0315	.0781	2400	16.9	1600	7.5	.0157	.0781
.1875	12000	192.9	8000	82.7	.0394	.0937	2000	16.5	1300	7.1	.0197	.0937
.2500	9100	181.1	6000	86.6	.0472	.125	1500	13.8	1000	5.9	.0236	.125
Depth of cut												

RE : Radius

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

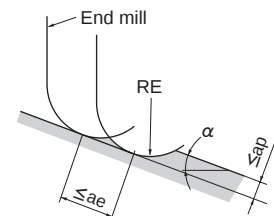
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 3) If the depth of cut is smaller than this table, feed rate can be increased.

Note 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 work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

Note 5) α is the inclination of the machined surface.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

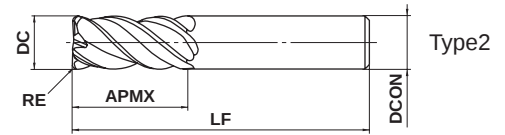
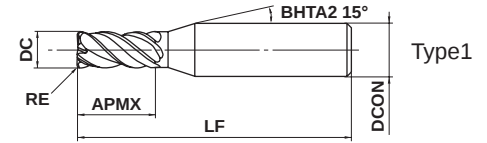
VQMHV RB

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes



CARBIDE

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



$0.2 \leq RE \leq 6.35$				
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± 0.015				
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DC ≤ 12	DC > 12			
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0 $- 0.02$	0 $- 0.03$			
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$4 \leq DCON \leq 6$	$8 \leq DCON \leq 10$	$12 \leq DCON \leq 16$	DCON = 20	
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0 $- 0.008$	0 $- 0.009$	0 $- 0.011$	0 $- 0.013$	
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- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials and for long overhang applications.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHV RBD0200R020	2	0.2	4	45	4	4	●	1
VQMHV RBD0200R030	2	0.3	4	45	4	4	●	1
VQMHV RBD0300R020	3	0.2	8	45	6	4	●	1
VQMHV RBD0300R030	3	0.3	8	45	6	4	●	1
VQMHV RBD0300R050	3	0.5	8	45	6	4	●	1
VQMHV RBD0400R020	4	0.2	11	45	6	4	●	1
VQMHV RBD0400R030	4	0.3	11	45	6	4	●	1
VQMHV RBD0400R050	4	0.5	11	45	6	4	●	1
VQMHV RBD0500R020	5	0.2	13	50	6	4	●	1
VQMHV RBD0500R030	5	0.3	13	50	6	4	●	1
VQMHV RBD0500R050	5	0.5	13	50	6	4	●	1
VQMHV RBD0500R100	5	1	13	50	6	4	●	1
VQMHV RBD0600R030	6	0.3	13	50	6	4	●	2
VQMHV RBD0600R050	6	0.5	13	50	6	4	●	2
VQMHV RBD0600R100	6	1	13	50	6	4	●	2
VQMHV RBD0800R030	8	0.3	19	60	8	4	●	2
VQMHV RBD0800R050	8	0.5	19	60	8	4	●	2
VQMHV RBD0800R100	8	1	19	60	8	4	●	2
VQMHV RBD0800R150	8	1.5	19	60	8	4	●	2
VQMHV RBD1000R030	10	0.3	22	70	10	4	●	2
VQMHV RBD1000R050	10	0.5	22	70	10	4	●	2
VQMHV RBD1000R100	10	1	22	70	10	4	●	2
VQMHV RBD1000R150	10	1.5	22	70	10	4	●	2
VQMHV RBD1000R200	10	2	22	70	10	4	●	2
VQMHV RBD1200R050	12	0.5	26	75	12	4	●	2
VQMHV RBD1200R100	12	1	26	75	12	4	●	2
VQMHV RBD1200R150	12	1.5	26	75	12	4	●	2
VQMHV RBD1200R200	12	2	26	75	12	4	●	2
VQMHV RBD1200R250	12	2.5	26	75	12	4	●	2
VQMHV RBD1200R300	12	3	26	75	12	4	●	2

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

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
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

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHV RB

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■ Shoulder milling

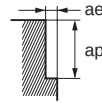
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
2	150	24000	2400	3	0.6	120	19000	1100	3	0.6	100	16000	830	3	0.6	75	12000	720	3	0.4
3	150	16000	2600	4.5	0.9	120	13000	1200	4.5	0.9	100	11000	880	4.5	0.9	75	8000	770	4.5	0.6
4	150	12000	2600	6	1.2	120	9500	1300	6	1.2	100	8000	900	6	1.2	75	6000	790	6	0.8
5	150	9500	2600	7.5	1.5	120	7600	1300	7.5	1.5	100	6400	900	7.5	1.5	75	4800	810	7.5	1
6	150	8000	2600	9	1.8	120	6400	1300	9	1.8	100	5300	1100	9	1.8	75	4000	810	9	1.2
8	150	6000	2500	12	2.4	120	4800	1300	12	2.4	100	4000	1200	12	2.4	75	3000	840	12	1.6
10	150	4800	2300	15	3	120	3800	1200	15	3	100	3200	1300	15	3	75	2400	770	15	2
12	150	4000	1900	18	3.6	120	3200	1200	18	3.6	100	2700	1200	18	3.6	75	2000	720	18	2.4
16	150	3000	1600	24	4.8	120	2400	960	24	4.8	100	2000	960	24	4.8	75	1500	600	24	3.2
20	150	2400	1300	30	6	120	1900	760	30	6	100	1600	770	30	6	75	1200	480	30	4
25	150	1900	1100	37.5	7.5	120	1500	600	37.5	7.5	100	1300	620	37.5	7.5	75	950	380	37.5	5

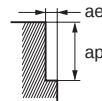
Depth of cut



General purpose cutting conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy					Hardened stainless steel, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 304, AISI 316, Ti-6Al-4V					AISI 630, AISI 631 15-5PH, 17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
2	120	19000	1300	3	0.6	100	16000	630	3	0.6	80	13000	450	1.5	0.2	70	11000	440	3	0.4
3	120	13000	1400	4.5	0.9	100	11000	700	4.5	0.9	80	8500	450	2.2	0.3	70	7400	470	4.5	0.6
4	120	9500	1400	6	1.2	100	8000	700	6	1.2	80	6400	470	3	0.6	70	5600	490	6	0.8
5	120	7600	1400	7.5	1.5	100	6400	710	7.5	1.5	80	5100	470	4.5	0.9	70	4500	500	7.5	1
6	120	6400	1400	9	1.8	100	5300	710	9	1.8	80	4200	580	6	1.2	70	3700	500	9	1.2
8	120	4800	1300	12	2.4	100	4000	740	12	2.4	80	3200	630	7.5	1.5	70	2800	520	12	1.6
10	120	3800	1200	15	3	100	3200	680	15	3	80	2500	660	9	1.8	70	2200	460	15	2
12	120	3200	1000	18	3.6	100	2700	640	18	3.6	80	2100	610	12	2.4	70	1900	450	18	2.4
16	120	2400	860	24	4.8	100	2000	530	24	4.8	80	1600	510	15	3	70	1400	370	24	3.2
20	120	1900	680	30	6	100	1600	420	30	6	80	1300	410	18	3.6	70	1100	290	30	4
25	120	1500	390	37.5	7.5	100	1300	340	37.5	7.5	80	1000	210	24	4.8	70	890	230	37.5	5

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

Shoulder milling

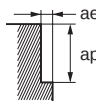
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
2	180	29000	2900	3	0.6	40	6400	230	3	0.2
3	180	19000	3000	4.5	0.9	40	4200	240	4.5	0.3
4	180	14000	3000	6	1.2	40	3200	240	6	0.4
5	180	11000	3000	7.5	1.5	40	2500	240	7.5	0.5
6	180	9500	3000	9	1.8	40	2100	250	9	0.6
8	180	7200	3000	12	2.4	40	1600	260	12	0.8
10	180	5700	2700	15	3	40	1300	290	15	1
12	180	4800	2300	18	3.6	40	1100	280	18	1.2
16	180	3600	1900	24	4.8	40	800	200	24	1.6
20	180	2900	1600	30	6	40	640	160	30	2
25	180	2300	1300	37	7.5	40	510	130	37.5	2.5

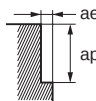
Depth of cut



General-purpose conditions

Work Material	Copper, Copper alloy					Heat resistant alloy				
						Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
2	140	22000	1500	3	0.6	30	4800	110	3	0.2
3	140	15000	1600	4.5	0.9	30	3200	120	4.5	0.3
4	140	11000	1600	6	1.2	30	2400	120	6	0.4
5	140	8900	1600	7.5	1.5	30	1900	120	7.5	0.5
6	140	7400	1600	9	1.8	30	1600	130	9	0.6
8	140	5600	1600	12	2.4	30	1200	130	12	0.8
10	140	4500	1400	15	3	30	950	140	15	1
12	140	3700	1200	18	3.6	30	800	140	18	1.2
16	140	2800	1000	24	4.8	30	600	100	24	1.6
20	140	2200	780	30	6	30	480	81	30	2
25	140	1800	670	37.5	7.5	30	380	64	37.5	2.5

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SMART MIRACLE END MILLS

VQMHV RB

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■ Slotting

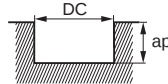
When machine rigidity, work material rigidity and chip discharge are enough, please select the high efficiency cutting conditions.

When either machine rigidity, work material rigidity or chip discharge are not enough, please select the general-purpose cutting conditions.

High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
2	150	24000	1200	2	120	19000	610	2	100	16000	640	2	60	9500	300	1	180	29000	1500	2	30	4800	130	0.6
3	150	16000	1500	3	120	13000	730	3	100	11000	660	3	60	6400	360	1.5	180	19000	1700	3	30	3200	150	0.9
4	150	12000	1900	4	120	9500	910	4	100	8000	700	4	60	4800	460	2	180	14000	2200	4	30	2400	170	1.2
5	150	9500	1900	5	120	7600	910	5	100	6400	720	5	60	3800	460	2.5	180	11000	2200	5	30	1900	170	1.5
6	150	8000	1900	6	120	6400	1000	6	100	5300	740	6	60	3200	510	3	180	9500	2300	6	30	1600	180	1.8
8	150	6000	1700	8	120	4800	960	8	100	4000	800	8	60	2400	480	4	180	7200	2000	8	30	1200	190	2.4
10	150	4800	1500	10	120	3800	840	10	100	3200	900	10	60	1900	420	5	180	5700	1800	10	30	950	210	3
12	150	4000	1300	12	120	3200	770	12	100	2700	860	12	60	1600	380	6	180	4800	1500	12	30	800	200	3.6
16	150	3000	1100	12	120	2400	670	12	100	2000	640	12	60	1200	340	8	180	3600	1300	12	30	600	150	4.8
20	150	2400	860	12	120	1900	530	12	100	1600	510	12	60	950	270	10	180	2900	1000	12	30	480	120	6
25	150	1900	760	12	120	1500	420	12	100	1300	420	12	60	760	210	12	180	2300	920	12	30	380	100	7.5

Depth of cut

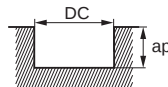


DC : Dia.

General-purpose conditions

Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy				Hardened stainless steel, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloy			
	AISI 1045, AISI 4140, ASTM A36, AISI 1010				AISI P21, AISI P20, AISI 4340, SKD, SKT				AISI 304, AISI 316, Ti-6Al-4V				AISI 630, AISI 631 15-5PH, 17-4PH								Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
2	100	16000	550	2	80	13000	270	2	60	9500	250	2	50	8000	170	1	120	19000	650	2	25	4000	74	0.6
3	100	11000	670	3	80	8500	310	3	60	6400	250	3	50	5300	200	1.5	120	13000	790	3	25	2700	86	0.9
4	100	8000	840	4	80	6400	410	4	60	4800	280	4	50	4000	250	2	120	9500	1000	4	25	2000	93	1.2
5	100	6400	840	5	80	5100	410	5	60	3800	280	5	50	3200	250	2.5	120	7600	1000	5	25	1600	95	1.5
6	100	5300	840	6	80	4200	440	6	60	3200	300	6	50	2700	290	3	120	6400	1000	6	25	1300	96	1.8
8	100	4000	740	8	80	3200	420	8	60	2400	320	8	50	2000	260	4	120	4800	890	8	25	990	100	2.4
10	100	3200	680	10	80	2500	360	10	60	1900	350	10	50	1600	230	5	120	3800	800	10	25	800	120	3
12	100	2700	570	12	80	2100	330	12	60	1600	340	12	50	1300	210	6	120	3200	680	12	25	660	110	3.6
16	100	2000	480	12	80	1600	300	12	60	1200	250	12	50	990	180	8	120	2400	570	12	25	500	84	4.8
20	100	1600	380	12	80	1300	240	12	60	950	200	12	50	800	150	10	120	1900	450	12	25	400	68	6
25	100	1300	340	12	80	1000	180	12	60	760	160	12	50	640	120	12	120	1500	400	12	25	320	50	7.5

Depth of cut



DC : Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

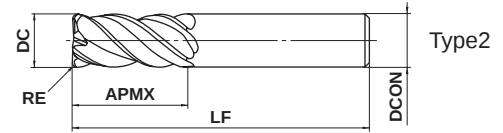
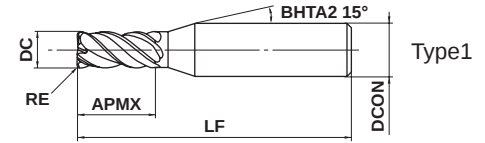
Note 4) When the depth of cut is smaller than shown the feed rate can be increased.

VQMHVRB – Inch sizes

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes



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



.0080" ≤ RE ≤ .1200"				
±.0006"				
DC < .5000"	DC = .5000"			
0 - .0008"	0 - .0012"			
.2500" ≤ DCON ≤ .3750"	DCON = .5000"			
0 - .00035"	0 - .00043"			

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials and for long overhang applications.

(inch)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVRBD1/8R008	.1250	.0080	.3130	2.0	.2500	4	●	1
VQMHVRBD1/8R010	.1250	.0100	.3130	2.0	.2500	4	●	1
VQMHVRBD3/16R010	.1875	.0100	.4375	2.0	.2500	4	●	1
VQMHVRBD3/16R015	.1875	.0150	.4375	2.0	.2500	4	●	1
VQMHVRBD3/16R020	.1875	.0200	.4375	2.0	.2500	4	●	1
VQMHVRBD3/16R030	.1875	.0300	.4375	2.0	.2500	4	●	1
VQMHVRBD1/4R008	.2500	.0080	.6250	2.5	.2500	4	●	2
VQMHVRBD1/4R010	.2500	.0100	.6250	2.5	.2500	4	●	2
VQMHVRBD1/4R015	.2500	.0150	.6250	2.5	.2500	4	●	2
VQMHVRBD1/4R020	.2500	.0200	.6250	2.5	.2500	4	●	2
VQMHVRBD1/4R030	.2500	.0300	.6250	2.5	.2500	4	●	2
VQMHVRBD5/16R010	.3125	.0100	.7500	2.75	.3125	4	●	2
VQMHVRBD5/16R015	.3125	.0150	.7500	2.75	.3125	4	●	2
VQMHVRBD5/16R020	.3125	.0200	.7500	2.75	.3125	4	●	2
VQMHVRBD5/16R030	.3125	.0300	.7500	2.75	.3125	4	●	2
VQMHVRBD5/16R060	.3125	.0600	.7500	2.75	.3125	4	●	2
VQMHVRBD3/8R010	.3750	.0100	.8750	3.0	.3750	4	●	2
VQMHVRBD3/8R015	.3750	.0150	.8750	3.0	.3750	4	●	2
VQMHVRBD3/8R020	.3750	.0200	.8750	3.0	.3750	4	●	2
VQMHVRBD3/8R030	.3750	.0300	.8750	3.0	.3750	4	●	2
VQMHVRBD3/8R040	.3750	.0400	.8750	3.0	.3750	4	●	2
VQMHVRBD3/8R060	.3750	.0600	.8750	3.0	.3750	4	●	2
VQMHVRBD3/8R090	.3750	.0900	.8750	3.0	.3750	4	●	2
VQMHVRBD1/2R010	.5000	.0100	1.1250	3.5	.5000	4	●	2
VQMHVRBD1/2R015	.5000	.0150	1.1250	3.5	.5000	4	●	2
VQMHVRBD1/2R020	.5000	.0200	1.1250	3.5	.5000	4	●	2
VQMHVRBD1/2R030	.5000	.0300	1.1250	3.5	.5000	4	●	2
VQMHVRBD1/2R060	.5000	.0600	1.1250	3.5	.5000	4	●	2
VQMHVRBD1/2R090	.5000	.0900	1.1250	3.5	.5000	4	●	2
VQMHVRBD1/2R120	.5000	.1200	1.1250	3.5	.5000	4	●	2

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

● : USA Stock

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHV RB – Inch sizes

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes

CARBIDE

RECOMMENDED CUTTING CONDITIONS

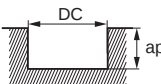
Shoulder milling

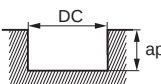
DC (inch)	Carbon steel (–30HRC) AISI 1035, AISI 1050, ASTM 283						Alloy steel, Pre-hardened steel AISI H13, AISI 4140, AISI P21						Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.					
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/8	15000	102.0	12000	55.1	.19	.038	12000	49.1	10000	27.2	.19	.038	10000	34.6	8000	18.1	.19	.038
3/16	10000	99.2	8000	51.2	.28	.056	8000	50.4	6700	28.0	.28	.056	6700	35.3	5300	18.5	.28	.056
1/4	7500	99.2	6000	51.2	.38	.075	6000	52.0	5000	28.7	.38	.075	5000	47.2	4000	24.8	.38	.075
5/16	6000	99.2	4800	51.2	.47	.094	4800	52.9	4000	29.1	.47	.094	4000	47.2	3200	24.8	.47	.094
3/8	5000	90.6	4000	47.2	.56	.11	4000	49.1	3300	26.8	.56	.11	3300	49.4	2700	26.8	.56	.11
1/2	3800	74.8	3000	39.0	.75	.15	3000	43.5	2500	24.0	.75	.15	2500	43.3	2000	22.8	.75	.15
Depth of cut																		

DC (inch)	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.						Copper, Copper alloy						Heat resistant alloy Inconel718 etc.					
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	Width of cut ae (inch)
	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)			Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		
1/8	7500	30.7	7000	18.9	.19	.025	18000	122.0	14000	63.0	.19	.038	4000	9.5	3000	4.7	.19	.013
3/16	5000	31.5	4700	19.7	.28	.038	12000	119.0	9400	63.0	.28	.056	2700	9.8	2000	4.7	.28	.019
1/4	3800	32.9	3500	20.1	.38	.050	9000	119.0	7000	63.0	.38	.075	2000	10.1	1500	5.1	.38	.025
5/16	3000	33.1	2800	20.5	.47	.063	7200	119.0	5600	63.0	.47	.094	1600	10.1	1200	5.1	.47	.031
3/8	2500	30.7	2300	18.5	.56	.075	6000	109.0	4700	55.1	.56	.11	1300	10.6	1000	5.5	.56	.038
1/2	1900	27.5	1800	17.3	.75	.10	4500	88.6	3500	47.2	.75	.15	1000	10.1	750	5.1	.75	.050
Depth of cut																		

- Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
- Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.
- Note 3) Higher feeds and speeds can be used for smaller depth of cut.
- Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

Slotting

Work Material	Carbon steel (–30HRC)					Alloy steel, Pre-hardened steel					Austenitic stainless steel, Titanium alloy				
	AISI 1035, AISI 1050, ASTM 283					AISI H13, AISI 4140, AISI P21					AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.				
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	
1/8	15000	59.1	10000	26.0	.13	12000	30.2	8000	13.4	.13	10000	26.8	6000	10.6	.13
3/16	10000	75.6	6700	33.5	.19	8000	35.9	5300	15.7	.19	6700	28.5	4000	11.4	.19
1/4	7500	74.4	5000	32.7	.25	6000	39.7	4000	17.3	.25	5000	29.1	3000	11.4	.25
5/16	6000	66.1	4000	29.1	.31	4800	37.8	3200	16.5	.31	4000	31.5	2400	12.6	.31
3/8	5000	61.4	3300	26.8	.38	4000	34.0	2700	15.0	.38	3300	33.8	2000	13.4	.38
1/2	3800	47.9	2500	20.9	.50	3000	29.8	2000	13.0	.50	2500	31.5	1500	12.6	.50
Depth of cut															
	DC : Dia.														

Work Material	Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy					Copper, Copper alloy					Heat resistant alloy				
	ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.										Inconel718 etc.				
	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)	High speed cutting		General purpose cutting		Depth of cut ap (inch)
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	
1/8	6000	15.1	5000	8.3	.063	18000	70.9	12000	31.1	.13	3000	6.14	2500	3.4	.038
3/16	4000	18.3	3300	9.8	.094	12000	90.7	8000	39.4	.19	2000	6.80	1700	3.8	.056
1/4	3000	19.8	2500	11.0	.13	9000	89.3	6000	39.4	.25	1500	7.09	1300	3.9	.075
5/16	2400	18.9	2000	10.2	.16	7200	79.4	4800	35.0	.31	1200	7.56	1000	4.3	.094
3/8	2000	17.0	1700	9.4	.19	6000	73.7	4000	32.3	.38	1000	8.19	840	4.7	.11
1/2	1500	14.9	1300	8.7	.25	4500	56.7	3000	24.8	.50	750	7.56	630	4.3	.15
Depth of cut															
	DC : Dia.														

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.

Note 3) Higher feeds and speeds can be used for smaller depth of cut.

Note 4) Vibration can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.

SMART MIRACLE END MILLS

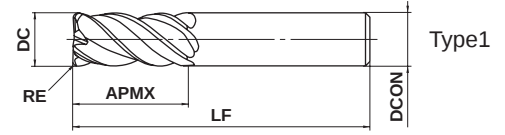
VQMHVRFB

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes (for finishing)



CARBIDE

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



Type1



$0.3 \leq RE \leq 3$				
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± 0.015				
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$DC \leq 12$	$DC > 12$			
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0	0			
$- 0.02$	$- 0.03$			



$DCON = 6$	$8 \leq DCON \leq 10$	$12 \leq DCON \leq 16$		
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0	0	0		
$- 0.008$	$- 0.009$	$- 0.011$		

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials.
- With the special substrate, suitable for finishing of heat resistance alloy, etc.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVRBFD0600R030	6	0.3	13	50	6	4	●	1
VQMHVRBFD0600R050	6	0.5	13	50	6	4	●	1
VQMHVRBFD0600R100	6	1	13	50	6	4	●	1
VQMHVRBFD0800R050	8	0.5	19	60	8	4	●	1
VQMHVRBFD0800R100	8	1	19	60	8	4	●	1
VQMHVRBFD1000R030	10	0.3	22	70	10	4	●	1
VQMHVRBFD1000R050	10	0.5	22	70	10	4	●	1
VQMHVRBFD1000R100	10	1	22	70	10	4	●	1
VQMHVRBFD1000R200	10	2	22	70	10	4	●	1
VQMHVRBFD1200R100	12	1	26	75	12	4	●	1
VQMHVRBFD1200R200	12	2	26	75	12	4	●	1
VQMHVRBFD1200R300	12	3	26	75	12	4	●	1
VQMHVRBFD1600R100	16	1	35	90	16	4	★	1
VQMHVRBFD1600R200	16	2	35	90	16	4	★	1

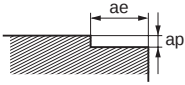
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Hardened stainless steel, Cobalt chromium alloy					Copper, Copper alloy					Heat resistant alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 630, AISI 631, 15-5PH, 17-4PH										Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
6	150	8000	2600	9	0.3	120	6400	1300	9	0.3	75	4000	800	9	0.3	180	9500	3000	9	0.3	40	2100	250	9	0.18
8	150	6000	2500	12	0.4	120	4800	1300	12	0.4	75	3000	840	12	0.4	180	7200	3000	12	0.4	40	1600	260	12	0.24
10	150	4800	2300	15	0.5	120	3800	1200	15	0.5	75	2400	770	15	0.5	180	5700	2700	15	0.5	41	1300	290	15	0.3
12	150	4000	1900	18	0.6	120	3200	1200	18	0.6	75	2000	720	18	0.6	180	4800	2300	18	0.6	41	1100	280	18	0.36
16	150	3000	1600	24	0.8	120	2400	960	24	0.8	75	1500	600	24	0.8	180	3600	1900	24	0.8	40	800	200	24	0.48
Depth of cut																									

Bottom face milling

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Hardened stainless steel, Cobalt chromium alloy					Copper, Copper alloy					Heat resistant alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340, SKD, SKT					AISI 630, AISI 631, 15-5PH, 17-4PH										Inconel718				
DC (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
6	110	5800	1400	0.3	4.8	90	4800	770	0.3	4.8	55	2900	460	0.3	4.8	130	6900	1700	0.3	4.8	30	1600	180	0.18	4.8
8	110	4400	1200	0.4	6.4	90	3600	720	0.4	6.4	55	2200	440	0.4	6.4	130	5200	1500	0.4	6.4	30	1200	190	0.24	6.4
10	110	3500	1100	0.5	8	90	2900	640	0.5	8	55	1800	400	0.5	8	130	4100	1300	0.5	8	30	950	210	0.3	8
12	110	2900	930	0.6	9.6	90	2400	580	0.6	9.6	55	1500	360	0.6	9.6	130	3400	1100	0.6	9.6	30	800	200	0.36	9.6
16	110	2200	790	0.8	12.8	90	1800	500	0.8	12.8	55	1100	310	0.8	12.8	130	2600	940	0.8	12.8	30	600	150	0.48	12.8
Depth of cut																									

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

Note 2) Effective cutting of stainless steel, titanium alloy and heat-resistant alloy etc. can be achieved with the use of emulsion.

Note 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.

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

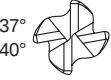
I

SOLID END MILLS

SMART MIRACLE END MILLS

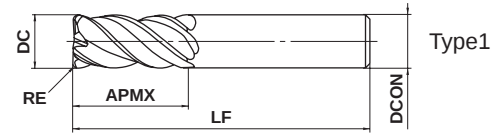
VQMHVRFB – Inch sizes

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes (for finishing)



CARBIDE

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



Type1



.2500"≤RE≤.5000"				
±.0006"				



DC<.5000"	DC=.5000"			
0 - .0008"	0 - .0012"			



.250"≤DCON≤.375"	DCON=.500"			
0 - .00035"	0 - .00043"			

- Smart Miracle vibration control end mill achieving stable machining of difficult-to-cut materials.
- With the special substrate, suitable for finishing of heat resistance alloy, etc.

(inch)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVRFBFD1/4R015	.2500	.0150	.6250	2.5	.2500	4	●	1
VQMHVRFBFD1/4R030	.2500	.0300	.6250	2.5	.2500	4	●	1
VQMHVRFBFD5/16R015	.3125	.0150	.7500	2.75	.3125	4	●	1
VQMHVRFBFD5/16R030	.3125	.0300	.7500	2.75	.3125	4	●	1
VQMHVRFBFD5/16R060	.3125	.0600	.7500	2.75	.3125	4	●	1
VQMHVRFBFD3/8R015	.3750	.0150	.8750	3.0	.3750	4	●	1
VQMHVRFBFD3/8R030	.3750	.0300	.8750	3.0	.3750	4	●	1
VQMHVRFBFD3/8R060	.3750	.0600	.8750	3.0	.3750	4	●	1
VQMHVRFBFD3/8R090	.3750	.0900	.8750	3.0	.3750	4	●	1
VQMHVRFBFD1/2R030	.5000	.0300	1.1250	3.5	.5000	4	●	1
VQMHVRFBFD1/2R060	.5000	.0600	1.1250	3.5	.5000	4	●	1
VQMHVRFBFD1/2R090	.5000	.0900	1.1250	3.5	.5000	4	●	1
VQMHVRFBFD1/2R120	.5000	.1200	1.1250	3.5	.5000	4	●	1

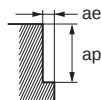
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

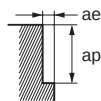
Work Material	Carbon steel (—30HRC)				Alloy steel, Pre-hardened steel				Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy			
	AISI 1035, AISI 1050, ASTM 283				AISI H13, AISI 4140, AISI P21				ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.			
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/4	7500	94.5	.38	.013	6000	47.2	.38	.013	3800	29.9	.38	.013
5/16	6000	99.2	.47	.016	4800	52.9	.47	.016	3000	33.1	.47	.016
3/8	5000	94.5	.56	.019	4000	50.4	.56	.019	2500	31.5	.56	.019
1/2	3800	71.8	.75	.025	3000	42.5	.75	.025	1900	26.9	.75	.025

Depth of cut



Work Material	Copper, Copper alloy				Heat resistant alloy			
					Inconel718 etc.			
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/4	9000	113	.38	.013	2000	9.5	.38	.008
5/16	7200	119	.47	.016	1600	10.1	.47	.009
3/8	6000	113	.56	.019	1300	11.5	.56	.011
1/2	4500	85.0	.75	.025	1000	10.1	.75	.015

Depth of cut



- Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
- Note 2) Effective cutting of stainless steel, titanium alloy, and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.
- Note 3) If the depth of cut is smaller than this table, feed rate can be increased.
- Note 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 work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

VQMHVRF – Inch sizes

Corner radius, Medium cutting length, 4 flute, Irregular helix flutes (for finishing)

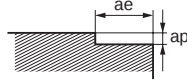
CARBIDE

RECOMMENDED CUTTING CONDITIONS

■ Face milling

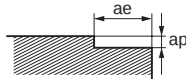
Work Material	Carbon steel (–30HRC)				Alloy steel, Pre-hardened steel				Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy			
	AISI 1035, AISI 1050, ASTM 283				AISI H13, AISI 4140, AISI P21				ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.			
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/4	5500	52.0	.013	.2	4500	28.3	.013	.2	2800	17.6	.013	.2
5/16	4400	48.5	.016	.25	3600	28.3	.016	.25	2200	17.3	.016	.25
3/8	3700	46.6	.019	.3	3000	26.0	.019	.3	1800	15.6	.019	.3
1/2	2800	35.3	.025	.4	2300	21.7	.025	.4	1400	13.2	.025	.4

Depth of cut



Work Material	Copper, Copper alloy				Heat resistant alloy			
					Inconel718 etc.			
DC (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/4	6500	61.4	.013	.2	1500	6.6	.008	.2
5/16	5200	57.3	.016	.25	1200	7.6	.009	.25
3/8	4300	54.2	.019	.3	1000	8.8	.011	.3
1/2	3300	41.6	.025	.4	750	7.6	.015	.4

Depth of cut



- Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
- Note 2) Effective cutting of stainless steel, titanium alloy, and heat-resistant alloy can be achieved with the use of water-soluble cutting fluid.
- Note 3) Higher feeds and speeds can be used for smaller depth of cut.
- Note 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 work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SOLID END MILLS

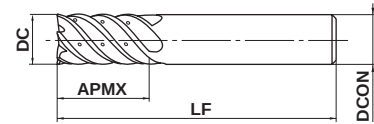
VQ6MHVCH NEW

End mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple thru-coolant



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

CoolStar



Type1



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	

- Vibration control end mill with multiple thru-coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQ6MHVCHD1000	10	22	70	10	6	●	1
VQ6MHVCHD1200	12	26	75	12	6	●	1
VQ6MHVCHD1600	16	32	90	16	6	●	1
VQ6MHVCHD2000	20	38	100	20	6	●	1

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

SMART MIRACLE END MILLS

VQ6MHVRBCH NEW

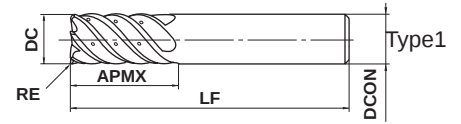
Corner radius, Medium cut length, 6 flute, Irregular helix flutes, With multiple thru-coolant



CARBIDE

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

CoolStar



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

	$0.5 \leq RE \leq 4$				
	± 0.015				
	$DC \leq 12$	$DC > 12$			
	$\begin{matrix} 0 \\ - 0.020 \end{matrix}$	$\begin{matrix} 0 \\ - 0.030 \end{matrix}$			
	$DCON=10$	$DCON=12$	$DCON=16$	$DCON=20$	
	$\begin{matrix} 0 \\ - 0.009 \end{matrix}$	$\begin{matrix} 0 \\ - 0.011 \end{matrix}$	$\begin{matrix} 0 \\ - 0.011 \end{matrix}$	$\begin{matrix} 0 \\ - 0.013 \end{matrix}$	

- Vibration control corner radius end mill with multiple thru-coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQ6MHVRBCHD1000R050	10	0.5	22	70	10	6	●	1
VQ6MHVRBCHD1000R100	10	1	22	70	10	6	●	1
VQ6MHVRBCHD1200R050	12	0.5	26	75	12	6	●	1
VQ6MHVRBCHD1200R100	12	1	26	75	12	6	●	1
VQ6MHVRBCHD1600R100	16	1	32	90	16	6	●	1
VQ6MHVRBCHD1600R300	16	3	32	90	16	6	●	1
VQ6MHVRBCHD1600R400	16	4	32	90	16	6	●	1
VQ6MHVRBCHD2000R100	20	1	38	100	20	6	●	1
VQ6MHVRBCHD2000R300	20	3	38	100	20	6	●	1
VQ6MHVRBCHD2000R400	20	4	38	100	20	6	●	1

VQ6MHVCH NEW

End mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple thru-coolant

VQ6MHVRBCH NEW

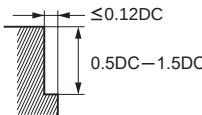
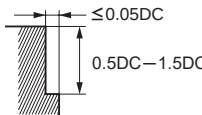
Corner radius, Medium cut length, 6 flute, Irregular helix flutes, With multiple thru-coolant

CARBIDE

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

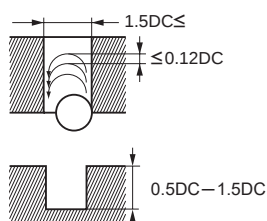
(inch)

Work Material		Alloy Steel, Tool Steel, Pre-hardened Steel		Austenitic Stainless Steel(≤200HB) Titanium Alloy		Copper, Copper Alloy		Heat Resistant Alloy	
		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 316, Ti-6AL-4V				Inconel 718	
DC		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)
(mm)	(inch)								
10	.394	—	—	4800	78.7	—	—	1300	10.2
12	.472	—	—	4000	78.7	—	—	1100	9.1
16	.630	4000	86.6	3000	63.0	2400	55.1	800	7.1
20	.787	3200	74.8	2400	55.1	1900	43.3	640	5.9
Depth of Cut									

DC : Dia.

Trochoid milling

(inch)

Work Material		Alloy Steel, Tool Steel, Pre-hardened Steel		Austenitic Stainless Steel(≤200HB) Titanium Alloy	
		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 316, Ti-6AL-4V	
DC		Revolution (min ⁻¹)	Table feed (IPM)	Revolution (min ⁻¹)	Table feed (IPM)
(mm)	(inch)				
10	.394	—	—	4800	55.1
12	.472	—	—	4000	47.2
16	.630	4000	63.0	3000	43.3
20	.787	3200	55.1	2400	35.4
Depth of Cut					

DC : Dia.

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

Note 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 work material installation is very low, then vibration can occur. In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

VQT5MVRB

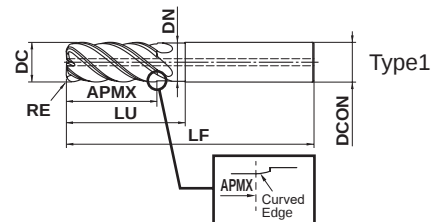
NEW

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



CARBIDE

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



RE				
±0.02				



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



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

● Flute geometry suitable for slot milling.

● The sharp corner R edges provide long tool life in machining of titanium alloys.

(mm)

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQT5MVRB160R300N048C	16	3	34	48	15.5	100	16	5	●	1
VQT5MVRB200R400N060C	20	4	44	60	19.5	120	20	5	●	1
VQT5MVRB250R400N075C	25	4	54	75	24.5	140	25	5	●	1

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.

Note 2) Non-standard corner R sizes are available by special orders. Contact us for details.

Special Corner R Size Range

(mm)

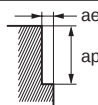
DC	RE
16	1-5
20, 25	1-6

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

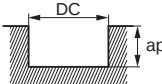
Shoulder milling

Overhang Length DC×3 (DC=Dia.) (inch)

Work Material		Austenitic stainless steel ($\leq 200\text{HB}$), Titanium alloy				
		AISI 304, AISI 316, Ti-6Al-4V etc.				
DC		Cutting speed (SFM)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap	Depth of cut ae
(mm)	(inch)					
16	.630	230	1400	27.6	1.260	.094
20	.787	230	1100	21.7	1.575	.118
25	.984	230	890	17.3	1.969	.150
Depth of Cut						

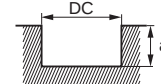
Slot milling

Depth of Cut DC×1 (inch)

Work Material		Austenitic stainless steel ($\leq 200\text{HB}$), Titanium alloy			
		AISI 304, AISI 316, Ti-6Al-4V etc.			
DC		Cutting speed (SFM)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap
(mm)	(inch)				
16	.630	195	1200	16.5	.630
20	.787	195	950	13.0	.787
25	.984	165	640	8.7	.984
Depth of Cut					

DC : Dia.

Depth of Cut DC×2 (inch)

Work Material		Austenitic stainless steel ($\leq 200\text{HB}$), Titanium alloy			
		AISI 304, AISI 316, Ti-6Al-4V etc.			
DC		Cutting speed (SFM)	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap
(mm)	(inch)				
16	.630	195	1200	9.4	1.260
20	.787	195	950	7.5	1.575
25	.984	165	640	5.1	1.969
Depth of Cut					

DC : Dia.

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.

When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.

Note 2) When cutting titanium alloy, the use of water-soluble cutting fluid is effective.

Note 3) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is poor, vibration or abnormal sound can occur.

In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.

Note 4) If the depth of cut is smaller, the revolution and the feed rate can be increased.

Note 5) For slot milling, use a chuck with high clamping force.

SMART MIRACLE END MILLS

VQT6UR NEW

Barrel, Medium cut length, 6 flute



CARBIDE

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



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



RE1≤4	RE2≤100			
±0.01	±0.01			
DCON≤10	DCON=12			
$\begin{smallmatrix} 0 \\ -0.009 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.011 \end{smallmatrix}$			



- Nose and tangential form part has two distinct radii.
- Irregular pitch design prevents chattering.

(mm)

Order Number	DC	RE1	RE2	APMX	LF	DCON	No. of Flutes	Stock	Type
VQT6URR020R075S08	8	2	75	21	90	8	6	●	1
VQT6URR020R085S10	10	2	85	26	100	10	6	●	1
VQT6URR030R075S10	10	3	75	22	100	10	6	●	1
VQT6URR040R100S12	12	4	100	25	110	12	6	●	1

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

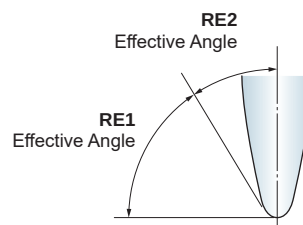
RECOMMENDED CUTTING CONDITIONS

Effective Angle

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

Order Number	Nose Radius		Tangential Form Radius	
	RE1	Effective Angle	RE2	Effective Angle
VQT6URR020R075S08	.079 (2mm)	76.6°	2.953 (75mm)	13.4°
VQT6URR020R085S10	.079 (2mm)	74.5°	3.346 (85mm)	15.5°
VQT6URR030R075S10	.118 (3mm)	76.4°	2.953 (75mm)	13.6°
VQT6URR040R100S12	.157 (4mm)	78.3°	3.937 (100mm)	11.7°

(inch)



Side Milling with the Use of the Tangential Form Radius (RE2)

(inch)

Work Material				Mild steel ($\leq 180\text{HB}$) Carbon steel, Alloy steel (180—280HB)			Austenitic stainless steel ($\leq 200\text{HB}$) Titanium alloy			Aluminum alloy (Si < 5%)		
				Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap	Revolution (min ⁻¹)	Table feed (IPM)	Depth of cut ap
DC	RE2											
mm	inch	mm	inch									
8	.315	75	2.953	8000	94.5	.002—.012	3200	30.3	.002—.012	16000	189.0	.002—.012
10	.394	85	3.346	6400	74.8	.002—.012	2500	23.6	.002—.012	13000	153.5	.002—.012
10	.394	75	2.953	6400	74.8	.002—.012	2500	23.6	.002—.012	13000	153.5	.002—.012
12	.472	100	3.937	5300	63.0	.002—.012	2100	19.7	.002—.012	11000	129.9	.002—.012

Depth of Cut Calculation Table Based on Tangential Form Radius (RE2) and Cusp Height (h)

(inch)

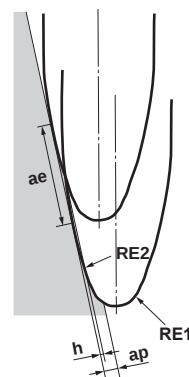
Order Number	RE2	Cusp Height h	.000004	.000012	.000020	.000031	.000039	.000118	.000197	.000315
VQT6URR020R075S08	2.953 (75mm)	Depth of Cut ap	.0096	.0167	.0216	.0273	.0305	.0528	.0682	.0863
VQT6URR030R075S10	2.953 (75mm)		.0096	.0167	.0216	.0273	.0305	.0528	.0682	.0863
VQT6URR020R085S10	3.346 (85mm)		.0103	.0178	.0230	.0291	.0325	.0562	.0726	.0918
VQT6URR040R100S12	3.937 (100mm)		.0111	.0193	.0249	.0315	.0352	.0610	.0787	.0996

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.

When measuring the tool length, an internal contact/non-electric type or laser tool setter is recommended.

Note 2) Recommended for finish cutting only.

Note 3) The tool contact part differs between the nose radius and tangential form radius depending on machining geometries and tilt angles. Select suitable cutting conditions according to tool contact parts.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

SMART MIRACLE END MILLS

VQT6UR NEW

Barrel, Medium cut length, 6 flute

CARBIDE

RECOMMENDED CUTTING CONDITIONS

■ Fillet Milling with the Use of the Nose Radius (RE1)

(inch)

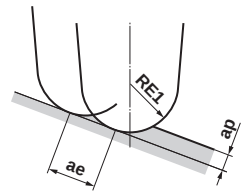
Work Material				Mild Steel ($\leq 180\text{HB}$) Carbon Steel, Alloy Steel (180—280HB)				Austenitic Stainless Steel ($\leq 200\text{HB}$) Titanium Alloy				Aluminum Alloy (Si < 5%)			
DC		RE1		Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap	Depth of cut ae	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap	Depth of cut ae	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap	Depth of cut ae
mm	inch	mm	inch												
8	.315	2	.079	16000	94.5	.016	.039	6400	22.8	.016	.039	32000	189.0	.016	.039
10	.394	2	.079	16000	94.5	.016	.039	6400	22.8	.016	.039	32000	189.0	.016	.039
10	.394	3	.118	11000	66.9	.024	.059	4200	15.0	.024	.059	21000	126.0	.024	.059
12	.472	4	.157	8000	47.2	.031	.079	3200	11.4	.031	.079	16000	94.5	.031	.079

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.

When measuring the tool length, an internal contact/non-electric type or laser tool setter is recommended.

Note 2) Recommended for finish cutting only.

Note 3) The tool contact part differs between the nose radius and tangential form radius depending on machining geometries and tilt angles. Select suitable cutting conditions according to tool contact parts.



ae: Pick Feed

SOLID END MILLS

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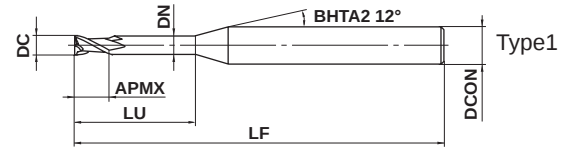
IMPACT MIRACLE END MILLS

VF2XL

End mill, 2 flute, Long neck



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



$0.1 \leq DC \leq 3$

0
- 0.020



$4 \leq DCON \leq 6$

0
- 0.008

● 2 flute long neck end mill for high-speed machining of hardened steels.

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2XLD0010N005	0.1	0.15	0.5	0.085	45	4	2	★	1
VF2XLD0020N006	0.2	0.3	0.6	0.17	45	4	2	★	1
VF2XLD0020N010	0.2	0.3	1	0.17	45	4	2	★	1
VF2XLD0020N015	0.2	0.3	1.5	0.17	45	4	2	★	1
VF2XLD0030N010	0.3	0.5	1	0.27	45	4	2	★	1
VF2XLD0030N020	0.3	0.5	2	0.27	45	4	2	★	1
VF2XLD0030N030	0.3	0.5	3	0.27	45	4	2	★	1
VF2XLD0040N010	0.4	0.6	1	0.36	45	4	2	★	1
VF2XLD0040N020	0.4	0.6	2	0.36	45	4	2	★	1
VF2XLD0040N040	0.4	0.6	4	0.36	45	4	2	★	1
VF2XLD0050N020	0.5	0.8	2	0.46	45	4	2	★	1
VF2XLD0050N040	0.5	0.8	4	0.46	45	4	2	★	1
VF2XLD0050N060	0.5	0.8	6	0.46	45	4	2	★	1
VF2XLD0060N020	0.6	0.9	2	0.56	45	4	2	★	1
VF2XLD0060N040	0.6	0.9	4	0.56	45	4	2	★	1
VF2XLD0060N060	0.6	0.9	6	0.56	45	4	2	★	1
VF2XLD0080N040	0.8	1.2	4	0.76	45	4	2	★	1
VF2XLD0080N060	0.8	1.2	6	0.76	45	4	2	★	1
VF2XLD0080N080	0.8	1.2	8	0.76	50	4	2	★	1
VF2XLD0080N100	0.8	1.2	10	0.76	50	4	2	★	1
VF2XLD0100N040	1	1.5	4	0.94	50	4	2	★	1
VF2XLD0100N060	1	1.5	6	0.94	50	4	2	★	1
VF2XLD0100N080	1	1.5	8	0.94	50	4	2	★	1
VF2XLD0100N100	1	1.5	10	0.94	50	4	2	★	1
VF2XLD0100N120	1	1.5	12	0.94	50	4	2	★	1
VF2XLD0150N060	1.5	2.3	6	1.44	50	4	2	★	1
VF2XLD0150N080	1.5	2.3	8	1.44	50	4	2	★	1
VF2XLD0150N100	1.5	2.3	10	1.44	50	4	2	★	1
VF2XLD0150N120	1.5	2.3	12	1.44	50	4	2	★	1
VF2XLD0150N160	1.5	2.3	16	1.44	60	4	2	★	1
VF2XLD0200N060	2	3	6	1.9	50	4	2	★	1

★ : Stocked in Japan

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF2XL

End mill, 2 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

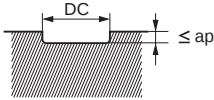
ROUGHING

—

SOLID END MILLS

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2XLD0200N080	2	3	8	1.9	50	4	2	★	1
VF2XLD0200N100	2	3	10	1.9	50	4	2	★	1
VF2XLD0200N120	2	3	12	1.9	50	4	2	★	1
VF2XLD0200N160	2	3	16	1.9	60	4	2	★	1
VF2XLD0200N200	2	3	20	1.9	60	4	2	★	1
VF2XLD0300N120	3	4.5	12	2.9	50	6	2	★	1
VF2XLD0300N160	3	4.5	16	2.9	60	6	2	★	1
VF2XLD0300N200	3	4.5	20	2.9	60	6	2	★	1

RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
		Revolution (min ⁻¹)	Table feed		Depth of cut per pass ap (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut per pass ap (mm)
DC (mm)	LU (mm)		(mm/min)	(IPM)			(mm/min)	(IPM)	
0.1	0.5	40000	100	3.9	0.002	40000	80	3.1	0.001
0.2	0.6	40000	400	15.7	0.004	40000	360	14.2	0.004
	1	40000	300	11.8	0.003	40000	250	9.8	0.002
	1.5	40000	200	7.9	0.002	40000	150	5.9	0.001
0.3	1	40000	500	19.7	0.006	40000	450	17.7	0.004
	2	40000	400	15.7	0.003	38000	350	13.8	0.002
	3	38000	250	9.8	0.002	36000	200	7.9	0.001
0.4	1	40000	800	31.5	0.008	36000	500	19.7	0.006
	2	40000	500	19.7	0.007	30000	350	13.8	0.005
	4	36000	300	11.8	0.004	27000	200	7.9	0.003
0.5	2	40000	800	31.5	0.01	30000	600	23.6	0.009
	4	36000	600	23.6	0.008	27000	450	17.7	0.007
	6	30000	400	15.7	0.005	22000	300	11.8	0.004
0.6	2	40000	1000	39.4	0.015	30000	700	27.6	0.012
	4	36000	800	31.5	0.01	27000	500	19.7	0.01
	6	30000	600	23.6	0.006	22000	350	13.8	0.006
0.8	4	36000	1200	47.2	0.03	27000	900	35.4	0.02
	6	30000	900	35.4	0.02	22000	650	25.6	0.015
	8	24000	600	23.6	0.01	18000	450	17.7	0.008
	10	20000	400	15.7	0.008	15000	300	11.8	0.005
1	4	32000	1600	63.0	0.05	24000	1100	43.3	0.04
	6	32000	1400	55.1	0.04	24000	1000	39.4	0.03
	8	28000	1000	39.4	0.03	21000	750	29.5	0.02
	10	28000	800	31.5	0.02	21000	600	23.6	0.015
	12	24000	500	19.7	0.02	18000	370	14.6	0.01
1.5	6	22000	1200	47.2	0.08	16000	900	35.4	0.06
	8	22000	1100	43.3	0.07	16000	800	31.5	0.05
	10	22000	1000	39.4	0.06	16000	750	29.5	0.04
	12	20000	800	31.5	0.05	15000	600	23.6	0.03
	16	18000	500	19.7	0.03	13000	350	13.8	0.02
2	6	16000	1000	39.4	0.15	12000	750	29.5	0.15
	8	16000	1000	39.4	0.15	12000	750	29.5	0.1
	10	16000	800	31.5	0.1	12000	600	23.6	0.08
	12	16000	800	31.5	0.08	12000	600	23.6	0.06
	16	15000	600	23.6	0.06	11000	450	17.7	0.05
	20	14000	500	19.7	0.05	10000	350	13.8	0.04
3	12	11000	800	31.5	0.2	8200	600	23.6	0.15
	16	11000	600	23.6	0.15	8200	450	17.7	0.15
	20	11000	500	19.7	0.1	8200	350	13.8	0.1
Depth of cut									

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

IMPACT MIRACLE END MILLS

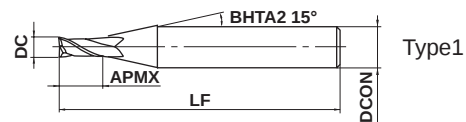
VF2MV

End mill, Medium cut length, 2 flute, Irregular helix flutes



CARBIDE

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



0.5 ≤ DC ≤ 6				
0 - 0.020				
4 ≤ DCON ≤ 6				
0 - 0.008				

● An irregular helix 2 flute square end mill suitable for high-speed machining of hardened steel.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF2MVD0050	0.5	1.3	40	4	2	●	1
VF2MVD0100	1	2.5	40	4	2	●	1
VF2MVD0150	1.5	3.8	40	4	2	●	1
VF2MVD0200	2	5	40	4	2	●	1
VF2MVD0250	2.5	6.3	40	4	2	●	1
VF2MVD0300	3	7.5	50	6	2	●	1
VF2MVD0400	4	10	50	6	2	●	1
VF2MVD0500	5	12.5	50	6	2	●	1
VF2MVD0600	6	15	50	6	2	●	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
	AISI H13, AISI W1—10, AISI P21 etc.				AISI H13 etc.				AISI D2 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)			(mm/min)	(IPM)	
0.5	40000	1000	39.4	0.015	40000	960	37.8	0.015	30000	600	23.6	0.01
1	40000	2000	78.7	0.06	32000	1600	63.0	0.06	16000	550	21.7	0.05
1.5	40000	3000	118.1	0.12	32000	1900	74.8	0.08	10600	500	19.7	0.08
2	30000	3000	118.1	0.18	24000	1900	74.8	0.10	8100	400	15.7	0.1
2.5	24000	2600	102.4	0.25	19000	1600	63.0	0.13	6400	350	13.8	0.13
3	20000	2300	90.6	0.30	16000	1400	55.1	0.15	5400	300	11.8	0.15
4	15000	2000	78.7	0.40	12000	1200	47.2	0.20	4000	240	9.4	0.2
5	12000	1600	63.0	0.50	9000	900	35.4	0.25	3200	190	7.5	0.2
6	10000	1400	55.1	0.60	7000	700	27.6	0.30	2700	160	6.3	0.2
Depth of cut	≤Please refer to the list above for depth of cut. ≤Please refer to the list above for depth of cut. DC : Dia.											

Note 1) When slotting, reduce the revolutions by 50 - 70% and the feed rate by 40 - 60%.

Note 2) For austenitic stainless steel, titanium and heat-resistant alloys, VFMHV is recommended.

Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

IMPACT MIRACLE END MILLS

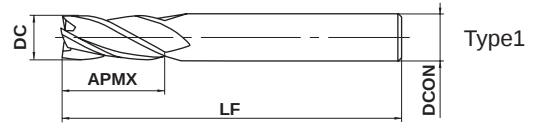
VF4MV

End mill, Medium cut length, 4 flute, Irregular helix flutes



CARBIDE

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



Type1



DC≤12	DC>12			
0 - 0.020	0 - 0.030			
DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● An irregular helix 4 flute square end mill suitable for high-speed machining of hardened steel.

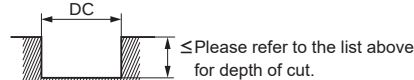
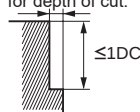
(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF4MVD0600	6	15	50	6	4	●	1
VF4MVD0800	8	20	60	8	4	●	1
VF4MVD1000	10	25	70	10	4	●	1
VF4MVD1200	12	30	90	12	4	●	1
VF4MVD1600	16	40	100	16	4	★	1
VF4MVD2000	20	50	110	20	4	★	1

RECOMMENDED CUTTING CONDITIONS

Work Material	Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
	AISI H13, AISI W1—10, AISI P21 etc.				AISI H13 etc.				AISI D2 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)			(mm/min)	(IPM)	
6	10000	2100	82.7	0.60	7000	1400	55.1	0.30	2700	320	12.6	0.20
8	8000	1500	59.1	0.80	5600	1100	43.3	0.40	2000	240	9.4	0.20
10	6400	1400	55.1	1.00	4500	950	37.4	0.50	1600	210	8.3	0.30
12	5400	1200	47.2	1.00	3800	860	33.9	0.50	1300	160	6.3	0.30
16	2400	550	21.7	3.00	1200	280	11.0	0.80	1000	130	5.1	0.30
20	1900	480	18.9	4.00	1000	240	9.4	1.00	800	100	3.9	0.30

≤Please refer to the list above for depth of cut.



DC : Dia.

Note 1) When slotting, reduce the revolutions by 50 - 70% and the feed rate by 40 - 60%.

Note 2) For austenitic stainless steel, titanium and heat-resistant alloys, VF4MV is recommended.

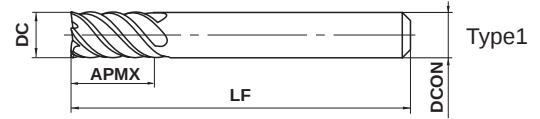
Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VF6MHV

End mill, Medium cut length, 6 flute, Irregular helix flutes



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



DC ≤ 12	DC > 12			
0 - 0.020	0 - 0.030			
DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

- Newly developed irregular helix 6 flute geometry reduces vibrations and achieves high efficiency machining. Suitable for machining of difficult-to-cut materials such as stainless steel, titanium alloy and inconel.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6MHVD0600	6	13	50	6	6	★	1
VF6MHVD0800	8	19	60	8	6	★	1
VF6MHVD1000	10	22	70	10	6	★	1
VF6MHVD1200	12	26	75	12	6	★	1
VF6MHVD1600	16	32	90	16	6	★	1
VF6MHVD2000	20	38	100	20	6	★	1

RECOMMENDED CUTTING CONDITIONS

Side milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Heat resistant alloy		
	AISI H13, AISI W1-10, AISI P21 etc.			AISI 304, AISI 306, Ti-6Al-4V etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
6	10600	2900	114.2	8000	2000	78.7	2100	320	12.6
8	8000	2900	114.2	6000	2000	78.7	1600	300	11.8
10	6400	2700	106.3	4800	2000	78.7	1300	260	10.2
12	5300	2700	106.3	4000	2000	78.7	1100	230	9.1
16	4000	2200	86.6	3000	1600	63.0	800	180	7.1
20	3200	1900	74.8	2400	1400	55.1	640	150	5.9
Depth of cut									

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF8MHVCH

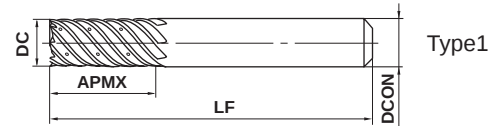
End mill, Medium cut length, Irregular helix flutes, with multiple thru-coolant



CARBIDE

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

CoolStar



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	16≤DC≤20				
	0 - 0.03				
	DCON=16	DCON=20			
	0 - 0.011	0 - 0.013			

- Vibration control end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

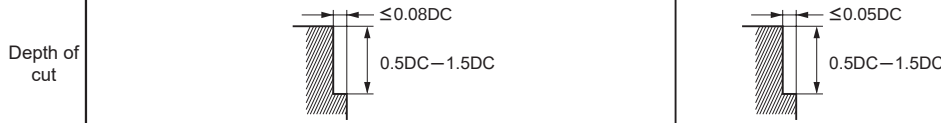
(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF8MHVCHD1600	16	32	90	16	8	★	1
VF8MHVCHD2000	20	38	100	20	8	★	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

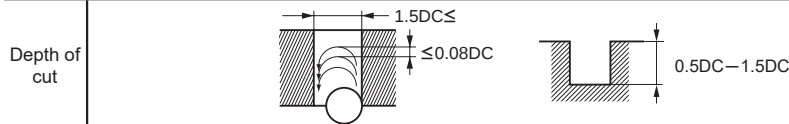
Work Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
16	4000	2400	94.5	3000	2100	82.7	800	240	9.4
20	3200	1900	74.8	2400	1900	74.8	640	200	7.9



Trochoidal milling

DC: Dia.

Work Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
16	4000	1900	74.8	3000	1400	55.1
20	3200	1500	59.0	2400	1200	47.2



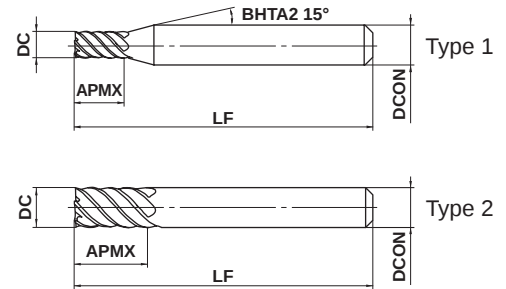
- Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.
- Note 2) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is poor, vibration or abnormal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VFSD

End mill, Short cut length, For hardened materials



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



1≤DC≤12				
0 - 0.02				
DCON=6	8≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

● End mills with Impact Miracle coating for high hardness materials.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSD0100	1	2	45	6	4	●	1
VFSD0150	1.5	3	45	6	4	●	1
VFSD0200	2	4	45	6	4	●	1
VFSD0250	2.5	5	45	6	4	●	1
VFSD0300	3	6	45	6	6	●	1
VFSD0350	3.5	7	45	6	6	●	1
VFSD0400	4	8	45	6	6	●	1
VFSD0500	5	10	50	6	6	●	1
VFSD0600	6	12	50	6	6	●	2
VFSD0800	8	16	60	8	6	●	2
VFSD1000	10	20	70	10	6	●	2
VFSD1200	12	24	75	12	6	●	2

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

IMPACT MIRACLE END MILLS

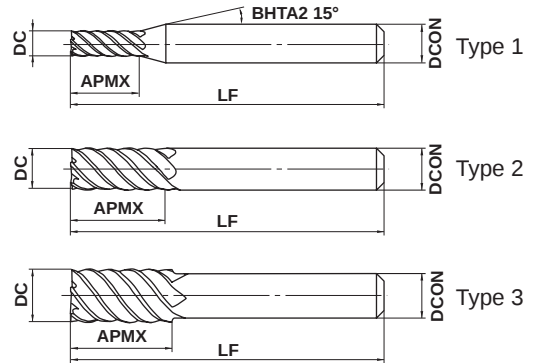
VFMD

End mill, Medium cut length, For hardened materials



CARBIDE

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



DC≤12	DC>12			
0 - 0.02	0 - 0.03			
DCON=6	8≤DCON≤10	12≤DCON≤16	20≤DCON≤25	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	



● End mills with Impact Miracle coating for high hardness materials.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMD0100	1	3.5	60	6	4	●	1
VFMD0150	1.5	5	60	6	4	●	1
VFMD0200	2	7	60	6	4	●	1
VFMD0250	2.5	8	60	6	4	●	1
VFMD0300	3	10	60	6	6	●	1
VFMD0400	4	12	60	6	6	●	1
VFMD0500	5	15	60	6	6	●	1
VFMD0600	6	15	60	6	6	●	2
VFMD0800	8	20	75	8	6	●	2
VFMD1000	10	25	80	10	6	●	2
VFMD1200	12	30	100	12	6	●	2
VFMD1400	14	35	105	12	6	★	3
VFMD1500	15	40	110	16	6	★	1
VFMD1600	16	40	110	16	6	★	2
VFMD1800	18	40	120	16	6	★	3
VFMD2000	20	45	125	20	6	★	2
VFMD2200	22	45	135	20	6	★	3
VFMD2500	25	60	160	25	6	★	2

VFSD

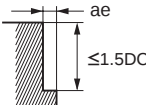
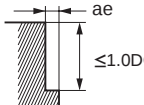
End mill, Short cut length, For hardened materials

VFMD

End mill, Medium cut length, For hardened materials

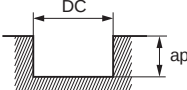
CARBIDE

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.				Hardened steel (62—70HRC) AISI W1, AISI M2 etc.				
	DC (mm)	Revolution (min ⁻¹)	Table feed		Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Width of cut ae (mm)
			(mm/min)	(IPM)			(mm/min)	(IPM)			(mm/min)	(IPM)	
1	40000	1200	47.2	0.05	40000	800	31.5	0.03	32000	500	19.7	0.02	
2	40000	2000	78.7	0.1	24000	1000	39.4	0.05	16000	600	23.6	0.05	
3	32000	3800	149.6	0.2	16000	1900	74.8	0.1	11000	1200	47.2	0.05	
4	24000	4400	173.2	0.2	12000	2200	86.6	0.1	8000	1300	51.2	0.05	
6	16000	5800	228.3	0.3	8000	2900	114.2	0.2	5300	1800	70.9	0.1	
8	12000	5800	228.3	0.4	6000	2900	114.2	0.2	4000	1800	70.9	0.1	
10	9600	5800	228.3	0.5	4800	2900	114.2	0.3	3200	1800	70.9	0.2	
12	8000	4800	189.0	0.6	4000	2400	94.5	0.3	2700	1500	59.1	0.2	
16	6000	3600	141.7	0.8	3000	1800	70.9	0.5	2000	1100	43.3	0.3	
20	4800	2900	114.2	1.0	2400	1400	55.1	0.5	1600	880	34.6	0.3	
25	3800	2300	90.6	1.0	1900	1100	43.3	0.5	1300	720	28.3	0.3	
Depth of cut													

DC : Dia.

Slot milling with small diameter tools

Work Material	Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
DC (mm)		(mm/min)	(IPM)			(mm/min)	(IPM)	
1	15000	300	11.8	0.1	9500	110	4.3	0.05
2	8000	320	12.6	0.2	4800	190	7.5	0.1
Depth of cut	 DC : Dia.							

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

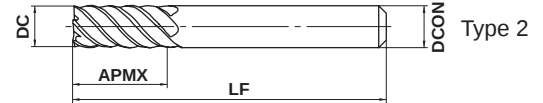
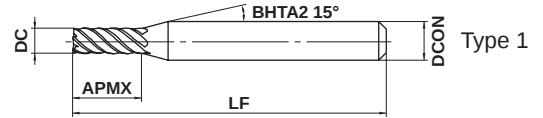
VFMD – Inch sizes

End mill, Medium cut length, For hardened materials



CARBIDE

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



DC < .5000"	DC = .5000"			
0 - .0008"	0 - .0012"			
.2500" ≤ DCON ≤ .3750"	DCON = .5000"			
0 - .00035"	0 - .00043"			

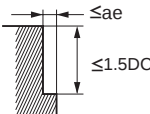
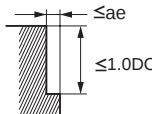


● End mills with Impact Miracle coating for high hardness materials.

(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMD1/32	.0313	.0938	2.5	.2500	4	●	1
VFMD1/16	.0625	.1875	2.5	.2500	4	●	1
VFMD3/32	.0938	.2813	2.5	.2500	4	●	1
VFMD1/8	.1250	.3750	2.5	.2500	6	●	1
VFMD5/32	.1563	.5000	2.5	.2500	6	●	1
VFMD3/16	.1875	.5630	2.5	.2500	6	●	1
VFMD1/4	.2500	.5630	3.5	.2500	6	●	2
VFMD5/16	.3125	.6875	4.0	.3125	6	●	2
VFMD3/8	.3750	.8125	4.0	.3750	6	●	2
VFMD1/2	.5000	1.0938	4.5	.5000	6	●	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.				Hardened steel (62—70HRC) AISI W1, AISI M2 etc.				
	DC (inch)	Revolution (min ⁻¹)	Table feed		Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Width of cut ae (inch)
			(mm/min)	(IPM)			(mm/min)	(IPM)			(mm/min)	(IPM)	
.0313	40000	1100	43.3	.0016	40000	800	31.5	.00094	36000	500	19.6	.00063	
.0625	40000	1800	70.8	.0031	30000	960	37.8	.0019	20000	560	22	.0013	
.0938	40000	2600	102	.0047	20000	1100	43	.0028	13000	680	26.6	.0019	
.1250	30000	4100	161	.0063	15000	2100	82	.0038	10000	1300	49.6	.0025	
.1563	24000	4300	170	.0078	12000	2200	86	.0047	8000	1300	51	.0031	
.1875	20000	4800	189	.0094	10000	2400	94.5	.0056	6700	1400	55	.0038	
.2500	15000	5800	228	.013	7500	2900	114	.0075	5000	1800	70.8	.005	
.3125	12000	5800	228	.016	6000	2900	114	.0094	4000	1800	70.8	.0063	
.3750	10000	5800	228	.019	5000	2900	114	.011	3300	1800	70.8	.0075	
.5000	7500	4500	177	.025	3800	2300	90.5	.015	2500	1400	55	.01	
Depth of cut													

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

IMPACT MIRACLE END MILLS

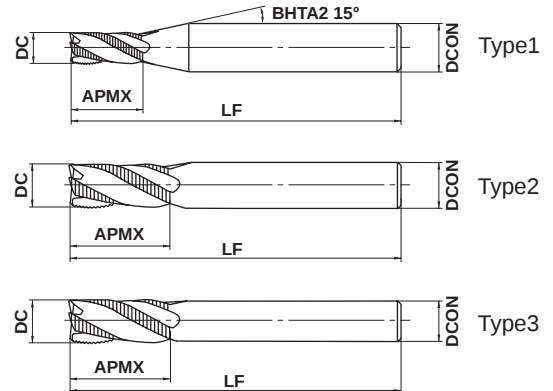
VFSFPR

Roughing end mill, Short cut length, 3—4 flute



CARBIDE

Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○			○	○		



DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

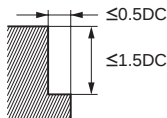
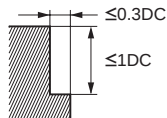
- Impact Miracle roughing end mills for a wide range of work materials from carbon and alloy steel through to difficult-to-cut materials.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSFPRD0300	3	6	50	6	3	★	1
VFSFPRD0400	4	8	50	6	3	★	1
VFSFPRD0500	5	10	50	6	3	★	1
VFSFPRD0600	6	12	50	6	3	★	2
VFSFPRD0700	7	17	60	8	3	★	1
VFSFPRD0800	8	17	60	8	4	★	2
VFSFPRD0900	9	22	70	10	4	★	1
VFSFPRD1000S08	10	22	90	8	4	★	3
VFSFPRD1000	10	22	70	10	4	★	2
VFSFPRD1200S10	12	27	100	10	4	★	3
VFSFPRD1200	12	27	75	12	4	★	2
VFSFPRD1400	14	27	75	12	4	★	3
VFSFPRD1600	16	33	90	16	4	★	2
VFSFPRD1800	18	33	90	16	4	★	3
VFSFPRD2000	20	38	100	20	4	★	2

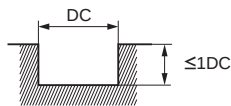
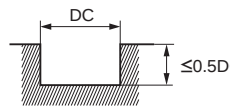
RECOMMENDED CUTTING CONDITIONS

Side milling

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1—10, AISI P21 etc.			AISI 304, AISI 306, Ti—6Al—4V etc.			AISI H13 etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
3	16000	960	37.8	13000	640	25.2	6400	260	10.2	5300	320	12.6	4200	70	2.8
4	12000	960	37.8	9500	640	25.2	4800	260	10.2	4000	320	12.6	3200	70	2.8
5	9500	960	37.8	7600	640	25.2	3800	260	10.2	3200	320	12.6	2500	70	2.8
6	8000	960	37.8	6400	680	26.8	3200	290	11.4	2700	340	13.4	2100	75	3.0
8	6000	1050	41.3	4800	760	29.9	2400	340	13.4	2000	400	15.7	1600	95	3.7
10	4800	1050	41.3	3800	760	29.9	1900	340	13.4	1600	400	15.7	1300	105	4.1
12	4000	960	37.8	3200	700	27.6	1600	320	12.6	1300	400	15.7	1100	110	4.3
16	3000	840	33.1	2400	620	24.4	1200	300	11.8	1000	360	14.2	800	110	4.3
20	2400	760	29.9	1900	560	22.0	1000	300	11.8	800	320	12.6	600	100	3.9
Depth of cut															

DC : Dia.

Slotting

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1—10, AISI P21 etc.			AISI 304, AISI 306, Ti—6Al—4V etc.			AISI H13 etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	
3	13000	720	28.3	11000	480	18.9	4800	190	7.5	3200	190	7.5	2100	25	1.0
4	9500	720	28.3	8000	480	18.9	3600	190	7.5	2400	190	7.5	1600	25	1.0
5	7600	720	28.3	6400	480	18.9	3200	190	7.5	1900	190	7.5	1300	25	1.0
6	6400	720	28.3	5300	480	18.9	2700	200	7.9	1600	200	7.9	1100	30	1.2
8	4800	800	31.5	4000	520	20.5	2000	220	8.7	1200	220	8.7	800	35	1.4
10	3800	800	31.5	3200	520	20.5	1600	220	8.7	1000	220	8.7	600	35	1.4
12	3200	750	29.5	2700	520	20.5	1300	210	8.3	800	210	8.3	500	40	1.6
16	2400	620	24.4	2000	450	17.7	1000	180	7.1	600	180	7.1	400	45	1.8
20	1900	540	21.3	1600	400	15.7	800	160	6.3	500	160	6.3	300	40	1.6
Depth of cut															

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

IMPACT MIRACLE END MILLS

VFSFPRCH

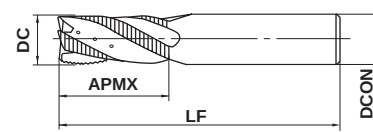
Roughing end mill, Short cut length, 4 flute, with multiple thru-coolant



CARBIDE

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

CoolStar



Type1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

h6	DCON=16	DCON=20			
	0 - 0.011	0 - 0.013			

- Roughing end mill with multiple internal through coolant holes suitable for difficult-to-cut materials.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSFPRCHD1600	16	33	90	16	4	★	1
VFSFPRCHD2000	20	38	100	20	4	★	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel (—45HRC)			Austenitic stainless steel, Titanium alloy			Heat resistant alloy		
	AISI 1050, AISI No 35 B, AISI P20			AISI H13, AISI W1-10, AISI P21			AISI 304, AISI 306, Ti-6Al-4V			Inconel718		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	3000	840	33.1	2400	620	24.4	1200	300	11.8	800	110	4.3
20	2400	760	29.9	1900	560	22.0	1000	300	11.8	600	100	3.9
Depth of cut												

Slotting

DC: Dia.

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel (—45HRC)			Austenitic stainless steel, Titanium alloy		
	AISI 1050, AISI No 35 B, AISI P20			AISI H13, AISI W1-10, AISI P21			AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	2400	620	24.4	2000	450	17.7	800	100	3.9
20	1900	540	21.3	1600	400	15.4	600	80	3.1
Depth of cut									

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

Note 2) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

DC: Dia.

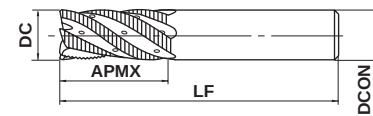
VF6SVRCH

Roughing end mill, Short cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant



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

CoolStar



Type1



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

● Roughing end mill with multiple internal through coolant holes suitable for difficult-to-cut materials.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6SVRCHD1600	16	33	90	16	6	★	1
VF6SVRCHD2000	20	38	100	20	6	★	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel (—45HRC)			Austenitic stainless steel, Titanium alloy			Heat resistant alloy		
	AISI H13, AISI W1-10, AISI P21			AISI 304, AISI 306, Ti-6Al-4V			Inconel718		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	3000	1500	59.1	2400	1200	47.2	800	160	6.3
20	2400	1200	47.2	2000	1000	39.4	640	140	5.5
Depth of cut									

DC: Dia.

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

Note 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 work material installation is poor, vibration or abnormal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

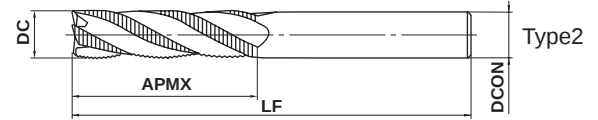
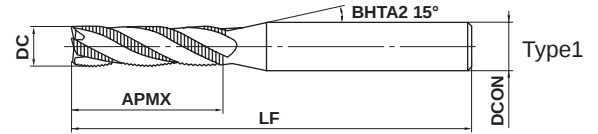
VFMFPR

Roughing end mill, Medium cut length, 4 flute



CARBIDE

Carbon Steel, Alloy Steel, Cast Iron ($<30\text{HRC}$)	Tool Steel, Pre-Hardened Steel, Hardened Steel ($\leq 45\text{HRC}$)	Hardened Steel ($\leq 55\text{HRC}$)	Hardened Steel ($>55\text{HRC}$)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○			◎	◎		



DCON=6	$8 \leq \text{DCON} \leq 10$	$12 \leq \text{DCON} \leq 16$	DCON=20	
$\begin{smallmatrix} 0 \\ -0.008 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.009 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.011 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.013 \end{smallmatrix}$	

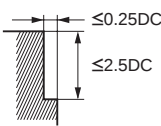
- Impact Miracle roughing end mills suitable for the machining of deep walled components.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMFPRD0500	5	15	60	6	4	★	1
VFMFPRD0600	6	17	60	6	4	★	2
VFMFPRD0700	7	22	75	8	4	★	1
VFMFPRD0800	8	28	75	8	4	★	2
VFMFPRD0900	9	28	100	10	4	★	1
VFMFPRD1000	10	34	100	10	4	★	2
VFMFPRD1200	12	40	110	12	4	★	2
VFMFPRD1600	16	48	125	16	4	★	2
VFMFPRD2000	20	57	140	20	4	★	2

RECOMMENDED CUTTING CONDITIONS

Side milling

Work Material	Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy			Hardened steel (45—55HRC)			Heat resistant alloy		
	AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1—10, AISI P21 etc.			AISI 304, AISI 306, Ti—6Al—4V etc.			AISI H13 etc.			Inconel718 etc.		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
5	3800	360	14.2	3200	290	11.4	2500	150	5.9	2500	150	5.9	1900	50	2.0
6	3200	360	14.2	2700	290	11.4	2100	160	6.3	2100	160	6.3	1600	60	2.4
8	2400	450	17.7	2000	360	14.2	1600	160	6.3	1600	160	6.3	1200	70	2.8
10	1900	450	17.7	1600	360	14.2	1300	180	7.1	1300	180	7.1	1000	75	3.0
12	1600	400	15.7	1300	320	12.6	1100	180	7.1	1100	180	7.1	800	80	3.1
16	1200	360	14.2	1000	290	11.4	800	160	6.3	800	160	6.3	600	80	3.1
20	1000	340	13.4	800	270	10.6	600	150	5.9	600	150	5.9	500	80	3.1
Depth of cut															

DC: Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

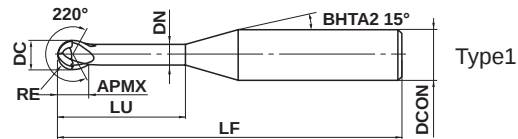
VF2WB

Wide ball nose, Medium cut length, 2 flute



CARBIDE

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



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	$1 \leq RE \leq 3$				
	± 0.01				
	DCON=6				
	0 $- 0.008$				

- Ball nose end mill suitable for machining of undercut geometries and complex geometries using a 5-axis machine.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2WBR0100N060	1	2	1.5	6	1.6	60	6	2	★	1
VF2WBR0150N080	1.5	3	2	8	2.4	60	6	2	★	1
VF2WBR0200N100	2	4	3	10	3.2	60	6	2	★	1
VF2WBR0300N120	3	6	4	12	4.8	80	6	2	★	1

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel (≤30HRC)				Alloy steel, Tool steel, Pre-hardened steel				Austenitic stainless steel, Titanium alloy				Hardened steel (45—55HRC)			
	AISI 1050, AISI 35, AISI P20 etc.				AISI H13, AISI W1—10, AISI P21 etc.				AISI 304, AISI 306, Ti—6Al—4V etc.				AISI H13 etc.			
RE (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)
R1	40000	5000	196.9	0.07	40000	5000	196.9	0.06	32000	2500	98.4	0.05	32000	3000	118.1	0.03
R1.5	32000	5000	196.9	0.12	32000	5000	196.9	0.11	26000	2500	98.4	0.10	26000	3000	118.1	0.07
R2	24000	3800	149.6	0.15	24000	3800	149.6	0.13	20000	2000	98.4	0.12	20000	2800	110.2	0.10
R3	16000	2800	110.2	0.20	16000	2800	110.2	0.18	13000	1500	59.1	0.15	13000	2100	82.7	0.12
Depth of cut																

RE : Radius

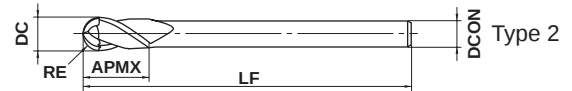
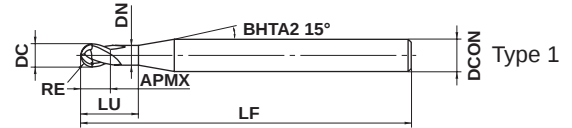
- Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
 Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

VF2SB – Inch sizes

Ball nose, Short cut length, 2 flute, For hardened materials



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



	.0156" ≤ RE ≤ .2500"				
	±.0002"				
	DC < .5000"	DC = .5000"			
	$\begin{matrix} 0 \\ - 0.0004" \end{matrix}$	$\begin{matrix} 0 \\ - 0.0008" \end{matrix}$			
	.2500" ≤ DCON ≤ .3750"				
	$\begin{matrix} 0 \\ - .00024" \end{matrix}$				
	DCON = .5000"				
	$\begin{matrix} 0 \\ - 0.00043" \end{matrix}$				

● 2 flute ball nose end mills with Impact Miracle coating for high hardness materials.

(inch)										
Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2SBD1/32	.0156	.0313	.0313	.0625	.0296	2.5	.2500	2	●	1
VF2SBD1/16	.0313	.0625	.0625	.1250	.0601	2.5	.2500	2	●	1
VF2SBD3/32	.0469	.0938	.0938	.1875	.0898	2.5	.2500	2	●	1
VF2SBD1/8	.0625	.1250	.1250	.2500	.1211	3.0	.2500	2	●	1
VF2SBD3/16	.0938	.1875	.1875	.3750	.1835	3.0	.2500	2	●	1
VF2SBD1/4	.1250	.2500	.5000	—	—	3.5	.2500	2	●	2
VF2SBD5/16	.1563	.3125	.6250	—	—	4.0	.3125	2	●	2
VF2SBD3/8	.1875	.3750	.7500	—	—	4.0	.3750	2	●	2
VF2SBD1/2	.2500	.5000	1.0000	—	—	4.5	.5000	2	●	2

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF2SB – Inch sizes

Ball nose, Short cut length, 2 flute, For hardened materials

CARBIDE

SQUARE

BALL

RADIUS

TAPER

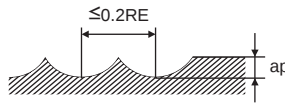
BARREL

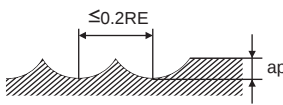
ROUGHING

—

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

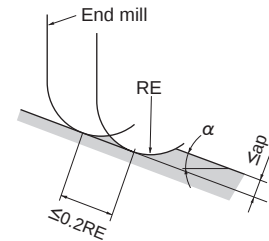
Work Material	Hardened steel(45—55HRC) AISI H13 etc.							Hardened steel (55—62HRC) AISI D2 etc.						
	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (inch)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (inch)
RE (inch)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed			Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		
		(mm/min)	(IPM)		(mm/min)	(IPM)			(mm/min)	(IPM)		(mm/min)	(IPM)	
R .0156	40000	6400	252	40000	2400	94.5	.0020	40000	4000	157	40000	1600	63	.0016
R .0313	40000	9600	378	40000	4000	157	.0039	40000	8000	315	30000	2400	94.5	.0031
R .0469	40000	10000	394	33000	4600	182	.0047	36000	7900	312	20000	2400	94.5	.0043
R .0625	38000	11000	433	25000	4000	157	.0051	30000	7200	283	15000	2100	82.7	.0047
R .0938	27000	9700	383	17000	3100	122	.0067	20000	5600	220	10000	1800	70.9	.0055
R .1250	20000	8000	315	13000	2600	102	.0098	15000	4500	177	7500	1500	59.1	.0079
R .1563	16000	6400	252	10000	2000	78.7	.0118	12000	3600	142	6000	1200	47.2	.0079
R .1875	13000	5200	205	8400	1700	66.9	.0197	10000	3000	118	5000	1000	39.4	.0079
R .2500	8500	3400	134	5700	1100	43.3	.0197	6500	2100	82.7	3400	680	26.8	.0118
Depth of cut														
	RE : Radius													

Work Material	Hardened steel (62—70HRC) AISI W1, AISI M2 etc.							
	RE (inch)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (inch)
		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		
			(mm/min)	(IPM)		(mm/min)	(IPM)	
R .0156	40000	2800	110	40000	1600	63	.0012	
R .0313	30000	4200	165	20000	1200	47.2	.0024	
R .0469	20000	3600	142	13000	900	35.4	.0031	
R .0625	15000	3000	118	10000	800	31.5	.0035	
R .0938	10000	2200	86.6	6300	630	24.8	.0039	
R .1250	7500	1700	66.9	4800	580	22.7	.0043	
R .1563	6000	1400	55.1	4000	480	18.9	.0043	
R .1875	5000	1100	43.3	3200	450	17.6	.0047	
R .2500	3400	750	29.4	2000	280	11	.0047	
Depth of cut								
	RE : Radius							

Note 1) α is the inclination of the machined surface.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.



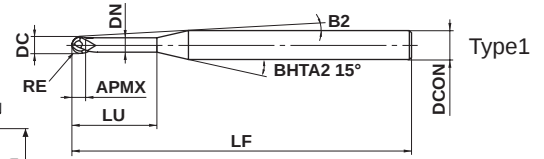
VF2XLBS

Ball nose, 2 flute, Long neck, Short shank

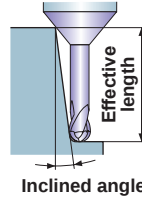


CARBIDE

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



Effective length
for inclined angle



0.2 ≤ RE ≤ 1

±0.007



0.4 ≤ DC ≤ 2

0
- 0.02



DCON=4

0
- 0.008

- 2 flute long neck ball nose end mill for high-speed machining of hardened steel.
- Short shank type suitable for use with a shrink fit holder.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLBSR0020N010	0.2	0.4	0.32	1	0.36	13.4°	40	4	2	★	1	1.0	1.0	1.1	1.2
VF2XLBSR0020N020	0.2	0.4	0.32	2	0.36	11.9°	40	4	2	★	1	2.0	2.1	2.3	2.5
VF2XLBSR0020N030	0.2	0.4	0.32	3	0.36	10.7°	40	4	2	★	1	3.1	3.2	3.4	3.7
VF2XLBSR0020N040	0.2	0.4	0.32	4	0.36	9.7°	40	4	2	★	1	4.1	4.3	4.6	4.9
VF2XLBSR0025N040	0.25	0.5	0.4	4	0.46	9.6°	40	4	2	★	1	4.1	4.3	4.6	4.9
VF2XLBSR0025N060	0.25	0.5	0.4	6	0.46	8.1°	40	4	2	★	1	6.2	6.4	6.9	7.4
VF2XLBSR0030N020	0.3	0.6	0.48	2	0.56	11.8°	40	4	2	★	1	2.1	2.2	2.3	2.5
VF2XLBSR0030N030	0.3	0.6	0.48	3	0.56	10.5°	40	4	2	★	1	3.1	3.3	3.5	3.8
VF2XLBSR0030N040	0.3	0.6	0.48	4	0.56	9.5°	40	4	2	★	1	4.2	4.3	4.6	5.0
VF2XLBSR0030N060	0.3	0.6	0.48	6	0.56	8.0°	40	4	2	★	1	6.3	6.5	6.9	7.5
VF2XLBSR0040N040	0.4	0.8	0.64	4	0.76	9.4°	40	4	2	★	1	4.2	4.3	4.6	5.0
VF2XLBSR0040N060	0.4	0.8	0.64	6	0.76	7.8°	40	4	2	★	1	6.3	6.5	6.9	7.5
VF2XLBSR0050N030	0.5	1	0.8	3	0.94	10.1°	40	4	2	★	1	3.2	3.3	3.6	3.9
VF2XLBSR0050N040	0.5	1	0.8	4	0.94	9.1°	40	4	2	★	1	4.2	4.4	4.8	5.2
VF2XLBSR0050N060	0.5	1	0.8	6	0.94	7.5°	40	4	2	★	1	6.3	6.6	7.1	7.7
VF2XLBSR0050N080	0.5	1	0.8	8	0.94	6.4°	40	4	2	★	1	8.4	8.8	9.4	10.2
VF2XLBSR0100N060	1	2	1.6	6	1.9	6.4°	40	4	2	★	1	6.2	6.5	6.9	7.4
VF2XLBSR0100N080	1	2	1.6	8	1.9	5.3°	40	4	2	★	1	8.3	8.7	9.2	9.9
VF2XLBSR0100N100	1	2	1.6	10	1.9	4.5°	40	4	2	★	1	10.4	10.8	11.5	12.4

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF2XLB

Ball nose, 2 flute, Long neck

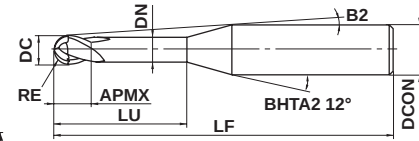
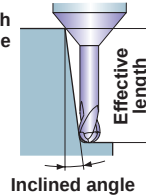


CARBIDE

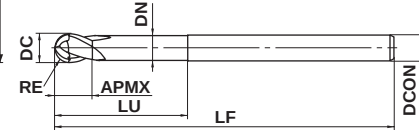
Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	◎	◎	◎				



Effective length
for inclined angle



Type 1



Type 2



RE ≤ 1	RE > 1		
±0.007	±0.010		



0.2 ≤ DC ≤ 6			
0 - 0.02			



4 ≤ DCON ≤ 6			
0 - 0.008			

● 2 flute long neck ball nose end mill with Impact Miracle coating for high hardened materials.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLB0010N005S04	0.1	0.2	0.16	0.5	0.17	11.5°	50	4	2	★	1	0.5	0.5	0.6	0.6
VF2XLB0010N005S06	0.1	0.2	0.16	0.5	0.17	11.7°	50	6	2	★	1	0.5	0.5	0.6	0.6
VF2XLB0010N008S04	0.1	0.2	0.16	0.75	0.17	11.2°	50	4	2	★	1	0.7	0.8	0.9	1.0
VF2XLB0010N010S04	0.1	0.2	0.16	1	0.17	10.9°	50	4	2	★	1	1.0	1.1	1.2	1.3
VF2XLB0010N010S06	0.1	0.2	0.16	1	0.17	11.3°	50	6	2	★	1	1.0	1.1	1.2	1.3
VF2XLB0010N013S04	0.1	0.2	0.16	1.25	0.17	10.7°	50	4	2	★	1	1.3	1.3	1.5	1.6
VF2XLB0010N015S04	0.1	0.2	0.16	1.5	0.17	10.4°	50	4	2	★	1	1.5	1.6	1.8	2.0
VF2XLB0010N015S06	0.1	0.2	0.16	1.5	0.17	10.9°	50	6	2	★	1	1.5	1.6	1.8	2.0
VF2XLB0010N018S04	0.1	0.2	0.16	1.75	0.17	10.2°	50	4	2	★	1	1.8	1.9	2.1	2.3
VF2XLB0010N020S04	0.1	0.2	0.16	2	0.17	10°	50	4	2	★	1	2.1	2.2	2.4	2.6
VF2XLB0010N025S04	0.1	0.2	0.16	2.5	0.17	9.5°	50	4	2	★	1	2.6	2.7	3.0	3.3
VF2XLB0015N010S04	0.15	0.3	0.24	1	0.27	11°	50	4	2	★	1	1.0	1.1	1.2	1.3
VF2XLB0015N010S06	0.15	0.3	0.24	1	0.27	11.3°	50	6	2	★	1	1.0	1.1	1.2	1.3
VF2XLB0015N013S04	0.15	0.3	0.24	1.25	0.27	10.7°	50	4	2	★	1	1.3	1.3	1.5	1.6
VF2XLB0015N015S04	0.15	0.3	0.24	1.5	0.27	10.4°	50	4	2	★	1	1.5	1.6	1.8	1.9
VF2XLB0015N015S06	0.15	0.3	0.24	1.5	0.27	10.9°	50	6	2	★	1	1.5	1.6	1.8	1.9
VF2XLB0015N018S04	0.15	0.3	0.24	1.75	0.27	10.2°	50	4	2	★	1	1.8	1.9	2.1	2.3
VF2XLB0015N020S04	0.15	0.3	0.24	2	0.27	9.9°	50	4	2	★	1	2.1	2.2	2.4	2.6
VF2XLB0015N020S06	0.15	0.3	0.24	2	0.27	10.6°	50	6	2	★	1	2.1	2.2	2.4	2.6
VF2XLB0015N025S04	0.15	0.3	0.24	2.5	0.27	9.5°	50	4	2	★	1	2.6	2.7	3.0	3.3
VF2XLB0015N030S04	0.15	0.3	0.24	3	0.27	9.1°	50	4	2	★	1	3.1	3.2	3.6	3.9
VF2XLB0015N040S04	0.15	0.3	0.24	4	0.27	8.4°	50	4	2	★	1	4.2	4.3	4.8	5.3
VF2XLB0020N010S04	0.2	0.4	0.32	1	0.36	11°	50	4	2	●	1	1.0	1.0	1.1	1.2
VF2XLB0020N010S06	0.2	0.4	0.32	1	0.36	11.3°	50	6	2	●	1	1.0	1.0	1.1	1.2
VF2XLB0020N015S04	0.2	0.4	0.32	1.5	0.36	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
VF2XLB0020N015S06	0.2	0.4	0.32	1.5	0.36	11°	50	6	2	●	1	1.5	1.6	1.7	1.9
VF2XLB0020N020S04	0.2	0.4	0.32	2	0.36	10°	50	4	2	●	1	2.0	2.1	2.3	2.6
VF2XLB0020N020S06	0.2	0.4	0.32	2	0.36	10.6°	50	6	2	●	1	2.0	2.1	2.3	2.6
VF2XLB0020N025S04	0.2	0.4	0.32	2.5	0.36	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
VF2XLB0020N025S06	0.2	0.4	0.32	2.5	0.36	10.3°	50	6	2	●	1	2.6	2.7	2.9	3.2
VF2XLB0020N030S04	0.2	0.4	0.32	3	0.36	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9

(mm)

CARBIDE

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLBR0020N030S06	0.2	0.4	0.32	3	0.36	10°	50	6	2	●	1	3.1	3.2	3.5	3.9
VF2XLBR0020N040S04	0.2	0.4	0.32	4	0.36	8.4°	50	4	2	●	1	4.1	4.3	4.7	5.2
VF2XLBR0020N050S04	0.2	0.4	0.32	5	0.36	7.8°	50	4	2	●	1	5.2	5.4	5.9	6.6
VF2XLBR0025N015S04	0.25	0.5	0.4	1.5	0.46	10.5°	50	4	2	●	1	1.5	1.6	1.7	1.9
VF2XLBR0025N015S06	0.25	0.5	0.4	1.5	0.46	11°	50	6	2	●	1	1.5	1.6	1.7	1.9
VF2XLBR0025N020S04	0.25	0.5	0.4	2	0.46	10°	50	4	2	●	1	2.0	2.1	2.3	2.6
VF2XLBR0025N020S06	0.25	0.5	0.4	2	0.46	10.6°	50	6	2	●	1	2.0	2.1	2.3	2.6
VF2XLBR0025N025S04	0.25	0.5	0.4	2.5	0.46	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
VF2XLBR0025N030S04	0.25	0.5	0.4	3	0.46	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
VF2XLBR0025N030S06	0.25	0.5	0.4	3	0.46	10°	50	6	2	●	1	3.1	3.2	3.5	3.9
VF2XLBR0025N035S04	0.25	0.5	0.4	3.5	0.46	8.7°	50	4	2	●	1	3.6	3.8	4.1	4.5
VF2XLBR0025N040S04	0.25	0.5	0.4	4	0.46	8.3°	50	4	2	●	1	4.1	4.3	4.7	5.2
VF2XLBR0025N040S06	0.25	0.5	0.4	4	0.46	9.4°	50	6	2	●	1	4.1	4.3	4.7	5.2
VF2XLBR0025N050S04	0.25	0.5	0.4	5	0.46	7.7°	50	4	2	●	1	5.2	5.4	5.9	6.5
VF2XLBR0025N050S06	0.25	0.5	0.4	5	0.46	8.9°	50	6	2	●	1	5.2	5.4	5.9	6.5
VF2XLBR0025N060S04	0.25	0.5	0.4	6	0.46	7.2°	50	4	2	●	1	6.2	6.5	7.1	7.9
VF2XLBR0025N060S06	0.25	0.5	0.4	6	0.46	8.4°	60	6	2	●	1	6.2	6.5	7.1	7.9
VF2XLBR0030N020S04	0.3	0.6	0.48	2	0.56	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0030N020S06	0.3	0.6	0.48	2	0.56	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0030N025S04	0.3	0.6	0.48	2.5	0.56	9.4°	50	4	2	●	1	2.6	2.7	3.0	3.3
VF2XLBR0030N030S04	0.3	0.6	0.48	3	0.56	9°	50	4	2	●	1	3.1	3.3	3.6	3.9
VF2XLBR0030N030S06	0.3	0.6	0.48	3	0.56	9.9°	50	6	2	●	1	3.1	3.3	3.6	3.9
VF2XLBR0030N035S04	0.3	0.6	0.48	3.5	0.56	8.6°	50	4	2	●	1	3.6	3.8	4.2	4.6
VF2XLBR0030N040S04	0.3	0.6	0.48	4	0.56	8.3°	50	4	2	●	1	4.2	4.4	4.8	5.2
VF2XLBR0030N040S06	0.3	0.6	0.48	4	0.56	9.3°	50	6	2	●	1	4.2	4.4	4.8	5.2
VF2XLBR0030N050S04	0.3	0.6	0.48	5	0.56	7.6°	50	4	2	●	1	5.2	5.4	6.0	6.6
VF2XLBR0030N050S06	0.3	0.6	0.48	5	0.56	8.8°	50	6	2	●	1	5.2	5.4	6.0	6.6
VF2XLBR0030N060S04	0.3	0.6	0.48	6	0.56	7.1°	50	4	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0030N060S06	0.3	0.6	0.48	6	0.56	8.4°	50	6	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0030N070S04	0.3	0.6	0.48	7	0.56	6.6°	50	4	2	●	1	7.3	7.6	8.3	9.2
VF2XLBR0030N080S04	0.3	0.6	0.48	8	0.56	6.2°	50	4	2	●	1	8.3	8.7	9.5	10.6
VF2XLBR0030N080S06	0.3	0.6	0.48	8	0.56	7.6°	60	6	2	●	1	8.3	8.7	9.5	10.6
VF2XLBR0040N020S04	0.4	0.8	0.64	2	0.76	9.9°	50	4	2	●	1	2.1	2.2	2.3	2.6
VF2XLBR0040N020S06	0.4	0.8	0.64	2	0.76	10.6°	50	6	2	●	1	2.1	2.2	2.3	2.6
VF2XLBR0040N030S04	0.4	0.8	0.64	3	0.76	8.9°	50	4	2	●	1	3.1	3.3	3.5	3.9
VF2XLBR0040N030S06	0.4	0.8	0.64	3	0.76	9.9°	50	6	2	●	1	3.1	3.3	3.5	3.9
VF2XLBR0040N040S04	0.4	0.8	0.64	4	0.76	8.2°	50	4	2	●	1	4.2	4.3	4.7	5.2
VF2XLBR0040N040S06	0.4	0.8	0.64	4	0.76	9.3°	50	6	2	●	1	4.2	4.3	4.7	5.2
VF2XLBR0040N050S04	0.4	0.8	0.64	5	0.76	7.5°	50	4	2	●	1	5.2	5.4	5.9	6.5
VF2XLBR0040N060S04	0.4	0.8	0.64	6	0.76	7°	50	4	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0040N060S06	0.4	0.8	0.64	6	0.76	8.3°	50	6	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0040N070S04	0.4	0.8	0.64	7	0.76	6.5°	50	4	2	●	1	7.3	7.6	8.3	9.2
VF2XLBR0040N080S04	0.4	0.8	0.64	8	0.76	6.1°	50	4	2	●	1	8.3	8.7	9.5	10.5
VF2XLBR0040N080S06	0.4	0.8	0.64	8	0.76	7.5°	50	6	2	●	1	8.3	8.7	9.5	10.5
VF2XLBR0040N100S04	0.4	0.8	0.64	10	0.76	5.4°	50	4	2	●	1	10.4	10.9	11.9	13.2
VF2XLBR0040N100S06	0.4	0.8	0.64	10	0.76	6.8°	60	6	2	●	1	10.4	10.9	11.9	13.2
VF2XLBR0050N030S04	0.5	1	0.8	3	0.94	8.8°	50	4	2	●	1	3.2	3.3	3.6	4.0
VF2XLBR0050N030S06	0.5	1	0.8	3	0.94	9.8°	50	6	2	●	1	3.2	3.3	3.6	4.0
VF2XLBR0050N040S04	0.5	1	0.8	4	0.94	8°	50	4	2	●	1	4.2	4.4	4.8	5.3
VF2XLBR0050N040S06	0.5	1	0.8	4	0.94	9.2°	50	6	2	●	1	4.2	4.4	4.8	5.3
VF2XLBR0050N050S04	0.5	1	0.8	5	0.94	7.3°	50	4	2	●	1	5.3	5.5	6.0	6.7

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF2XLB

Ball nose, 2 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLBR0050N050S06	0.5	1	0.8	5	0.94	8.7°	50	6	2	●	1	5.3	5.5	6.0	6.7
VF2XLBR0050N060S04	0.5	1	0.8	6	0.94	6.8°	50	4	2	●	1	6.3	6.6	7.2	8.0
VF2XLBR0050N060S06	0.5	1	0.8	6	0.94	8.2°	50	6	2	●	1	6.3	6.6	7.2	8.0
VF2XLBR0050N070S04	0.5	1	0.8	7	0.94	6.3°	50	4	2	●	1	7.4	7.7	8.4	9.3
VF2XLBR0050N080S04	0.5	1	0.8	8	0.94	5.9°	50	4	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0050N080S06	0.5	1	0.8	8	0.94	7.4°	50	6	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0050N090S04	0.5	1	0.8	9	0.94	5.5°	50	4	2	●	1	9.5	9.9	10.8	12.0
VF2XLBR0050N100S04	0.5	1	0.8	10	0.94	5.2°	50	4	2	●	1	10.5	11.0	12.0	13.3
VF2XLBR0050N100S06	0.5	1	0.8	10	0.94	6.7°	50	6	2	●	1	10.5	11.0	12.0	13.3
VF2XLBR0050N120S04	0.5	1	0.8	12	0.94	4.6°	50	4	2	●	1	12.6	13.2	14.4	15.9
VF2XLBR0050N120S06	0.5	1	0.8	12	0.94	6.1°	60	6	2	●	1	12.6	13.2	14.4	15.9
VF2XLBR0050N140S04	0.5	1	0.8	14	0.94	4.2°	60	4	2	★	1	14.7	15.3	16.8	18.6
VF2XLBR0050N160S04	0.5	1	0.8	16	0.94	3.8°	60	4	2	★	1	16.8	17.5	19.2	21.3
VF2XLBR0050N160S06	0.5	1	0.8	16	0.94	5.3°	70	6	2	★	1	16.8	17.5	19.2	21.3
VF2XLBR0050N180S04	0.5	1	0.8	18	0.94	3.5°	60	4	2	★	1	18.9	19.7	21.6	23.9
VF2XLBR0050N200S04	0.5	1	0.8	20	0.94	3.3°	60	4	2	★	1	21.0	21.9	24.0	26.6
VF2XLBR0050N200S06	0.5	1	0.8	20	0.94	4.6°	70	6	2	★	1	21.0	21.9	24.0	26.6
VF2XLBR0060N060S04	0.6	1.2	0.96	6	1.14	6.6°	50	4	2	★	1	6.3	6.6	7.2	8.0
VF2XLBR0060N060S06	0.6	1.2	0.96	6	1.14	8.1°	50	6	2	★	1	6.3	6.6	7.2	8.0
VF2XLBR0060N080S04	0.6	1.2	0.96	8	1.14	5.7°	50	4	2	★	1	8.4	8.8	9.6	10.6
VF2XLBR0060N080S06	0.6	1.2	0.96	8	1.14	7.3°	50	6	2	★	1	8.4	8.8	9.6	10.6
VF2XLBR0060N100S04	0.6	1.2	0.96	10	1.14	5°	50	4	2	★	1	10.5	11.0	12.0	13.3
VF2XLBR0060N100S06	0.6	1.2	0.96	10	1.14	6.6°	50	6	2	★	1	10.5	11.0	12.0	13.3
VF2XLBR0060N120S04	0.6	1.2	0.96	12	1.14	4.5°	50	4	2	★	1	12.6	13.2	14.4	15.9
VF2XLBR0060N120S06	0.6	1.2	0.96	12	1.14	6°	50	6	2	★	1	12.6	13.2	14.4	15.9
VF2XLBR0060N140S04	0.6	1.2	0.96	14	1.14	4°	60	4	2	★	1	14.7	15.3	16.8	18.6
VF2XLBR0060N160S04	0.6	1.2	0.96	16	1.14	3.7°	60	4	2	★	1	16.8	17.5	19.2	21.2
VF2XLBR0060N160S06	0.6	1.2	0.96	16	1.14	5.2°	70	6	2	★	1	16.8	17.5	19.2	21.2
VF2XLBR0070N080S04	0.7	1.4	1.12	8	1.34	5.5°	50	4	2	★	1	8.4	8.8	9.6	10.6
VF2XLBR0070N120S04	0.7	1.4	1.12	12	1.34	4.3°	50	4	2	★	1	12.6	13.1	14.4	15.9
VF2XLBR0070N160S04	0.7	1.4	1.12	16	1.34	3.5°	60	4	2	★	1	16.8	17.5	19.2	21.2
VF2XLBR0075N060S04	0.75	1.5	1.2	6	1.44	6.3°	50	4	2	●	1	6.3	6.6	7.2	7.9
VF2XLBR0075N060S06	0.75	1.5	1.2	6	1.44	8°	50	6	2	●	1	6.3	6.6	7.2	7.9
VF2XLBR0075N080S04	0.75	1.5	1.2	8	1.44	5.4°	50	4	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0075N080S06	0.75	1.5	1.2	8	1.44	7.2°	50	6	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0075N100S04	0.75	1.5	1.2	10	1.44	4.7°	50	4	2	●	1	10.5	11.0	12.0	13.2
VF2XLBR0075N100S06	0.75	1.5	1.2	10	1.44	6.5°	50	6	2	●	1	10.5	11.0	12.0	13.2
VF2XLBR0075N120S04	0.75	1.5	1.2	12	1.44	4.2°	50	4	2	●	1	12.6	13.1	14.4	15.9
VF2XLBR0075N120S06	0.75	1.5	1.2	12	1.44	5.9°	50	6	2	●	1	12.6	13.1	14.4	15.9
VF2XLBR0075N140S04	0.75	1.5	1.2	14	1.44	3.8°	50	4	2	●	1	14.7	15.3	16.8	18.5
VF2XLBR0075N140S06	0.75	1.5	1.2	14	1.44	5.4°	50	6	2	●	1	14.7	15.3	16.8	18.5
VF2XLBR0075N160S04	0.75	1.5	1.2	16	1.44	3.4°	60	4	2	●	1	16.8	17.5	19.2	21.2
VF2XLBR0075N160S06	0.75	1.5	1.2	16	1.44	5°	60	6	2	●	1	16.8	17.5	19.2	21.2
VF2XLBR0075N180S04	0.75	1.5	1.2	18	1.44	3.1°	60	4	2	●	1	18.9	19.7	21.6	23.8
VF2XLBR0075N200S04	0.75	1.5	1.2	20	1.44	2.9°	60	4	2	★	1	21.0	21.9	23.9	*
VF2XLBR0075N200S06	0.75	1.5	1.2	20	1.44	4.3°	70	6	2	★	1	21.0	21.9	23.9	26.5
VF2XLBR0080N080S04	0.8	1.6	1.28	8	1.54	5.3°	50	4	2	★	1	8.4	8.8	9.6	10.5
VF2XLBR0080N120S04	0.8	1.6	1.28	12	1.54	4.1°	50	4	2	★	1	12.6	13.1	14.4	15.9
VF2XLBR0080N160S04	0.8	1.6	1.28	16	1.54	3.3°	60	4	2	★	1	16.8	17.5	19.1	21.2
VF2XLBR0080N200S04	0.8	1.6	1.28	20	1.54	2.8°	60	4	2	★	1	21.0	21.9	23.9	*
VF2XLBR0090N080S04	0.9	1.8	1.44	8	1.74	5.1°	50	4	2	★	1	8.4	8.8	9.6	10.5

★ No interference

(mm)

CARBIDE

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLBR0090N120S04	0.9	1.8	1.44	12	1.74	3.9°	50	4	2	★	1	12.6	13.1	14.3	15.8
VF2XLBR0090N160S04	0.9	1.8	1.44	16	1.74	3.1°	60	4	2	★	1	16.8	17.5	19.1	21.1
VF2XLBR0090N200S04	0.9	1.8	1.44	20	1.74	2.6°	60	4	2	★	1	20.9	21.8	23.9	*
VF2XLBR0100N060S04	1	2	1.6	6	1.9	5.8°	50	4	2	●	1	6.2	6.5	7.0	7.7
VF2XLBR0100N060S06	1	2	1.6	6	1.9	7.9°	50	6	2	●	1	6.2	6.5	7.0	7.7
VF2XLBR0100N080S04	1	2	1.6	8	1.9	4.9°	50	4	2	●	1	8.3	8.7	9.4	10.4
VF2XLBR0100N080S06	1	2	1.6	8	1.9	6.9°	50	6	2	●	1	8.3	8.7	9.4	10.4
VF2XLBR0100N100S04	1	2	1.6	10	1.9	4.2°	50	4	2	●	1	10.4	10.9	11.8	13.0
VF2XLBR0100N100S06	1	2	1.6	10	1.9	6.2°	50	6	2	●	1	10.4	10.9	11.8	13.0
VF2XLBR0100N120S04	1	2	1.6	12	1.9	3.7°	50	4	2	●	1	12.5	13.0	14.2	15.7
VF2XLBR0100N120S06	1	2	1.6	12	1.9	5.6°	50	6	2	●	1	12.5	13.0	14.2	15.7
VF2XLBR0100N140S04	1	2	1.6	14	1.9	3.3°	50	4	2	●	1	14.6	15.2	16.6	18.3
VF2XLBR0100N140S06	1	2	1.6	14	1.9	5.1°	50	6	2	●	1	14.6	15.2	16.6	18.3
VF2XLBR0100N160S04	1	2	1.6	16	1.9	2.9°	60	4	2	●	1	16.7	17.4	19.0	*
VF2XLBR0100N160S06	1	2	1.6	16	1.9	4.7°	60	6	2	●	1	16.7	17.4	19.0	21.0
VF2XLBR0100N180S04	1	2	1.6	18	1.9	2.7°	60	4	2	●	1	18.8	19.6	21.4	*
VF2XLBR0100N180S06	1	2	1.6	18	1.9	4.4°	60	6	2	●	1	18.8	19.6	21.4	23.6
VF2XLBR0100N200S04	1	2	1.6	20	1.9	2.5°	60	4	2	●	1	20.9	21.8	23.8	*
VF2XLBR0100N200S06	1	2	1.6	20	1.9	4.1°	60	6	2	●	1	20.9	21.8	23.8	26.3
VF2XLBR0100N220S04	1	2	1.6	22	1.9	2.3°	60	4	2	●	1	22.9	23.9	26.2	*
VF2XLBR0100N250S04	1	2	1.6	25	1.9	2°	70	4	2	★	1	26.1	27.2	*	*
VF2XLBR0100N250S06	1	2	1.6	25	1.9	3.5°	70	6	2	★	1	26.1	27.2	29.8	32.9
VF2XLBR0100N300S04	1	2	1.6	30	1.9	1.7°	70	4	2	★	1	31.3	32.6	*	*
VF2XLBR0100N300S06	1	2	1.6	30	1.9	3°	80	6	2	★	1	31.3	32.6	35.8	*
VF2XLBR0100N350S04	1	2	1.6	35	1.9	1.5°	80	4	2	★	1	36.5	38.1	*	*
VF2XLBR0125N100S06	1.25	2.5	2	10	2.4	5.9°	60	6	2	★	1	10.4	10.8	11.8	12.9
VF2XLBR0125N150S06	1.25	2.5	2	15	2.4	4.6°	60	6	2	★	1	15.6	16.3	17.8	19.6
VF2XLBR0125N200S06	1.25	2.5	2	20	2.4	3.7°	70	6	2	★	1	20.8	21.7	23.8	26.2
VF2XLBR0125N250S06	1.25	2.5	2	25	2.4	3.2°	70	6	2	★	1	26.1	27.2	29.7	32.9
VF2XLBR0125N300S06	1.25	2.5	2	30	2.4	2.8°	80	6	2	★	1	31.3	32.6	35.7	*
VF2XLBR0125N350S06	1.25	2.5	2	35	2.4	2.4°	80	6	2	★	1	36.5	38.1	41.7	*
VF2XLBR0150N080S06	1.5	3	2.4	8	2.9	6.3°	60	6	2	●	1	8.3	8.6	9.3	10.2
VF2XLBR0150N100S06	1.5	3	2.4	10	2.9	5.5°	60	6	2	●	1	10.4	10.8	11.7	12.9
VF2XLBR0150N120S06	1.5	3	2.4	12	2.9	4.9°	60	6	2	●	1	12.5	13.0	14.1	15.5
VF2XLBR0150N140S06	1.5	3	2.4	14	2.9	4.4°	60	6	2	●	1	14.6	15.2	16.5	18.2
VF2XLBR0150N160S06	1.5	3	2.4	16	2.9	4°	60	6	2	●	1	16.7	17.3	18.9	20.8
VF2XLBR0150N200S06	1.5	3	2.4	20	2.9	3.4°	70	6	2	●	1	20.8	21.7	23.7	26.1
VF2XLBR0150N250S06	1.5	3	2.4	25	2.9	2.8°	70	6	2	●	1	26.1	27.2	29.7	*
VF2XLBR0150N300S06	1.5	3	2.4	30	2.9	2.5°	70	6	2	●	1	31.3	32.6	35.7	*
VF2XLBR0150N350S06	1.5	3	2.4	35	2.9	2.2°	80	6	2	★	1	36.5	38.0	41.7	*
VF2XLBR0150N400S06	1.5	3	2.4	40	2.9	1.9°	90	6	2	★	1	41.7	43.5	*	*
VF2XLBR0175N160S06	1.75	3.5	2.8	16	3.4	3.6°	60	6	2	★	1	16.7	17.3	18.9	20.8
VF2XLBR0175N200S06	1.75	3.5	2.8	20	3.4	3°	70	6	2	★	1	20.8	21.7	23.7	*
VF2XLBR0175N250S06	1.75	3.5	2.8	25	3.4	2.5°	70	6	2	★	1	26.0	27.1	29.6	*
VF2XLBR0175N300S06	1.75	3.5	2.8	30	3.4	2.1°	80	6	2	★	1	31.3	32.6	35.6	*
VF2XLBR0175N350S06	1.75	3.5	2.8	35	3.4	1.9°	80	6	2	★	1	36.5	38.0	*	*
VF2XLBR0175N400S06	1.75	3.5	2.8	40	3.4	1.7°	90	6	2	★	1	41.7	43.5	*	*
VF2XLBR0200N100S06	2	4	3.2	10	3.9	4.5°	70	6	2	●	1	10.4	10.8	11.6	12.7
VF2XLBR0200N120S06	2	4	3.2	12	3.9	3.9°	70	6	2	●	1	12.5	12.9	14.0	15.4
VF2XLBR0200N140S06	2	4	3.2	14	3.9	3.4°	70	6	2	●	1	14.6	15.1	16.4	18.0
VF2XLBR0200N160S06	2	4	3.2	16	3.9	3.1°	70	6	2	●	1	16.6	17.3	18.8	20.7

★ No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF2XLB

Ball nose, 2 flute, Long neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLBR0200N200S06	2	4	3.2	20	3.9	2.6°	70	6	2	●	1	20.8	21.7	23.6	★
VF2XLBR0200N250S06	2	4	3.2	25	3.9	2.1°	70	6	2	●	1	26.0	27.1	29.6	★
VF2XLBR0200N300S06	2	4	3.2	30	3.9	1.8°	70	6	2	●	1	31.2	32.6	★	★
VF2XLBR0200N350S06	2	4	3.2	35	3.9	1.6°	80	6	2	●	1	36.5	38.0	★	★
VF2XLBR0200N400S06	2	4	3.2	40	3.9	1.4°	90	6	2	★	1	41.7	43.5	★	★
VF2XLBR0200N450S06	2	4	3.2	45	3.9	1.2°	90	6	2	★	1	46.9	48.9	★	★
VF2XLBR0200N500S06	2	4	3.2	50	3.9	1.1°	100	6	2	★	1	52.1	54.3	★	★
VF2XLBR0250N200S06	2.5	5	4	20	4.9	1.5°	70	6	2	★	1	20.8	21.6	★	★
VF2XLBR0250N250S06	2.5	5	4	25	4.9	1.2°	70	6	2	★	1	26.0	27.1	★	★
VF2XLBR0250N300S06	2.5	5	4	30	4.9	1°	80	6	2	★	1	31.2	★	★	★
VF2XLBR0250N350S06	2.5	5	4	35	4.9	0.9°	80	6	2	★	1	36.4	★	★	★
VF2XLBR0300N300S06	3	6	4.8	30	5.85	—	80	6	2	●	2	★	★	★	★
VF2XLBR0300N400S06	3	6	4.8	40	5.85	—	90	6	2	●	2	★	★	★	★
VF2XLBR0300N500S06	3	6	4.8	50	5.85	—	100	6	2	●	2	★	★	★	★

★ No interference

VF2XLBS

Ball nose, 2 flute, Long neck, Short shank

VF2XLB

Ball nose, 2 flute, Long neck

CARBIDE

RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
		AISI H13 etc.			AISI D2 etc.		
RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Depth of cut ap (mm)
R 0.1	0.5	40000	300	11.8	0.003	40000	300
	1	40000	300	11.8	0.002	40000	300
	1.5	40000	300	11.8	0.001	40000	200
	2	40000	200	7.9	0.001	40000	100
	2.5	40000	100	3.9	0.001	40000	60
R 0.15	1	40000	500	19.7	0.007	40000	500
	1.5	40000	500	19.7	0.005	40000	500
	2	40000	500	19.7	0.003	40000	500
	2.5	40000	400	15.7	0.003	40000	400
	3	40000	300	11.8	0.002	40000	300
R 0.2	4	30000	200	7.9	0.002	30000	200
	1	40000	1400	55.1	0.015	40000	1400
	1.5	40000	1000	39.4	0.01	40000	1000
	2	40000	1000	39.4	0.01	40000	1000
	2.5	40000	700	27.6	0.005	40000	700
R 0.25	3	40000	700	27.6	0.005	40000	700
	4	40000	600	23.6	0.004	40000	500
	5	40000	400	15.7	0.003	40000	300
	1.5	40000	2000	78.7	0.02	40000	2000
	2	40000	2000	78.7	0.02	40000	2000
R 0.3	3	40000	1200	47.2	0.015	40000	1200
	4	36000	900	35.4	0.01	36000	900
	5	36000	700	27.6	0.007	36000	600
	6	36000	600	23.6	0.006	36000	500
	2	40000	2800	110.2	0.03	40000	2800
R 0.4	3	40000	2800	110.2	0.03	40000	2800
	4	35000	2000	78.7	0.02	35000	2000
	5	30000	1000	39.4	0.01	30000	1000
	6	30000	800	31.5	0.008	30000	800
	7	30000	600	23.6	0.008	30000	600
R 0.5	8	25000	400	15.7	0.006	25000	400
	2	40000	3500	137.8	0.04	40000	3500
	3	40000	3000	118.1	0.04	40000	3000
	4	40000	3000	118.1	0.02	40000	3000
	6	30000	1600	63.0	0.02	30000	1600
R 0.6	8	25000	1000	39.4	0.01	25000	1000
	10	25000	600	23.6	0.008	25000	600
	3	40000	4000	157.5	0.05	40000	4000
	4	40000	4000	157.5	0.05	40000	4000
	5	40000	3000	118.1	0.03	40000	3000
R 0.7	6	35000	2000	78.7	0.03	35000	2000
	8	30000	1600	63.0	0.02	30000	1600
	10	20000	1000	39.4	0.01	20000	1000
	12	20000	1000	39.4	0.01	18000	800
	14	18000	600	23.6	0.008	18000	400
R 0.75	16	18000	500	19.7	0.008	18000	400
	18	13000	300	11.8	0.005	13000	240
	20	13000	250	9.8	0.005	13000	200
	6	40000	4000	157.5	0.05	35000	3500
	8	40000	3000	118.1	0.05	27000	2000
R 0.8	10	27000	1900	74.8	0.03	24000	1700
	12	16000	1100	43.3	0.02	16000	1000
	14	16000	850	33.5	0.01	16000	780
	16	15000	500	19.7	0.01	14000	400
	8	40000	4500	177.2	0.06	28000	3200
R 0.9	12	32000	3000	118.1	0.03	19000	1800
	16	15000	1000	39.4	0.02	14000	800
	6	40000	5000	196.9	0.07	32000	4000
	8	40000	5000	196.9	0.07	28000	3500
	10	40000	4500	177.2	0.06	21000	2400
R 1	12	32000	3400	133.9	0.04	19000	2000
	14	16000	1500	59.1	0.04	13000	1200
	16	16000	1200	47.2	0.03	13000	1200
	18	13000	800	31.5	0.03	13000	1200
	20	13000	700	27.6	0.03	13000	1200
R 1.25	8	40000	6000	236.2	0.1	24000	3400
	10	40000	5000	196.9	0.1	24000	3000
	12	40000	5000	196.9	0.08	24000	3000
	14	40000	5000	196.9	0.08	24000	2600
	16	32000	3500	137.8	0.05	16000	1700
R 1.5	18	24000	2400	94.5	0.04	13000	1300
	20	10000	1000	39.4	0.04	10000	1000
	22	10000	1000	39.4	0.04	10000	1000
	25	10000	1000	39.4	0.04	8000	800
	30	10000	800	31.5	0.02	8000	800
R 1.75	35	10000	500	19.7	0.02	8000	400
	10	36000	5000	196.9	0.12	20000	2600
	15	36000	4600	181.1	0.08	18000	2000
	20	26000	3000	118.1	0.07	13000	1400
	25	10000	1100	43.3	0.06	8000	800
R 2	30	8000	800	31.5	0.05	7000	700
	35	8000	500	19.7	0.03	5000	400
	8	32000	6400	252.0	0.15	16000	3000
	10	32000	5100	200.8	0.15	16000	2200
	12	32000	5100	200.8	0.13	16000	2200
R 2.5	14	32000	4500	177.2	0.13	16000	2200
	16	32000	4500	177.2	0.1	16000	1800
	20	27000	3800	149.6	0.1	14000	1600
	25	21000	2700	106.3	0.08	11000	1200
	30	9000	1000	39.4	0.08	7000	700
R 3	35	6000	700	27.6	0.06	6000	600
	40	6000	600	23.6	0.04	5000	400
	16	28000	4200	165.4	0.13	14000	1600
	20	26000	3800	149.6	0.13	13000	1600
	25	23000	3300	129.9	0.12	11000	1200
R 3.5	30	13000	1900	74.8	0.09	9000	1000
	35	9000	1200	47.2	0.08	6000	600
	40	8500	1100	43.3	0.07	5500	500
	10	24000	4800	189.0	0.2	12000	2200
	12	24000	4800	189.0	0.2	12000	2200
R 4	14	24000	3800	149.6	0.15	12000	1500
	16	24000	3800	149.6	0.15	12000	1500
	20	24000	3800	149.6	0.15	12000	1500
	25	24000	3800	149.6	0.15	10000	1100
	30	20000	3000	118.1	0.1	10000	1100
R 4.5	35	12000	1700	66.9	0.1	8000	900
	40	11000	1500	59.1	0.1	5000	500
	45	10000	1300	51.2	0.08	5000	500
	50	8000	1000	39.4	0.05	4000	400
	20	19000	3400	133.9	0.2	10000	1400
R 5	25	19000	3400	133.9	0.2	10000	1400
	30	19000	3200	126.0	0.15	8000	1000
	35	16000	2700	106.3	0.1	8000	900
	30	16000	3500	137.8	0.2	8000	1000
	40	16000	3000	118.1	0.15	8000	800
	50	16000	2700	106.3	0.15	6000	500

SQUARE

BALL

RADIUS

TAPER

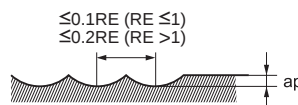
BARREL

ROUGHING

I

SOLID END MILLS

Depth of cut



RE : Radius

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

IMPACT MIRACLE END MILLS

VF2XLB - Inch sizes

Ball nose, 2 flute, Long neck

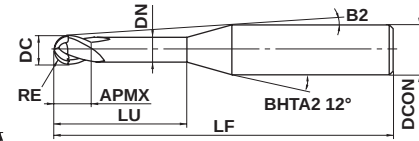
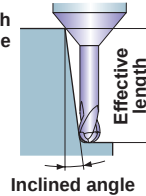


CARBIDE

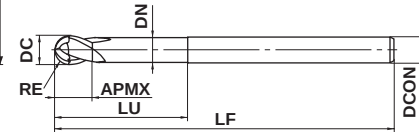
Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	◎	◎	◎				



Effective length
for inclined angle



Type 1



Type 2



.0156" ≤ RE ≤ .1250"

±0.002"



.0313" ≤ DC ≤ .2500"

0
- 0.0008"



DCON = .2500"

0
- 0.00024"

● 2 flute long neck ball nose end mill with Impact Miracle coating for high hardened materials.

(inch)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLB D1/32N4D	.0156	.0313	.0313	.1250	.0296	9.9°	2.5	.2500	2	●	1	.130	.134	.146	.161
VF2XLB D1/32N6D	.0156	.0313	.0313	.1875	.0296	9.1°	2.5	.2500	2	●	1	.197	.205	.221	.244
VF2XLB D1/16N4D	.0313	.0625	.0625	.2500	.0601	8.0°	2.5	.2500	2	●	1	.264	.276	.299	.331
VF2XLB D1/16N6D	.0313	.0625	.0625	.3750	.0601	6.8°	2.5	.2500	2	●	1	.394	.409	.449	.496
VF2XLB D3/32N4D	.0469	.0938	.0938	.3750	.0898	6.4°	2.5	.2500	2	●	1	.390	.406	.441	.484
VF2XLB D3/32N6D	.0469	.0938	.0938	.5625	.0898	5.1°	2.5	.2500	2	●	1	.587	.610	.665	.736
VF2XLB D1/8N4D	.0625	.1250	.1250	.5000	.1211	4.9°	3.0	.2500	2	●	1	.520	.539	.591	.646
VF2XLB D1/8N6D	.0625	.1250	.1250	.7500	.1211	3.7°	3.0	.2500	2	●	1	.780	.815	.886	.980
VF2XLB D3/16N4D	.0938	.1875	.1875	.7500	.1835	2.3°	3.0	.2500	2	●	1	.780	.811	.882	*
VF2XLB D3/16N6D	.0938	.1875	.1875	1.1250	.1835	1.6°	3.0	.2500	2	●	1	1.169	1.221	*	*
VF2XLB D1/4N4D	.1250	.2500	.2500	1.0000	.2441	—	3.5	.2500	2	●	2	*	*	*	*
VF2XLB D1/4N6D	.1250	.2500	.2500	1.5000	.2441	—	3.5	.2500	2	●	2	*	*	*	*

* No interference

RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
		Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)
			(mm/min)	(IPM)			(mm/min)	(IPM)	
R .0156	.1250	40000	3000	118	.0016	40000	3000	118	.0012
R .0156	.1875	32000	1700	67	.0012	32000	1700	67	.0004
R .0313	.2500	40000	5000	197	.0031	26000	3300	129	.0028
R .0313	.3750	36000	3900	153	.0024	20000	2200	86	.0012
R .0469	.3750	37000	5200	204	.0047	20000	2600	102	.0043
R .0469	.5625	37000	4800	189	.0031	20000	2200	86.6	.0030
R .0625	.5000	30000	4800	189	.0051	15000	2100	82.6	.0051
R .0625	.7500	30000	4200	165	.0039	13000	1500	59	.0024
R .0938	.7500	20000	3600	142	.0079	10000	1400	55.1	.0071
R .0938	1.1250	20000	3400	134	.0059	8400	1100	43.3	.0055
R .1250	1.0000	15000	3300	130	.0079	7500	950	37.2	.0079
R .1250	1.5000	15000	3000	118	.0059	7500	750	29.5	.0059
Depth of cut		RE : Radius							

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

IMPACT MIRACLE END MILLS

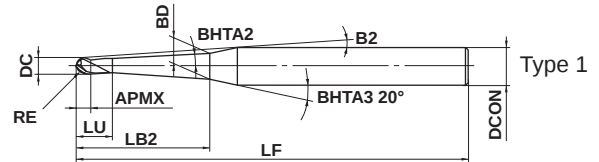
VF3XB

Ball nose, Medium cut length, 3 flute, Taper neck

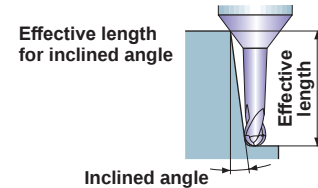


CARBIDE

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



	$0.4 \leq RE \leq 2.5$				
	± 0.01				
	$0.8 \leq DC \leq 5$				
	$0 - 0.02$				
	$4 \leq DCON \leq 6$	$DCON = 8$			
	$0 - 0.008$	$0 - 0.009$			



● 3 flute ball end mill, high rigidity taper neck type.

(mm)

	Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	DN	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
															0.5°	1°	2°	3°
ROUGHING	VF3XBR0040T0024L006	0.4	0.8	0.4°	0.5	6	1.5	8.9°	0.82	60	4	3	★	1	6.3	6.6	6.9	7.3
	VF3XBR0040T0024L008	0.4	0.8	0.4°	0.5	8	1.5	7.5°	0.85	60	4	3	★	1	8.4	8.6	9.1	9.5
	VF3XBR0040T0024L012	0.4	0.8	0.4°	0.5	12	1.5	5.7°	0.91	60	4	3	★	1	12.4	12.7	13.4	14.1
	VF3XBR0040T0054L008	0.4	0.8	0.9°	0.5	8	1.5	7.6°	0.96	60	4	3	★	1	—	8.4	8.9	9.3
	VF3XBR0040T0054L012	0.4	0.8	0.9°	0.5	12	1.5	5.8°	1.09	60	4	3	★	1	—	12.4	13.1	13.8
	VF3XBR0040T0054L016	0.4	0.8	0.9°	0.5	16	1.5	4.7°	1.22	60	4	3	★	1	—	16.5	17.3	18.3
	VF3XBR0050T0024L008	0.5	1	0.4°	0.8	8	2.3	9.6°	1.02	60	6	3	●	1	8.5	8.8	9.3	9.8
	VF3XBR0050T0024L010	0.5	1	0.4°	0.8	10	2.3	8.5°	1.05	60	6	3	●	1	10.5	10.9	11.4	12.1
	VF3XBR0050T0024L012	0.5	1	0.4°	0.8	12	2.3	7.6°	1.08	60	6	3	●	1	12.6	13.0	13.6	14.4
	VF3XBR0050T0024L016	0.5	1	0.4°	0.8	16	2.3	6.3°	1.13	70	6	3	●	1	16.6	17.1	18.0	18.9
	VF3XBR0050T0024L020	0.5	1	0.4°	0.8	20	2.3	5.4°	1.19	70	6	3	★	1	20.6	21.2	22.3	23.5
	VF3XBR0050T0024L025	0.5	1	0.4°	0.8	25	2.3	4.6°	1.26	70	6	3	★	1	25.7	26.3	27.7	29.3
	VF3XBR0050T0024L030	0.5	1	0.4°	0.8	30	2.3	4.0°	1.33	80	6	3	★	1	30.7	31.5	33.1	35.0
	VF3XBR0050T0024L035	0.5	1	0.4°	0.8	35	2.3	3.5°	1.40	80	6	3	★	1	35.7	36.6	38.6	40.7
	VF3XBR0050T0054L008	0.5	1	0.9°	0.8	8	2.3	9.7°	1.12	60	6	3	●	1	—	8.6	9.1	9.6
	VF3XBR0050T0054L012	0.5	1	0.9°	0.8	12	2.3	7.7°	1.24	60	6	3	●	1	—	12.6	13.3	14.1
	VF3XBR0050T0054L016	0.5	1	0.9°	0.8	16	2.3	6.4°	1.37	70	6	3	●	1	—	16.7	17.6	18.5
	VF3XBR0050T0054L020	0.5	1	0.9°	0.8	20	2.3	5.5°	1.50	70	6	3	●	1	—	20.7	21.8	23.0
	VF3XBR0050T0054L025	0.5	1	0.9°	0.8	25	2.3	4.7°	1.65	70	6	3	★	1	—	25.7	27.1	28.6
	VF3XBR0050T0054L030	0.5	1	0.9°	0.8	30	2.3	4.0°	1.81	80	6	3	★	1	—	30.8	32.4	34.2
	VF3XBR0050T0054L035	0.5	1	0.9°	0.8	35	2.3	3.6°	1.97	80	6	3	★	1	—	35.8	37.7	39.8
	VF3XBR0050T0054L040	0.5	1	0.9°	0.8	40	2.3	3.2°	2.12	80	6	3	★	1	—	40.8	43.0	45.4
	VF3XBR0050T0054L050	0.5	1	0.9°	0.8	50	2.3	2.7°	2.44	110	6	3	★	1	—	50.9	53.6	*
	VF3XBR0050T0054L060	0.5	1	0.9°	0.8	60	2.3	2.3°	2.75	110	6	3	★	1	—	60.9	64.1	*
	VF3XBR0050T0054L070	0.5	1	0.9°	0.8	70	2.3	2.0°	3.07	110	6	3	★	1	—	71.0	74.7	*
	VF3XBR0050T0130L012	0.5	1	1.5°	0.8	12	2.3	7.9°	1.45	60	6	3	★	1	—	—	13.0	13.7
	VF3XBR0050T0130L016	0.5	1	1.5°	0.8	16	2.3	6.5°	1.66	70	6	3	★	1	—	—	17.1	18.0
	VF3XBR0050T0130L020	0.5	1	1.5°	0.8	20	2.3	5.6°	1.87	70	6	3	★	1	—	—	21.2	22.4
	VF3XBR0050T0130L025	0.5	1	1.5°	0.8	25	2.3	4.8°	2.13	70	6	3	★	1	—	—	26.3	27.8
	VF3XBR0050T0130L030	0.5	1	1.5°	0.8	30	2.3	4.1°	2.39	80	6	3	★	1	—	—	31.5	33.2
	VF3XBR0050T0130L035	0.5	1	1.5°	0.8	35	2.3	3.7°	2.65	80	6	3	★	1	—	—	36.6	38.6

* No interference

(mm)

CARBIDE

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	DN	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
VF3XBR0075T0024L010	0.75	1.5	0.4°	1.3	10	2.8	8.1°	1.54	60	6	3	●	1	10.6	10.9	11.4	12.0
VF3XBR0075T0024L015	0.75	1.5	0.4°	1.3	15	2.8	6.2°	1.61	60	6	3	●	1	15.6	16.0	16.9	17.8
VF3XBR0075T0024L020	0.75	1.5	0.4°	1.3	20	2.8	5.0°	1.68	70	6	3	●	1	20.6	21.2	22.3	23.5
VF3XBR0075T0024L030	0.75	1.5	0.4°	1.3	30	2.8	3.7°	1.82	80	6	3	●	1	30.7	31.5	33.1	35.0
VF3XBR0075T0054L015	0.75	1.5	0.9°	1.3	15	2.8	6.3°	1.82	60	6	3	●	1	—	15.7	16.5	17.4
VF3XBR0075T0054L020	0.75	1.5	0.9°	1.3	20	2.8	5.1°	1.98	70	6	3	●	1	—	20.7	21.8	23.0
VF3XBR0075T0054L030	0.75	1.5	0.9°	1.3	30	2.8	3.7°	2.29	80	6	3	●	1	—	30.8	32.4	34.2
VF3XBR0075T0054L040	0.75	1.5	0.9°	1.3	40	2.8	3.0°	2.61	80	6	3	★	1	—	40.8	43.0	45.3
VF3XBR0075T0130L015	0.75	1.5	1.5°	1.3	15	2.8	6.4°	2.08	60	6	3	★	1	—	—	16.1	17.0
VF3XBR0075T0130L020	0.75	1.5	1.5°	1.3	20	2.8	5.2°	2.34	70	6	3	★	1	—	—	21.2	22.4
VF3XBR0075T0130L030	0.75	1.5	1.5°	1.3	30	2.8	3.8°	2.86	80	6	3	★	1	—	—	31.5	33.2
VF3XBR0100T0024L016	1	2	0.4°	1.6	16	3.6	5.5°	2.07	70	6	3	●	1	16.7	17.1	18.0	19.0
VF3XBR0100T0024L020	1	2	0.4°	1.6	20	3.6	4.6°	2.13	70	6	3	●	1	20.7	21.3	22.3	23.5
VF3XBR0100T0024L025	1	2	0.4°	1.6	25	3.6	3.9°	2.20	70	6	3	●	1	25.8	26.4	27.8	29.3
VF3XBR0100T0024L030	1	2	0.4°	1.6	30	3.6	3.4°	2.27	80	6	3	●	1	30.8	31.6	33.2	35.0
VF3XBR0100T0024L035	1	2	0.4°	1.6	35	3.6	2.9°	2.34	80	6	3	●	1	35.8	36.7	38.6	*
VF3XBR0100T0024L040	1	2	0.4°	1.6	40	3.6	2.6°	2.41	80	6	3	●	1	40.8	41.9	44.0	*
VF3XBR0100T0054L020	1	2	0.9°	1.6	20	3.6	4.7°	2.42	70	6	3	●	1	—	20.8	21.9	23.0
VF3XBR0100T0054L025	1	2	0.9°	1.6	25	3.6	4.0°	2.57	70	6	3	●	1	—	25.8	27.2	28.6
VF3XBR0100T0054L030	1	2	0.9°	1.6	30	3.6	3.4°	2.73	80	6	3	●	1	—	30.9	32.5	34.2
VF3XBR0100T0054L035	1	2	0.9°	1.6	35	3.6	3.0°	2.89	80	6	3	●	1	—	35.9	37.7	39.8
VF3XBR0100T0054L040	1	2	0.9°	1.6	40	3.6	2.7°	3.04	80	6	3	●	1	—	40.9	43.0	*
VF3XBR0100T0054L050	1	2	0.9°	1.6	50	3.6	2.2°	3.36	110	6	3	★	1	—	51.0	53.6	*
VF3XBR0100T0054L060	1	2	0.9°	1.6	60	3.6	1.9°	3.67	110	6	3	★	1	—	61.0	*	*
VF3XBR0100T0054L070	1	2	0.9°	1.6	70	3.6	1.6°	3.99	110	6	3	★	1	—	71.1	*	*
VF3XBR0100T0130L025	1	2	1.5°	1.6	25	3.6	4.1°	3.02	70	6	3	★	1	—	—	26.4	27.9
VF3XBR0100T0130L030	1	2	1.5°	1.6	30	3.6	3.5°	3.28	80	6	3	★	1	—	—	31.6	33.3
VF3XBR0100T0130L035	1	2	1.5°	1.6	35	3.6	3.1°	3.54	80	6	3	★	1	—	—	36.7	38.7
VF3XBR0100T0130L040	1	2	1.5°	1.6	40	3.6	2.7°	3.81	80	6	3	★	1	—	—	41.8	*
VF3XBR0125T0054L020	1.25	2.5	0.9°	2	20	4.5	4.3°	2.89	60	6	3	★	1	—	20.8	21.9	23.1
VF3XBR0125T0054L030	1.25	2.5	0.9°	2	30	4.5	3.1°	3.20	80	6	3	★	1	—	30.9	32.5	34.2
VF3XBR0125T0054L040	1.25	2.5	0.9°	2	40	4.5	2.4°	3.52	80	6	3	★	1	—	40.9	43.1	*
VF3XBR0125T0130L020	1.25	2.5	1.5°	2	20	4.5	4.4°	3.21	60	6	3	★	1	—	—	21.4	22.5
VF3XBR0125T0130L030	1.25	2.5	1.5°	2	30	4.5	3.1°	3.74	80	6	3	★	1	—	—	31.6	33.3
VF3XBR0125T0130L040	1.25	2.5	1.5°	2	40	4.5	2.5°	4.26	80	6	3	★	1	—	—	41.9	*
VF3XBR0150T0024L020	1.5	3	0.4°	2	20	5	3.8°	3.11	60	6	3	●	1	20.7	21.3	22.3	23.5
VF3XBR0150T0024L025	1.5	3	0.4°	2	25	5	3.1°	3.18	80	6	3	●	1	25.8	26.4	27.7	29.2
VF3XBR0150T0024L030	1.5	3	0.4°	2	30	5	2.7°	3.25	80	6	3	●	1	30.8	31.6	33.2	*
VF3XBR0150T0024L040	1.5	3	0.4°	2	40	5	2.1°	3.39	80	6	3	●	1	40.9	41.9	44.0	*
VF3XBR0150T0024L050	1.5	3	0.4°	2	50	5	1.7°	3.53	100	6	3	●	1	50.9	52.2	*	*
VF3XBR0150T0054L020	1.5	3	0.9°	2	20	5	3.8°	3.37	60	6	3	●	1	—	20.9	21.9	23.0
VF3XBR0150T0054L030	1.5	3	0.9°	2	30	5	2.7°	3.69	80	6	3	●	1	—	30.9	32.5	*
VF3XBR0150T0054L040	1.5	3	0.9°	2	40	5	2.1°	4.00	80	6	3	●	1	—	41.0	43.1	*
VF3XBR0150T0054L050	1.5	3	0.9°	2	50	5	1.7°	4.31	100	6	3	●	1	—	51.0	*	*
VF3XBR0150T0054L060	1.5	3	0.9°	2	60	5	2.3°	4.63	110	8	3	●	1	—	61.1	64.2	*
VF3XBR0150T0054L070	1.5	3	0.9°	2	70	5	2.0°	4.94	120	8	3	●	1	—	71.1	74.8	*
VF3XBR0150T0130L040	1.5	3	1.5°	2	40	5	2.2°	4.73	80	6	3	★	1	—	—	41.9	*
VF3XBR0150T0130L050	1.5	3	1.5°	2	50	5	2.8°	5.26	110	8	3	★	1	—	—	52.2	*
VF3XBR0150T0130L060	1.5	3	1.5°	2	60	5	2.4°	5.78	110	8	3	★	1	—	—	62.4	*
VF3XBR0150T0130L070	1.5	3	1.5°	2	70	5	2.1°	6.30	120	8	3	★	1	—	—	72.7	*
VF3XBR0200T0054L030	2	4	0.9°	3	30	6	3.5°	4.65	90	8	3	●	1	—	30.9	32.5	34.2

* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF3XB

Ball nose, Medium cut length, 3 flute, Taper neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

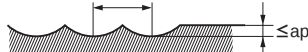
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SOLID END MILLS

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	DN	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
VF3XBR0200T0054L040	2	4	0.9°	3	40	6	2.7°	4.97	90	8	3	●	1	—	41.0	43.0	*
VF3XBR0200T0054L050	2	4	0.9°	3	50	6	2.2°	5.28	110	8	3	●	1	—	51.0	53.6	*
VF3XBR0200T0054L060	2	4	0.9°	3	60	6	1.9°	5.60	110	8	3	●	1	—	61.1	*	*
VF3XBR0250T0054L035	2.5	5	0.9°	3.5	35	6.5	2.4°	5.80	90	8	3	●	1	—	35.9	37.7	*
VF3XBR0250T0054L040	2.5	5	0.9°	3.5	40	6.5	2.2°	5.95	90	8	3	●	1	—	41.0	43.0	*
VF3XBR0250T0054L050	2.5	5	0.9°	3.5	50	6.5	1.8°	6.27	110	8	3	●	1	—	51.0	*	*
VF3XBR0250T0054L060	2.5	5	0.9°	3.5	60	6.5	1.5°	6.58	110	8	3	●	1	—	61.1	*	*

* No interference

RECOMMENDED CUTTING CONDITIONS

Work Material			Carbon steel, Cast iron, Alloy steel (—30HRC)				Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
			AISI 1050, AISI 35, AISI P20 etc.				AISI H13, AISI W1—10, AISI P21 etc.				AISI H13 etc.				AISI D2 etc.			
RE (mm)	BHTA2	LB2 (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)
R0.4	0.4°	6	34000	2700	106.3	0.03	31000	2200	86.6	0.025	24000	1700	66.9	0.02	19000	1400	55.1	0.015
		8	31000	2100	82.7	0.02	29000	1700	66.9	0.02	22000	1300	51.2	0.015	18000	1000	39.4	0.01
		12	28000	2000	78.7	0.015	26000	1600	63.0	0.01	20000	1200	47.2	0.01	16000	960	37.8	0.007
	0.9°	8	31000	2200	86.6	0.02	29000	1800	70.9	0.02	22000	1400	55.1	0.015	18000	1100	43.3	0.01
		12	28000	2100	82.7	0.015	26000	1700	66.9	0.01	20000	1300	51.2	0.01	16000	1000	39.4	0.007
		16	25000	1100	43.3	0.01	23000	910	35.8	0.01	18000	700	27.6	0.008	14000	560	22.0	0.006
R0.5	0.4°	8	27000	2700	106.3	0.04	25000	2200	86.6	0.04	19000	1700	66.9	0.03	15000	1400	55.1	0.02
		10	24000	2200	86.6	0.03	22000	1800	70.9	0.025	17000	1400	55.1	0.02	14000	1100	43.3	0.015
		12	24000	2200	86.6	0.03	22000	1800	70.9	0.025	17000	1400	55.1	0.02	14000	1100	43.3	0.015
		16	22000	2100	82.7	0.03	21000	1700	66.9	0.025	16000	1300	51.2	0.02	13000	1000	39.4	0.015
		20	20000	1400	55.1	0.015	18000	1200	47.2	0.01	14000	900	35.4	0.01	11000	720	28.3	0.007
		25	18000	1300	51.2	0.015	17000	1000	39.4	0.01	13000	800	31.5	0.009	10000	640	25.2	0.006
		30	15000	960	37.8	0.01	14000	780	30.7	0.01	11000	600	23.6	0.008	8800	480	18.9	0.006
		35	14000	800	31.5	0.008	13000	650	25.6	0.007	10000	500	19.7	0.006	8000	400	15.7	0.004
	0.9°	8	27000	2900	114.2	0.04	25000	2300	90.6	0.04	19000	1800	70.9	0.03	15000	1400	55.1	0.02
		12	24000	2400	94.5	0.03	22000	2000	78.7	0.025	17000	1500	59.1	0.02	14000	1200	47.2	0.015
		16	22000	2200	86.6	0.03	21000	1800	70.9	0.025	16000	1400	55.1	0.02	13000	1100	43.3	0.015
		20	20000	1600	63.0	0.015	18000	1300	51.2	0.01	14000	1000	39.4	0.01	11000	800	31.5	0.007
		25	18000	1400	55.1	0.015	17000	1200	47.2	0.01	13000	900	35.4	0.009	10000	720	28.3	0.006
		30	15000	1100	43.3	0.01	14000	910	35.8	0.009	11000	700	27.6	0.008	8800	560	22.0	0.006
		35	14000	960	37.8	0.008	13000	780	30.7	0.007	10000	600	23.6	0.006	8000	480	18.9	0.004
		40	11000	800	31.5	0.007	11000	650	25.6	0.006	8000	500	19.7	0.005	6400	400	15.7	0.003
		50	8400	610	24.0	0.006	7800	490	19.3	0.005	6000	380	15.0	0.004	4800	300	11.8	0.003
		60	7000	510	20.1	0.004	6500	400	15.7	0.004	5000	320	12.6	0.003	4000	260	10.2	0.002
	70	7000	480	18.9	0.003	6500	390	15.4	0.002	5000	300	11.8	0.002	4000	240	9.4	0.001	
	1.5°	12	24000	2600	102.4	0.03	22000	2100	82.7	0.025	17000	1600	63.0	0.02	14000	1300	51.2	0.015
		16	22000	2400	94.5	0.03	21000	2000	78.7	0.025	16000	1500	59.1	0.02	13000	1200	47.2	0.015
		20	20000	1800	70.9	0.015	18000	1400	55.1	0.01	14000	1100	43.3	0.01	11000	880	34.6	0.007
		25	18000	1600	63.0	0.015	17000	1300	51.2	0.01	13000	1000	39.4	0.009	11000	800	31.5	0.006
		30	15000	1300	51.2	0.01	14000	1000	39.4	0.01	11000	800	31.5	0.008	8800	640	25.2	0.006
35		14000	1100	43.3	0.008	13000	910	35.8	0.007	10000	700	27.6	0.006	8000	560	22.0	0.004	
Depth of cut			≤0.1RE (RE≤1) ≤0.2RE (RE>1)  RE : Radius															

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF3XB

Ball nose, Medium cut length, 3 flute, Taper neck

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

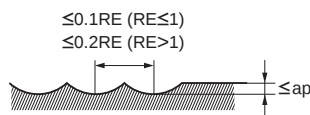
ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Work Material			Carbon steel, Cast iron, Alloy steel (—30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
			AISI 1050, AISI 35, AISI P20 etc.			AISI H13, AISI W1—10, AISI P21 etc.			AISI H13 etc.			AISI D2 etc.		
RE (mm)	BHTA2	LB2 (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut (mm)
R0.75	0.4°	10	18000	2700	106.3	0.06	17000	2200	86.6	0.05	13000	1700	66.9	0.04
		15	17000	2200	86.6	0.04	16000	1800	70.9	0.04	12000	1400	55.1	0.03
		20	17000	2100	82.7	0.03	16000	1700	66.9	0.025	12000	1300	51.2	0.02
		30	14000	1600	63.0	0.015	13000	1300	51.2	0.01	10000	1000	39.4	0.01
	0.9°	15	17000	2400	94.5	0.04	16000	2000	78.7	0.04	12000	1500	59.1	0.03
		20	17000	2200	86.6	0.03	16000	1800	70.9	0.025	12000	1400	55.1	0.02
		30	14000	1800	70.9	0.015	13000	1400	55.1	0.01	10000	1100	43.3	0.01
		40	13000	1300	51.2	0.01	12000	1000	39.4	0.01	9000	800	31.5	0.008
	1.5°	15	17000	2600	102.4	0.04	16000	2100	82.7	0.04	12000	1600	63.0	0.03
		20	17000	2400	94.5	0.03	16000	2000	78.7	0.025	12000	1500	59.1	0.02
		30	14000	2000	78.7	0.015	13000	1600	63.0	0.01	10000	1200	47.2	0.01
		40	13000	1300	51.2	0.01	12000	1000	39.4	0.01	9000	800	31.5	0.008
R1	0.4°	16	15000	3200	126.0	0.07	14000	2600	102.4	0.06	11000	2000	78.7	0.05
		20	14000	2400	94.5	0.06	13000	2000	78.7	0.05	10000	1500	59.1	0.04
		25	14000	2100	82.7	0.04	13000	1700	66.9	0.04	10000	1300	51.2	0.03
		30	13000	1800	70.9	0.03	12000	1400	55.1	0.03	9000	1100	43.3	0.025
		35	13000	1600	63.0	0.03	12000	1300	51.2	0.025	9000	1000	39.4	0.02
		40	12000	1400	55.1	0.015	11000	1200	47.2	0.01	8500	900	35.4	0.01
	0.9°	20	14000	2600	102.4	0.06	13000	2100	82.7	0.05	10000	1600	63.0	0.04
		25	14000	2200	86.6	0.05	13000	1800	70.9	0.04	10000	1400	55.1	0.03
		30	13000	1900	74.8	0.04	12000	1600	63.0	0.04	9000	1200	47.2	0.03
		35	13000	1800	70.9	0.04	12000	1400	55.1	0.03	9000	1100	43.3	0.025
		40	12000	1600	63.0	0.03	11000	1300	51.2	0.025	8500	1000	39.4	0.02
		50	11000	1400	55.1	0.015	10000	1200	47.2	0.01	8000	900	35.4	0.01
	1.5°	60	9800	1100	43.3	0.007	9100	910	35.8	0.006	7000	700	27.6	0.005
		70	8400	960	37.8	0.004	7800	780	30.7	0.004	6000	600	23.6	0.003
		25	14000	2400	94.5	0.05	13000	2000	78.7	0.04	10000	1500	59.1	0.03
		30	12600	2100	82.7	0.04	12000	1700	66.9	0.04	9000	1300	51.2	0.03
		35	13000	1900	74.8	0.04	12000	1600	63.0	0.03	9000	1200	47.2	0.025
		40	12000	1800	70.9	0.03	11000	1400	55.1	0.025	8500	1100	43.3	0.02
R1.25	0.9°	20	13000	2900	114.2	0.06	12000	2300	90.6	0.05	9000	1800	70.9	0.04
		30	12000	2600	102.4	0.05	11000	2100	82.7	0.04	8500	1600	63.0	0.03
		40	11000	2200	86.6	0.04	9800	1800	70.9	0.04	7500	1400	55.1	0.03
	1.5°	20	13000	3000	118.1	0.06	12000	2500	98.4	0.05	9000	1900	74.8	0.04
		30	12000	2700	106.3	0.05	11050	2200	86.6	0.04	8500	1700	66.9	0.03
		40	11000	2400	94.5	0.04	9800	2000	78.7	0.04	7500	1500	59.1	0.03

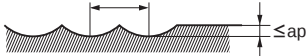
Depth of cut



RE : Radius

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

Work Material			Carbon steel, Cast iron, Alloy steel (‐30HRC)				Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45‐55HRC)				Hardened steel (55‐62HRC)			
			AISI 1050, AISI 35, AISI P20 etc.				AISI H13, AISI W1‐10, AISI P21 etc.				AISI H13 etc.				AISI D2 etc.			
RE (mm)	BHTA2	LB2 (mm)	Revolution (min ^{‐1})	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ^{‐1})	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ^{‐1})	Table feed (mm/min) (IPM)		Depth of cut (mm)	Revolution (min ^{‐1})	Table feed (mm/min) (IPM)		Depth of cut (mm)
R1.5	0.4°	20	12000	3700	145.7	0.13	11000	3000	118.1	0.1	8500	2300	90.6	0.09	6800	1800	70.9	0.06
		30	11000	2900	114.2	0.07	10000	2300	90.6	0.06	8000	1800	70.9	0.05	6400	1400	55.1	0.03
		40	11000	2400	94.5	0.06	10000	2000	78.7	0.05	8000	1500	59.1	0.04	6400	1200	47.2	0.03
		50	11000	2000	78.7	0.04	9800	1600	63.0	0.04	7500	1200	47.2	0.03	6000	960	37.8	0.02
	0.9°	20	12000	3800	149.6	0.13	11000	3100	122.0	0.1	8500	2400	94.5	0.09	6800	1900	74.8	0.06
		30	11000	3000	118.1	0.07	10000	2500	98.4	0.06	8000	1900	74.8	0.05	6400	1500	59.1	0.03
		40	11000	2600	102.4	0.06	10000	2100	82.7	0.05	8000	1600	63.0	0.04	6400	1300	51.2	0.03
		50	11000	2100	82.7	0.04	9800	1700	66.9	0.04	7500	1300	51.2	0.03	6000	1000	39.4	0.02
		60	9800	2000	78.7	0.03	9100	1600	63.0	0.025	7000	1200	47.2	0.02	5600	960	37.8	0.015
	1.5°	70	9800	1800	70.9	0.015	9100	1400	55.1	0.01	7000	1100	43.3	0.01	5600	880	34.6	0.007
		50	11000	2200	86.6	0.04	9800	1800	70.9	0.04	7500	1400	55.1	0.03	6000	1100	43.3	0.02
		60	9800	2100	82.7	0.03	9100	1700	66.9	0.025	7000	1300	51.2	0.02	5600	1000	39.4	0.015
	70	9800	2000	78.7	0.015	9100	1600	63.0	0.01	7000	1200	47.2	0.01	5600	960	37.8	0.007	
R2	0.9°	30	10000	3200	126.0	0.3	9400	2600	102.4	0.25	7200	2000	78.7	0.2	5800	1600	63.0	0.15
		40	9500	2400	94.5	0.15	8800	2000	78.7	0.12	6800	1500	59.1	0.1	5400	1200	47.2	0.07
		50	9500	2100	82.7	0.1	8800	1700	66.9	0.1	6800	1300	51.2	0.08	5400	1000	39.4	0.06
		60	9000	1900	74.8	0.07	8300	1600	63.0	0.06	6400	1200	47.2	0.05	5100	960	37.8	0.03
R2.5	0.9°	35	8000	3500	137.8	0.3	7400	2900	114.2	0.25	5700	2200	86.6	0.2	4600	1800	70.9	0.15
		40	8000	3200	126.0	0.2	7400	2600	102.4	0.18	5700	2000	78.7	0.15	4600	1600	63.0	0.1
		60	7600	2400	94.5	0.15	7000	2000	78.7	0.12	5400	1500	59.1	0.1	4300	1200	47.2	0.07
Depth of cut			≤0.1RE (RE≤1) ≤0.2RE (RE>1)  RE : Radius															

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

IMPACT MIRACLE END MILLS

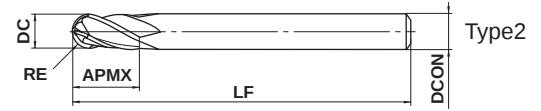
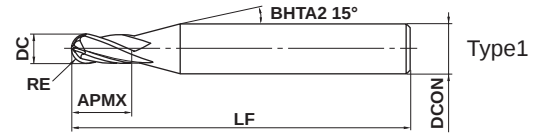
VF4MB

Ball nose, Medium cut length, 4 flute



CARBIDE

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



$0.5 \leq RE \leq 6$				
± 0.01				



$1 \leq DC \leq 12$				
$\begin{matrix} 0 \\ - 0.020 \end{matrix}$				



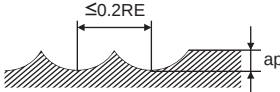
DCON=6	$8 \leq DCON \leq 10$	DCON=12		
$\begin{matrix} 0 \\ - 0.008 \end{matrix}$	$\begin{matrix} 0 \\ - 0.009 \end{matrix}$	$\begin{matrix} 0 \\ - 0.011 \end{matrix}$		

● 4 flute ball nose end mill for high-speed machining of hardened steel.

(mm)

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF4MBR0050	0.5	1	2.5	50	6	4	●	1
VF4MBR0100	1	2	6	60	6	4	●	1
VF4MBR0150	1.5	3	8	70	6	4	●	1
VF4MBR0200	2	4	8	70	6	4	●	1
VF4MBR0250	2.5	5	12	80	6	4	●	1
VF4MBR0300	3	6	12	80	6	4	●	2
VF4MBR0400	4	8	14	90	8	4	●	2
VF4MBR0500	5	10	18	100	10	4	●	2
VF4MBR0600	6	12	22	110	12	4	●	2

RECOMMENDED CUTTING CONDITIONS

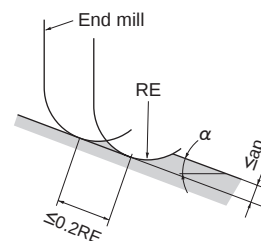
Work Material	Hardened steel (45—55HRC) AISI H13 etc.							Hardened steel (55—62HRC) AISI D2 etc.						
	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (mm)	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			Depth of cut ap (mm)
RE (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)			Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		
R0.5	40000	8000	315.0	40000	3800	149.6	0.06	40000	5600	220.5	40000	3100	122.0	0.05
R1	40000	9600	378.0	40000	5600	220.5	0.11	40000	8000	315.0	28000	3100	122.0	0.10
R1.5	40000	12000	472.4	32000	5600	220.5	0.13	32000	7700	303.1	19000	2900	114.2	0.12
R2	32000	11000	433.1	24000	4700	185.0	0.15	24000	6200	244.1	14000	2500	98.4	0.13
R2.5	25000	9000	354.3	19000	3800	149.6	0.20	19000	5300	208.7	12000	2200	86.6	0.15
R3	21000	8400	330.7	15000	3400	133.9	0.25	16000	4800	189.0	9600	2000	78.7	0.20
R4	16000	6400	252.0	12000	2600	102.4	0.30	12000	3600	141.7	7200	1600	63.0	0.20
R5	13000	5200	204.7	9600	2200	86.6	0.50	10000	3200	126.0	5800	1300	51.2	0.20
R6	9000	3600	141.7	7200	1700	66.9	0.50	7000	2200	86.6	4300	940	37.0	0.30
Depth of cut	 RE : Radius													

Work Material	Hardened steel (62—70HRC) AISI W1, AISI M2 etc.							
	RE (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$			Depth of cut ap (mm)	
		Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)			
	R0.5	40000	4700	185.0	32000	1700	66.9	0.03
	R1	24000	5000	196.9	16000	1200	47.2	0.06
	R1.5	16000	4200	165.4	11000	1100	43.3	0.07
	R2	12000	3100	122.0	8000	1000	39.4	0.08
	R2.5	9600	2700	106.3	6000	780	30.7	0.08
	R3	8000	2300	90.6	5000	780	30.7	0.09
	R4	6000	1900	74.8	4000	620	24.4	0.09
	R5	4800	1500	59.1	3000	550	21.7	0.10
	R6	3600	1100	43.3	2200	400	15.7	0.10
Depth of cut	$\leq 0.2RE$ <							

Note 1) α is the inclination of the machined surface.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.



IMPACT MIRACLE END MILLS

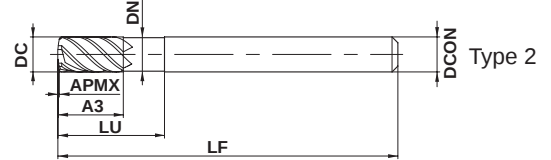
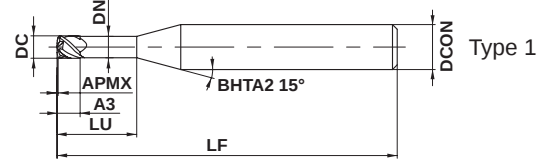
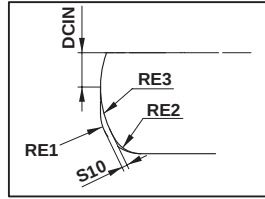
VFFDRB

Multi-task corner radius end mill for impact miracle high speed cutting



CARBIDE

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



DC≤12				
0 - 0.020				



DCON=6	8≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

- Multi-task corner radius type allows more efficient high feed.
- Adoption of multiple cuttings realized high feed cutting.

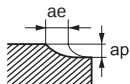
(mm)

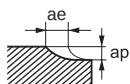
Order Number	DC	RE1 ^{*1}	APMX	A3 ^{*3}	LU	DN	LF	DCON	No. of Flutes	Multi-task radius part				RMPX ^{*2}	Stock	Type
										S10	DCIN	RE2	RE3			
VFFDRBD0300	3	0.64	0.18	3	10	2.8	60	6	4	0.08	0.75	0.5	2	2.1°	●	1
VFFDRBD0400	4	0.71	0.25	4	12	3.8	60	6	4	0.13	1	0.5	3	1.9°	●	1
VFFDRBD0600	6	0.92	0.36	9	18	5.6	80	6	4	0.21	1.5	0.6	5	1.7°	●	2
VFFDRBD0800	8	1.16	0.44	12	24	7.6	90	8	6	0.22	3.2	0.8	4.5	1.7°	●	2
VFFDRBD1000	10	1.47	0.57	15	30	9.4	100	10	6	0.28	4	1	5.5	1.7°	●	2
VFFDRBD1200	12	1.77	0.7	18	36	11.4	110	12	6	0.34	4.8	1.2	6.5	1.8°	●	2

- *1 RE1 : Approx. R
- *2 RMPX : Max. Ramping Angle
- *3 A3 : Cutting Edge Effective Length

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Carbon steel, Alloy steel (180–280HB), Alloy tool steel (≤350HB), Mild steel (≤180HB) AISI 1045, AISI 4140, ASTM A36, AISI 1010							Prehardened steel (35–45HRC) AISI P21, AISI P20, AISI 4340						
	Cutting Speed (m/min)	Main Spindle Revolution (min ⁻¹)	Feed per Tooth (mm/t.)	Table Feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min ⁻¹)	Feed per Tooth (mm/t.)	Table Feed		Depth of cut ap (mm)	Depth of cut ae (mm)
				(mm/min)	(IPM)						(mm/min)	(IPM)		
3	80	8500	0.07	2400	95.5	0.12	1.5	100	11000	0.07	3100	122.0	0.12	1.5
4	80	6400	0.1	2600	102.4	0.16	2	100	8000	0.1	3200	126.0	0.16	2
6	80	4200	0.17	2900	114.2	0.24	3	100	5300	0.17	3600	141.7	0.24	3
8	80	3200	0.17	3300	130.0	0.32	4.8	100	4000	0.17	4100	161.4	0.32	4.8
10	80	2500	0.2	3000	118.1	0.4	6	100	3200	0.2	3800	149.6	0.4	6
12	80	2100	0.22	2800	110.2	0.48	7.2	100	2700	0.22	3600	141.7	0.48	7.2
Depth of cut														

Dia. DC (mm)	Hardened steel (40–55HRC), Ferritic and martensitic stainless steel (>200HB), Precipitation hardening stainless steel (<450HB), AISI H13, L6, AISI 431, AISI 420, 15-5PH, 17-4PH etc.							Hardened steel (55–62HRC) AISI D2 etc.						
	Cutting Speed (m/min)	Main Spindle Revolution (min ⁻¹)	Feed per Tooth (mm/t.)	Table Feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min ⁻¹)	Feed per Tooth (mm/t.)	Table Feed		Depth of cut ap (mm)	Depth of cut ae (mm)
				(mm/min)	(IPM)						(mm/min)	(IPM)		
3	80	8500	0.07	2400	94.5	0.12	1.5	40	4200	0.05	840	33.1	0.12	1.5
4	80	6400	0.1	2600	102.4	0.16	2	40	3200	0.07	960	37.8	0.16	2
6	80	4200	0.17	2900	114.2	0.24	3	40	2100	0.15	1300	51.2	0.24	3
8	80	3200	0.17	3300	129.9	0.32	4.8	40	1600	0.15	1400	55.1	0.32	4.8
10	80	2500	0.2	3000	118.1	0.4	6	40	1300	0.17	1300	51.2	0.4	6
12	80	2100	0.22	2800	110.2	0.48	7.2	40	1100	0.2	1300	51.2	0.48	7.2
Depth of cut														

Note 1) When ramping process set the feed rate at 50%. A ramping angle of 1° is recommended.

Note 2) Use at a revolution of 70% and feed rate of 50% when the tool overhang exceeds 5D.

IMPACT MIRACLE END MILLS

VFHV RB

4 flute, Corner radius, Short cut length, Irregular helix flutes

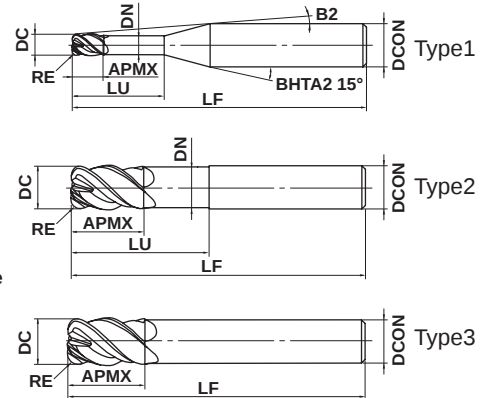
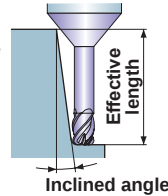


CARBIDE

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



Effective length
for inclined angle



DC ≤ 10	DC > 10
±0.007	±0.01



DC ≤ 12	DC > 12
0 - 0.02	0 - 0.03



DC ≤ 6	8 ≤ DC ≤ 10	12 ≤ DC ≤ 16
0 - 0.008	0 - 0.009	0 - 0.011

● Impact Miracle corner radius end mill for high feed and efficient machining.

(mm)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VFHVRBD0100R02N004	1	0.2	1	4	0.94	10.6°	60	6	4	●	1	4.2	4.5	4.7	5.3
VFHVRBD0100R02N006	1	0.2	1	6	0.94	9.2°	60	6	4	●	1	6.4	6.7	7.2	7.7
VFHVRBD0100R02N008	1	0.2	1	8	0.94	8.2°	60	6	4	●	1	8.5	8.8	9.5	10.2
VFHVRBD0100R02N010	1	0.2	1	10	0.94	7.4°	60	6	4	●	1	10.5	11	11.8	12.7
VFHVRBD0100R02N015	1	0.2	1	15	0.94	5.9°	60	6	4	★	1	15.8	16.3	17.5	18.9
VFHVRBD0100R02N020	1	0.2	1	20	0.94	4.9°	80	6	4	★	1	20.9	21.7	23.3	25.1
VFHVRBD0150R03N004	1.5	0.3	1.5	4	1.44	10.3°	60	6	4	●	1	4.2	4.5	4.6	5.2
VFHVRBD0150R03N006	1.5	0.3	1.5	6	1.44	8.9°	60	6	4	●	1	6.3	6.6	7.2	7.7
VFHVRBD0150R03N010	1.5	0.3	1.5	10	1.44	7°	60	6	4	●	1	10.5	10.9	11.8	12.7
VFHVRBD0150R03N015	1.5	0.3	1.5	15	1.44	5.5°	60	6	4	●	1	15.7	16.3	17.5	18.9
VFHVRBD0150R03N020	1.5	0.3	1.5	20	1.44	4.6°	80	6	4	★	1	20.9	21.6	23.3	25.1
VFHVRBD0150R03N025	1.5	0.3	1.5	25	1.44	3.9°	80	6	4	★	1	26.1	27	29	31.3
VFHVRBD0150R03N030	1.5	0.3	1.5	30	1.44	3.4°	80	6	4	★	1	31.3	32.3	34.7	37.5
VFHVRBD0200R05N006	2	0.5	2	6	1.9	8.7°	60	6	4	●	1	6.3	6.5	7	7.5
VFHVRBD0200R05N010	2	0.5	2	10	1.9	6.7°	60	6	4	●	1	10.5	10.8	11.6	12.5
VFHVRBD0200R05N015	2	0.5	2	15	1.9	5.2°	60	6	4	●	1	15.6	16.2	17.4	18.7
VFHVRBD0200R05N020	2	0.5	2	20	1.9	4.3°	80	6	4	●	1	20.8	21.5	23.1	24.9
VFHVRBD0200R05N025	2	0.5	2	25	1.9	3.6°	80	6	4	★	1	26	26.9	28.9	31.2
VFHVRBD0200R05N030	2	0.5	2	30	1.9	3.1°	80	6	4	★	1	31.2	32.2	34.6	37.4
VFHVRBD0200R05N035	2	0.5	2	35	1.9	2.8°	90	6	4	★	1	36.3	37.6	40.4	*
VFHVRBD0200R05N040	2	0.5	2	40	1.9	2.5°	90	6	4	★	1	41.5	42.9	46.1	*
VFHVRBD0300R05N010	3	0.5	3	10	2.9	5.6°	60	6	4	●	1	10.5	10.8	11.6	12.5
VFHVRBD0300R05N015	3	0.5	3	15	2.9	4.3°	60	6	4	●	1	15.6	16.2	17.4	18.7
VFHVRBD0300R05N020	3	0.5	3	20	2.9	3.4°	80	6	4	●	1	20.8	21.5	23.1	24.9
VFHVRBD0300R05N030	3	0.5	3	30	2.9	2.5°	80	6	4	●	1	31.2	32.2	34.6	*
VFHVRBD0300R08N010	3	0.8	3	10	2.9	5.7°	60	6	4	●	1	10.4	10.8	11.6	12.4
VFHVRBD0300R08N015	3	0.8	3	15	2.9	4.3°	60	6	4	●	1	15.6	16.2	17.3	18.7
VFHVRBD0300R08N020	3	0.8	3	20	2.9	3.5°	80	6	4	●	1	20.8	21.5	23.1	24.9
VFHVRBD0300R08N030	3	0.8	3	30	2.9	2.5°	80	6	4	●	1	31.1	32.2	34.6	*
VFHVRBD0300R08N040	3	0.8	3	40	2.9	2°	90	6	4	★	1	41.5	42.9	*	*
VFHVRBD0300R08N050	3	0.8	3	50	2.9	1.6°	90	6	4	★	1	51.8	53.6	*	*
VFHVRBD0400R05N012	4	0.5	4	12	3.9	3.8°	60	6	4	●	1	12.5	13	13.9	15

★ No interference

(mm)

CARBIDE

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VFHVRBD0400R05N020	4	0.5	4	20	3.9	2.5°	80	6	4	●	1	20.8	21.5	23.1	*
VFHVRBD0400R05N030	4	0.5	4	30	3.9	1.8°	80	6	4	●	1	31.2	32.2	*	*
VFHVRBD0400R05N048	4	0.5	4	48	3.9	1.2°	90	6	4	★	1	49.8	51.5	*	*
VFHVRBD0400R10N012	4	1	4	12	3.9	3.9°	60	6	4	●	1	12.5	12.9	13.8	14.9
VFHVRBD0400R10N020	4	1	4	20	3.9	2.5°	80	6	4	●	1	20.8	21.5	23	*
VFHVRBD0400R10N030	4	1	4	30	3.9	1.8°	80	6	4	●	1	31.1	32.2	*	*
VFHVRBD0600R05N018	6	0.5	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R05N030	6	0.5	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0600R10N018	6	1	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R10N030	6	1	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0600R10N054	6	1	9	54	5.85	—	90	6	4	★	2	*	*	*	*
VFHVRBD0600R15N018	6	1.5	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R15N030	6	1.5	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0600R15N042	6	1.5	9	42	5.85	—	90	6	4	●	2	*	*	*	*
VFHVRBD0600R15N054	6	1.5	9	54	5.85	—	90	6	4	★	2	*	*	*	*
VFHVRBD0600R20N018	6	2	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R20N030	6	2	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0700R15	7	1.5	11	—	—	—	80	6	4	★	3	*	*	*	*
VFHVRBD0800R05N024	8	0.5	12	24	7.85	—	60	8	4	★	2	*	*	*	*
VFHVRBD0800R05N040	8	0.5	12	40	7.85	—	100	8	4	★	2	*	*	*	*
VFHVRBD0800R10N024	8	1	12	24	7.85	—	60	8	4	●	2	*	*	*	*
VFHVRBD0800R10N040	8	1	12	40	7.85	—	100	8	4	●	2	*	*	*	*
VFHVRBD0800R20N024	8	2	12	24	7.85	—	60	8	4	●	2	*	*	*	*
VFHVRBD0800R20N040	8	2	12	40	7.85	—	100	8	4	●	2	*	*	*	*
VFHVRBD0800R20N056	8	2	12	56	7.85	—	120	8	4	●	2	*	*	*	*
VFHVRBD0800R20N072	8	2	12	72	7.85	—	120	8	4	●	2	*	*	*	*
VFHVRBD0900R20	9	2	13.5	—	—	—	100	8	4	★	3	*	*	*	*
VFHVRBD1000R05N030	10	0.5	15	30	9.7	—	70	10	4	★	2	*	*	*	*
VFHVRBD1000R05N050	10	0.5	15	50	9.7	—	110	10	4	★	2	*	*	*	*
VFHVRBD1000R10N030	10	1	15	30	9.7	—	70	10	4	●	2	*	*	*	*
VFHVRBD1000R10N050	10	1	15	50	9.7	—	110	10	4	●	2	*	*	*	*
VFHVRBD1000R20N030	10	2	15	30	9.7	—	70	10	4	●	2	*	*	*	*
VFHVRBD1000R20N050	10	2	15	50	9.7	—	110	10	4	●	2	*	*	*	*
VFHVRBD1000R20N070	10	2	15	70	9.7	—	150	10	4	★	2	*	*	*	*
VFHVRBD1000R20N090	10	2	15	90	9.7	—	150	10	4	★	2	*	*	*	*
VFHVRBD1100R20	11	2	16.5	—	—	—	110	10	4	★	3	*	*	*	*
VFHVRBD1200R05N036	12	0.5	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R05N060	12	0.5	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1200R10N036	12	1	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R10N060	12	1	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1200R20N036	12	2	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R20N060	12	2	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1200R20N084	12	2	18	84	11.7	—	160	12	4	★	2	*	*	*	*
VFHVRBD1200R20N108	12	2	18	108	11.7	—	160	12	4	★	2	*	*	*	*
VFHVRBD1200R30N036	12	3	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R30N060	12	3	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1300R30	13	3	19.5	—	—	—	120	12	4	★	3	*	*	*	*
VFHVRBD1600R05N042	16	0.5	24	42	15.5	—	100	16	4	★	2	*	*	*	*
VFHVRBD1600R20N042	16	2	24	42	15.5	—	100	16	4	★	2	*	*	*	*
VFHVRBD1600R30N042	16	3	24	42	15.5	—	100	16	4	★	2	*	*	*	*
VFHVRBD1600R30N080	16	3	24	80	15.5	—	140	16	4	★	2	*	*	*	*
VFHVRBD1600R30N120	16	3	24	120	15.5	—	175	16	4	★	2	*	*	*	*

* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VFHV RB

4 flute, Corner radius, Short cut length, Irregular helix flutes

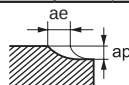
CARBIDE

RECOMMENDED CUTTING CONDITIONS

High feed conditions

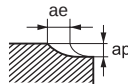
Work Material			Carbon steel, Cast iron, Alloy steel (—30HRC)				Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45—55HRC)				Hardened steel (55—62HRC)							
			AISI 1050, AISI 35, AISI P20 etc.				AISI H13, AISI W1—10, AISI P21 etc.				AISI H13 etc.				AISI D2 etc.							
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)
1	0.2	4	40000	7200	283.5	0.04	0.45	33000	5100	200.8	0.03	0.45	27000	4100	161.4	0.025	0.45	20000	1800	70.9	0.013	0.45
1	0.2	6	40000	6500	255.9	0.03	0.45	33000	4600	181.1	0.022	0.45	27000	3700	145.7	0.018	0.45	20000	1600	63.0	0.01	0.45
1	0.2	8	32000	4500	177.2	0.022	0.45	27000	3200	126.0	0.018	0.45	21000	2600	102.4	0.012	0.45	16000	1100	43.3	0.008	0.45
1	0.2	10	24000	2700	106.3	0.015	0.45	20000	1900	74.8	0.01	0.45	16000	1500	59.1	0.008	0.45	12000	700	27.6	0.006	0.45
1	0.2	15	16000	1200	47.2	0.008	0.45	14000	700	27.6	0.005	0.45	12000	500	19.7	0.003	0.45	10000	400	15.7	0.003	0.45
1	0.2	20	14000	1000	39.4	0.005	0.45	12000	600	23.6	0.004	0.45	10000	400	15.7	0.002	0.45	9000	300	11.8	0.002	0.45
1.5	0.3	4	32000	10000	393.7	0.1	0.65	27000	7100	279.5	0.08	0.65	21000	5700	224.4	0.06	0.65	16000	2500	98.4	0.03	0.65
1.5	0.3	6	32000	7800	307.1	0.08	0.65	27000	5500	216.5	0.06	0.65	21000	4200	165.4	0.05	0.65	16000	2000	78.7	0.025	0.65
1.5	0.3	10	27000	5700	224.4	0.05	0.65	22000	4000	157.5	0.035	0.65	18000	3000	118.1	0.03	0.65	14000	1400	55.1	0.014	0.65
1.5	0.3	15	22000	3200	126.0	0.03	0.65	18000	2300	90.6	0.025	0.65	15000	1700	66.9	0.018	0.65	11000	1000	39.4	0.009	0.65
1.5	0.3	20	16000	1400	55.1	0.02	0.65	14000	1200	47.2	0.016	0.65	13000	1000	39.4	0.012	0.65	9000	700	27.6	0.007	0.65
1.5	0.3	25	13000	1000	39.4	0.015	0.65	11000	800	31.5	0.012	0.65	10000	700	27.6	0.009	0.65	7500	500	19.7	0.005	0.65
1.5	0.3	30	13000	900	35.4	0.01	0.65	11000	700	27.6	0.008	0.65	10000	600	23.6	0.006	0.65	7500	400	15.7	0.004	0.65
2	0.5	6	24000	10000	393.7	0.1	0.75	20000	7100	279.5	0.08	0.75	16000	5700	224.4	0.06	0.75	12000	2500	98.4	0.03	0.75
2	0.5	10	24000	10000	393.7	0.08	0.75	20000	7100	279.5	0.06	0.75	16000	5700	224.4	0.05	0.75	12000	2500	98.4	0.025	0.75
2	0.5	15	20000	7000	275.6	0.05	0.75	17000	5000	196.9	0.04	0.75	13000	3200	126.0	0.03	0.75	10000	1800	70.9	0.016	0.75
2	0.5	20	20000	3600	141.7	0.04	0.75	17000	2600	102.4	0.03	0.75	13000	1800	70.9	0.025	0.75	10000	900	35.4	0.012	0.75
2	0.5	25	16000	1800	70.9	0.03	0.75	14000	1400	55.1	0.025	0.75	12000	1100	43.3	0.02	0.75	9000	720	28.3	0.01	0.75
2	0.5	30	16000	1400	55.1	0.025	0.75	14000	1200	47.2	0.02	0.75	12000	900	35.4	0.016	0.75	9000	650	25.6	0.008	0.75
2	0.5	35	13000	1100	43.3	0.02	0.75	11000	800	31.5	0.018	0.75	10000	700	27.6	0.014	0.75	7000	500	19.7	0.007	0.75
2	0.5	40	13000	1000	39.4	0.02	0.75	11000	700	27.6	0.015	0.75	10000	600	23.6	0.012	0.75	7000	400	15.7	0.006	0.75
3	0.5	10	16000	11000	433.1	0.12	1.5	13000	7800	307.1	0.09	1.5	11000	6300	248.0	0.07	1.5	8000	2800	110.2	0.04	1.5
3	0.5	15	16000	9000	354.3	0.11	1.5	13000	6400	252.0	0.08	1.5	11000	5100	200.8	0.06	1.5	8000	2300	90.6	0.04	1.5
3	0.5	20	13000	7200	283.5	0.09	1.5	11000	5100	200.8	0.07	1.5	8700	4000	157.5	0.05	1.5	6500	1800	70.9	0.03	1.5
3	0.5	30	13000	5700	224.4	0.06	1.5	11000	4000	157.5	0.05	1.5	8700	3000	118.1	0.04	1.5	6500	1400	55.1	0.02	1.5
3	0.8	10	16000	11000	433.1	0.24	1	13000	7800	307.1	0.19	1	11000	6300	248.0	0.14	1	8000	2800	110.2	0.07	1
3	0.8	15	16000	9000	354.3	0.22	1	13000	6400	252.0	0.17	1	11000	5100	200.8	0.13	1	8000	2300	90.6	0.07	1
3	0.8	20	13000	7200	283.5	0.19	1	11000	5100	200.8	0.15	1	8700	4000	157.5	0.11	1	6500	1800	70.9	0.06	1
3	0.8	30	13000	5700	224.4	0.12	1	11000	4000	157.5	0.09	1	8700	3000	118.1	0.07	1	6500	1400	55.1	0.04	1
3	0.8	40	11000	3600	141.7	0.08	1	9100	2600	102.4	0.06	1	7400	2000	78.7	0.05	1	5500	1000	39.4	0.025	1
3	0.8	50	8000	2600	102.4	0.07	1	6600	1800	70.9	0.05	1	5800	1500	59.1	0.04	1	4600	800	31.5	0.02	1
4	0.5	12	8400	6000	236.2	0.15	2	7000	4300	169.3	0.12	2	5600	3400	133.9	0.09	2	4200	1500	59.1	0.05	2
4	0.5	20	8400	6000	236.2	0.14	2	7000	4300	169.3	0.11	2	5600	3400	133.9	0.08	2	4200	1500	59.1	0.04	2
4	0.5	30	6900	4900	192.9	0.12	2	5700	3500	137.8	0.09	2	4600	2800	110.2	0.07	2	3500	1200	47.2	0.03	2
4	0.5	48	5600	2000	78.7	0.07	2	4600	1400	55.1	0.05	2	3800	1100	43.3	0.04	2	2800	500	19.7	0.02	2
4	1	12	12000	12000	472.4	0.3	1.5	10000	8500	334.6	0.23	1.5	8000	6800	267.7	0.18	1.5	6000	3000	118.1	0.1	1.5
4	1	20	12000	12000	472.4	0.27	1.5	10000	8500	334.6	0.21	1.5	8000	6800	267.7	0.16	1.5	6000	3000	118.1	0.08	1.5
4	1	30	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
6	0.5	18	4000	3900	153.5	0.15	3.5	3300	2800	110.2	0.12	3.5	2700	2200	86.6	0.09	3.5	2000	1000	39.4	0.05	3.5
6	0.5	30	4000	3900	153.5	0.14	3.5	3300	2800	110.2	0.11	3.5	2700	2200	86.6	0.08	3.5	2000	1000	39.4	0.04	3.5
6	1	18	8000	13000	511.8	0.5	3	6600	9200	362.2	0.4	3	5400	7400	291.3	0.3	3	4000	3300	129.9	0.15	3
6	1	30	8000	13000	511.8	0.45	3	6600	9200	362.2	0.35	3	5400	7400	291.3	0.27	3	4000	3300	129.9	0.14	3
6	1	54	6600	11000	433.1	0.25	3	5500	7800	307.1	0.2	3	4400	6300	248.0	0.15	3	3300	2800	110.2	0.08	3
6	1.5	18	8000	13000	511.8	0.5	2	6600	9200	362.2	0.4	2	5400	7400	291.3	0.3	2	4000	3300	129.9	0.15	2
6	1.5	30	8000	13000	511.8	0.45	2	6600	9200	362.2	0.35	2	5400	7400	291.3	0.27	2	4000	3300	129.9	0.14	2
6	1.5	42	6600	11000	433.1	0.4	2	5500	7800	307.1	0.3	2	4400	6300	248.0	0.24	2	3300	2800	110.2	0.12	2
6	1.5	54	6600	11000	433.1	0.25	2	5500	7800	307.1	0.2	2	4400	6300	248.0	0.15	2	3300	2800	110.2	0.08	2
6	2	18	8000	13000	511.8	0.5	1.5	6600	9200	362.2	0.4	1.5	5400	7400	291.3	0.3	1.5	4000	3300	129.9	0.15	1.5
6	2	30	8000	13000	511.8	0.45	1.5	6600	9200	362.2	0.35	1.5	5400	7400	291.3	0.27	1.5	4000	3300	129.9	0.14	1.5

Depth of cut



Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Using air blow or mist is recommended.

Work Material			Carbon steel, Cast iron, Alloy steel (—30HRC)					Alloy steel, Tool steel, Pre-hardened steel					Hardened steel (45—55HRC)					Hardened steel (55—62HRC)				
			AISI 1050, AISI 35, AISI P20 etc.					AISI H13, AISI W1—10, AISI P21 etc.					AISI H13 etc.					AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)
7	1.5	—	6800	13000	511.8	0.5	3	5600	9200	362.2	0.4	3	4600	7400	291.3	0.3	3	3400	3300	129.9	0.15	3
8	0.5	24	3000	3900	153.5	0.18	5	2500	2800	110.2	0.14	5	2000	2200	86.6	0.11	5	1500	1000	39.4	0.05	5
8	0.5	40	3000	3900	153.5	0.16	5	2500	2800	110.2	0.12	5	2000	2200	86.6	0.1	5	1500	1000	39.4	0.05	5
8	1	24	4200	6500	255.9	0.3	4.5	3500	4600	181.1	0.23	4.5	2800	3700	145.7	0.18	4.5	2100	1600	63.0	0.09	4.5
8	1	40	4200	6500	255.9	0.27	4.5	3500	4600	181.1	0.21	4.5	2800	3700	145.7	0.16	4.5	2100	1600	63.0	0.08	4.5
8	2	24	6000	13000	511.8	0.6	3	5000	9200	362.2	0.46	3	4000	7400	291.3	0.36	3	3000	3300	129.9	0.18	3
8	2	40	6000	13000	511.8	0.54	3	5000	9200	362.2	0.42	3	4000	7400	291.3	0.32	3	3000	3300	129.9	0.16	3
8	2	56	5000	11000	433.1	0.48	3	4200	7800	307.1	0.37	3	3400	6300	248.0	0.3	3	2500	2800	110.2	0.14	3
8	2	72	5000	11000	433.1	0.3	3	4200	7800	307.1	0.23	3	3400	6300	248.0	0.2	3	2500	2800	110.2	0.09	3
9	2	—	5300	13000	511.8	0.6	3.5	4400	9200	362.2	0.46	3.5	3600	7400	291.3	0.36	3.5	2700	3300	129.9	0.18	3.5
10	0.5	30	2400	3900	153.5	0.18	6.5	2000	2800	110.2	0.14	6.5	1600	2200	86.6	0.11	6.5	1200	1000	39.4	0.05	6.5
10	0.5	50	2400	3900	153.5	0.16	6.5	2000	2800	110.2	0.12	6.5	1600	2200	86.6	0.1	6.5	1200	1000	39.4	0.05	6.5
10	1	30	3300	6500	255.9	0.3	6	2700	4600	181.1	0.23	6	2200	3700	145.7	0.18	6	1700	1600	63.0	0.09	6
10	1	50	3300	6500	255.9	0.27	6	2700	4600	181.1	0.21	6	2200	3700	145.7	0.16	6	1700	1600	63.0	0.08	6
10	2	30	4800	13000	511.8	0.6	4.5	4000	9200	362.2	0.46	4.5	3200	7400	291.3	0.36	4.5	2400	3300	129.9	0.18	4.5
10	2	50	4800	13000	511.8	0.54	4.5	4000	9200	362.2	0.42	4.5	3200	7400	291.3	0.32	4.5	2400	3300	129.9	0.16	4.5
10	2	70	4000	11000	433.1	0.48	4.5	3300	7800	307.1	0.37	4.5	2700	6300	248.0	0.3	4.5	2000	2800	110.2	0.14	4.5
10	2	90	4000	11000	433.1	0.48	4.5	3300	7800	307.1	0.37	4.5	2700	6300	248.0	0.3	4.5	2000	2800	110.2	0.14	4.5
11	2	—	4300	12000	472.4	0.6	5	3600	8500	334.6	0.46	5	2900	6800	267.7	0.36	5	2200	3000	118.1	0.18	5
12	0.5	36	2000	3600	141.7	0.27	8	1700	2600	102.4	0.21	8	1300	2100	82.7	0.14	8	1000	900	35.4	0.07	8
12	0.5	60	2000	3600	141.7	0.24	8	1700	2600	102.4	0.18	8	1300	2100	82.7	0.12	8	1000	900	35.4	0.06	8
12	1	36	2400	4800	189.0	0.36	7.5	2000	3400	133.9	0.28	7.5	1600	2700	106.3	0.18	7.5	1200	1200	47.2	0.09	7.5
12	1	60	2400	4800	189.0	0.32	7.5	2000	3400	133.9	0.25	7.5	1600	2700	106.3	0.16	7.5	1200	1200	47.2	0.08	7.5
12	2	36	4000	12000	472.4	0.9	6	3300	8500	334.6	0.7	6	2700	6800	267.7	0.45	6	2000	3000	118.1	0.23	6
12	2	60	4000	12000	472.4	0.8	6	3300	8500	334.6	0.6	6	2700	6800	267.7	0.4	6	2000	3000	118.1	0.2	6
12	2	84	3300	9900	389.8	0.7	6	2700	7000	275.6	0.55	6	2200	5600	220.5	0.36	6	1700	2500	98.4	0.18	6
12	2	108	3300	9900	389.8	0.45	6	2700	7000	275.6	0.35	6	2200	5600	220.5	0.23	6	1700	2500	98.4	0.11	6
12	3	36	4000	12000	472.4	0.9	4.5	3300	8500	334.6	0.7	4.5	2700	6800	267.7	0.45	4.5	2000	3000	118.1	0.23	4.5
12	3	60	4000	12000	472.4	0.8	4.5	3300	8500	334.6	0.6	4.5	2700	6800	267.7	0.4	4.5	2000	3000	118.1	0.2	4.5
13	3	—	3700	12000	472.4	0.9	5	3100	8500	334.6	0.7	5	2500	6800	267.7	0.45	5	1900	3000	118.1	0.23	5
16	0.5	42	1500	3000	118.1	0.27	11	1200	2100	82.7	0.21	11	1000	1700	66.9	0.12	11	750	750	29.5	0.05	11
16	2	42	2100	5000	196.9	0.45	9	1700	3600	141.7	0.35	9	1400	2900	114.2	0.2	9	1100	1300	51.2	0.08	9
16	3	42	3000	10000	393.7	0.9	7.5	2500	7100	279.5	0.7	7.5	2000	5700	224.4	0.4	7.5	1500	2500	98.4	0.15	7.5
16	3	80	3000	10000	393.7	0.8	7.5	2500	7100	279.5	0.6	7.5	2000	5700	224.4	0.37	7.5	1500	2500	98.4	0.14	7.5
16	3	120	2500	8300	326.8	0.7	7.5	2100	5900	232.3	0.55	7.5	1700	4700	185.0	0.32	7.5	1300	2100	82.7	0.12	7.5
Depth of cut																						

Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the work material and depth of cut.

Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VFHV RB

4 flute, Corner radius, Short cut length, Irregular helix flutes

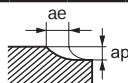
CARBIDE

RECOMMENDED CUTTING CONDITIONS

High depth of cut conditions

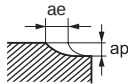
Work Material			Carbon steel, Cast iron, Alloy steel (—30HRC)					Alloy steel, Tool steel, Pre-hardened steel					Hardened steel (45—55HRC)					Hardened steel (55—62HRC)				
			AISI 1050, AISI 35, AISI P20 etc.					AISI H13, AISI W1—10, AISI P21 etc.					AISI H13 etc.					AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	IPM	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	IPM	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	IPM	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	IPM	Depth of cut ap (mm)	Width of cut ae (mm)
1	0.2	4	24000	2200	86.6	0.08	0.45	20000	1500	59.1	0.07	0.45	16000	1200	47.2	0.05	0.45	12000	550	21.7	0.025	0.45
1	0.2	6	24000	2000	78.7	0.07	0.45	20000	1400	55.1	0.05	0.45	16000	1100	43.3	0.04	0.45	12000	500	19.7	0.02	0.45
1	0.2	8	19000	1400	55.1	0.05	0.45	16000	1000	39.4	0.04	0.45	13000	800	31.5	0.03	0.45	9500	350	13.8	0.016	0.45
1	0.2	10	14000	800	31.5	0.04	0.45	12000	600	23.6	0.03	0.45	9000	400	15.7	0.025	0.45	7000	200	7.9	0.012	0.45
1	0.2	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	0.2	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.3	4	19000	3000	118.1	0.2	0.65	16000	2100	82.7	0.16	0.65	13000	1700	66.9	0.12	0.65	9500	750	29.5	0.06	0.65
1.5	0.3	6	19000	2300	90.6	0.16	0.65	16000	1600	63.0	0.13	0.65	13000	1300	51.2	0.1	0.65	9500	580	22.8	0.05	0.65
1.5	0.3	10	16000	1700	66.9	0.1	0.65	13000	1200	47.2	0.07	0.65	11000	1000	39.4	0.05	0.65	8000	430	16.9	0.03	0.65
1.5	0.3	15	13000	1000	39.4	0.06	0.65	11000	700	27.6	0.05	0.65	9000	600	23.6	0.04	0.65	6500	250	9.8	0.018	0.65
1.5	0.3	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.3	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.3	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	6	14000	3000	118.1	0.2	0.75	12000	2100	82.7	0.16	0.75	9400	1700	66.9	0.12	0.75	7000	750	29.5	0.06	0.75
2	0.5	10	14000	3000	118.1	0.16	0.75	12000	2100	82.7	0.13	0.75	9400	1700	66.9	0.1	0.75	7000	750	29.5	0.05	0.75
2	0.5	15	12000	2100	82.7	0.1	0.75	10000	1500	59.1	0.08	0.75	8000	1200	47.2	0.06	0.75	6000	530	20.9	0.03	0.75
2	0.5	20	12000	1100	43.3	0.08	0.75	10000	800	31.5	0.06	0.75	8000	600	23.6	0.05	0.75	6000	280	11.0	0.025	0.75
2	0.5	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	0.5	10	9600	3300	129.9	0.24	1.5	8000	2300	90.6	0.2	1.5	6400	1800	70.9	0.14	1.5	4800	830	32.7	0.07	1.5
3	0.5	15	9600	2700	106.3	0.22	1.5	8000	1900	74.8	0.17	1.5	6400	1500	59.1	0.13	1.5	4800	680	26.8	0.06	1.5
3	0.5	20	7800	2200	86.6	0.18	1.5	6500	1500	59.1	0.14	1.5	5200	1200	47.2	0.11	1.5	3900	550	21.7	0.05	1.5
3	0.5	30	7800	1700	66.9	0.12	1.5	6500	1200	47.2	0.1	1.5	5200	1000	39.4	0.07	1.5	3900	430	16.9	0.04	1.5
3	0.8	10	9600	3300	129.9	0.5	1	8000	2300	90.6	0.4	1	6400	1800	70.9	0.3	1	4800	830	32.7	0.14	1
3	0.8	15	9600	2700	106.3	0.5	1	8000	1900	74.8	0.35	1	6400	1500	59.1	0.25	1	4800	680	26.8	0.13	1
3	0.8	20	7800	2200	86.6	0.4	1	6500	1500	59.1	0.3	1	5200	1200	47.2	0.23	1	3900	550	21.7	0.11	1
3	0.8	30	7800	1700	66.9	0.24	1	6500	1200	47.2	0.2	1	5200	1000	39.4	0.14	1	3900	430	16.9	0.05	1
3	0.8	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	0.8	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	0.5	12	5000	1800	70.9	0.3	2	4200	1300	51.2	0.24	2	3400	1000	39.4	0.18	2	2500	450	17.7	0.06	2
4	0.5	20	5000	1800	70.9	0.3	2	4200	1300	51.2	0.22	2	3400	1000	39.4	0.17	2	2500	450	17.7	0.06	2
4	0.5	30	4100	1500	59.1	0.24	2	3400	1100	43.3	0.19	2	2700	840	33.1	0.14	2	2100	380	15.0	0.05	2
4	0.5	48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	1	12	7200	3600	141.7	0.6	1.5	6000	2500	98.4	0.5	1.5	4800	2000	78.7	0.36	1.5	3600	900	35.4	0.12	1.5
4	1	20	7200	3600	141.7	0.6	1.5	6000	2500	98.4	0.4	1.5	4800	2000	78.7	0.32	1.5	3600	900	35.4	0.11	1.5
4	1	30	6000	3000	118.1	0.5	1.5	5000	2100	82.7	0.4	1.5	4000	1700	66.9	0.3	1.5	3000	750	29.5	0.1	1.5
6	0.5	18	2400	1200	47.2	0.3	3.5	2000	840	33.1	0.24	3.5	1600	670	26.4	0.18	3.5	1200	300	11.8	0.06	3.5
6	0.5	30	2400	1200	47.2	0.3	3.5	2000	840	33.1	0.22	3.5	1600	670	26.4	0.17	3.5	1200	300	11.8	0.06	3.5
6	1	18	4800	3900	153.5	1	3	4000	2700	106.3	0.8	3	3200	2200	86.6	0.6	3	2400	980	38.6	0.2	3
6	1	30	4800	3900	153.5	0.9	3	4000	2700	106.3	0.7	3	3200	2200	86.6	0.5	3	2400	980	38.6	0.18	3
6	1	54	4000	3300	129.9	0.5	3	3300	2300	90.6	0.4	3	2700	1800	70.9	0.3	3	2000	830	32.7	0.1	3
6	1.5	18	4800	3900	153.5	1	2	4000	2700	106.3	0.8	2	3200	2200	86.6	0.6	2	2400	980	38.6	0.2	2
6	1.5	30	4800	3900	153.5	0.9	2	4000	2700	106.3	0.7	2	3200	2200	86.6	0.5	2	2400	980	38.6	0.18	2
6	1.5	42	4000	3300	129.9	0.8	2	3300	2300	90.6	0.6	2	2700	1800	70.9	0.5	2	2000	830	32.7	0.16	2
6	1.5	54	4000	3300	129.9	0.5	2	3300	2300	90.6	0.4	2	2700	1800	70.9	0.3	2	2000	830	32.7	0.1	2
6	2	18	4800	3900	153.5	1	1.5	4000	2700	106.3	0.8	1.5	3200	2200	86.6	0.6	1.5	2400	980	38.6	0.2	1.5
6	2	30	4800	3900	153.5	0.9	1.5	4000	2700	106.3	0.7	1.5	3200	2200	86.6	0.5	1.5	2400	980	38.6	0.18	1.5

Depth of cut



Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Using air blow or mist is recommended.

Work Material			Carbon steel, Cast iron, Alloy steel (—30HRC)					Alloy steel, Tool steel, Pre-hardened steel					Hardened steel (45—55HRC)					Hardened steel (55—62HRC)				
			AISI 1050, AISI 35, AISI P20 etc.					AISI H13, AISI W1—10, AISI P21 etc.					AISI H13 etc.					AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	(IPM)	Depth of cut ap (mm)	Width of cut ae (mm)
7	1.5	—	4100	3900	153.5	1	3	3400	2700	106.3	0.8	3	2700	2200	86.6	0.6	3	2100	980	38.6	0.2	3
8	0.5	24	1800	1200	47.2	0.35	5	1500	840	33.1	0.3	5	1200	670	26.4	0.2	5	900	300	11.8	0.07	5
8	0.5	40	1800	1200	47.2	0.3	5	1500	840	33.1	0.25	5	1200	670	26.4	0.2	5	900	300	11.8	0.06	5
8	1	24	2500	2000	78.7	0.6	4.5	2100	1400	55.1	0.5	4.5	1700	1100	43.3	0.4	4.5	1300	500	19.7	0.12	4.5
8	1	40	2500	2000	78.7	0.5	4.5	2100	1400	55.1	0.4	4.5	1700	1100	43.3	0.3	4.5	1300	500	19.7	0.11	4.5
8	2	24	3600	3900	153.5	1.2	3	3000	2700	106.3	1	3	2400	2200	86.6	0.7	3	1800	980	38.6	0.24	3
8	2	40	3600	3900	153.5	1.1	3	3000	2700	106.3	0.9	3	2400	2200	86.6	0.7	3	1800	980	38.6	0.22	3
8	2	56	3000	3300	129.9	1	3	2500	2300	90.6	0.8	3	2000	1800	70.9	0.6	3	1500	830	32.7	0.2	3
8	2	72	3000	3300	129.9	0.6	3	2500	2300	90.6	0.5	3	2000	1800	70.9	0.4	3	1500	830	32.7	0.12	3
9	2	—	3200	3900	153.5	1.2	3.5	2700	2700	106.3	1	3.5	2100	2200	86.6	0.7	3.5	1600	980	38.6	0.24	3.5
10	0.5	30	1400	1200	47.2	0.35	6.5	1200	840	33.1	0.3	6.5	940	670	26.4	0.2	6.5	700	300	11.8	0.07	6.5
10	0.5	50	1400	1200	47.2	0.3	6.5	1200	840	33.1	0.25	6.5	940	670	26.4	0.2	6.5	700	300	11.8	0.06	6.5
10	1	30	2000	2000	78.7	0.6	6	1700	1400	55.1	0.5	6	1300	1100	43.3	0.4	6	1000	500	19.7	0.12	6
10	1	50	2000	2000	78.7	0.5	6	1700	1400	55.1	0.4	6	1300	1100	43.3	0.3	6	1000	500	19.7	0.11	6
10	2	30	2900	3900	153.5	1.2	4.5	2400	2700	106.3	1	4.5	1900	2200	86.6	0.7	4.5	1500	980	38.6	0.24	4.5
10	2	50	2900	3900	153.5	1.1	4.5	2400	2700	106.3	0.9	4.5	1900	2200	86.6	0.7	4.5	1500	980	38.6	0.22	4.5
10	2	70	2400	3300	129.9	1	4.5	2000	2300	90.6	0.8	4.5	1600	1800	70.9	0.6	4.5	1200	830	32.7	0.2	4.5
10	2	90	2400	3300	129.9	1	4.5	2000	2300	90.6	0.8	4.5	1600	1800	70.9	0.6	4.5	1200	830	32.7	0.2	4.5
11	2	—	2600	3600	141.7	1.2	5	2200	2500	98.4	1	5	1700	2000	78.7	0.7	5	1300	900	35.4	0.24	5
12	0.5	36	1200	1100	43.3	0.5	8	1000	770	30.3	0.4	8	800	620	24.4	0.3	8	600	280	11.0	0.11	8
12	0.5	60	1200	1100	43.3	0.5	8	1000	770	30.3	0.4	8	800	620	24.4	0.3	8	600	280	11.0	0.1	8
12	1	36	1400	1400	55.1	0.7	7.5	1200	1000	39.4	0.6	7.5	940	780	30.7	0.4	7.5	700	350	13.8	0.14	7.5
12	1	60	1400	1400	55.1	0.6	7.5	1200	1000	39.4	0.5	7.5	940	780	30.7	0.4	7.5	700	350	13.8	0.13	7.5
12	2	36	2400	3600	141.7	1.8	6	2000	2500	98.4	1.4	6	1600	2000	78.7	1.1	6	1200	900	35.4	0.4	6
12	2	60	2400	3600	141.7	1.6	6	2000	2500	98.4	1.3	6	1600	2000	78.7	1	6	1200	900	35.4	0.3	6
12	2	84	2000	3000	118.1	1.4	6	1700	2100	82.7	1.1	6	1300	1700	66.9	0.8	6	1000	750	29.5	0.3	6
12	2	108	2000	3000	118.1	0.9	6	1700	2100	82.7	0.7	6	1300	1700	66.9	0.5	6	1000	750	29.5	0.2	6
12	3	36	2400	3600	141.7	1.8	4.5	2000	2500	98.4	1.4	4.5	1600	2000	78.7	1.1	4.5	1200	900	35.4	0.4	4.5
12	3	60	2400	3600	141.7	1.6	4.5	2000	2500	98.4	1.3	4.5	1600	2000	78.7	1	4.5	1200	900	35.4	0.3	4.5
13	3	—	2200	3600	141.7	1.8	5	1800	2500	98.4	1.4	5	1500	2000	78.7	1.1	5	1100	900	35.4	0.4	5
16	0.5	42	900	900	35.4	0.5	11	750	630	24.8	0.4	11	600	500	19.7	0.3	11	450	230	9.1	0.1	11
16	2	42	1300	1500	59.1	0.9	9	1100	1100	43.3	0.7	9	870	840	33.1	0.5	9	650	380	15.0	0.2	9
16	3	42	1800	3000	118.1	1.8	7.5	1500	2100	82.7	1.4	7.5	1200	1700	66.9	0.9	7.5	900	750	29.5	0.4	7.5
16	3	80	1800	3000	118.1	1.6	7.5	1500	2100	82.7	1.3	7.5	1200	1700	66.9	0.8	7.5	900	750	29.5	0.3	7.5
16	3	120	1500	2500	98.4	1.4	7.5	1200	1800	70.9	1.1	7.5	1000	1400	55.1	0.7	7.5	750	630	24.8	0.3	7.5
Depth of cut																						

Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the work material and depth of cut.

Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

IMPACT MIRACLE END MILLS

VFHVRB - Inch sizes

4 flute, Corner radius, Short cut length, Irregular helix flutes

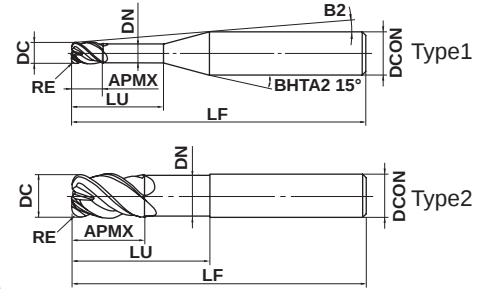
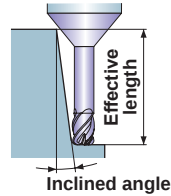


CARBIDE

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



Effective length
for inclined angle



DC ≤ .5000"			
±.0004"			



DC ≤ .5000"			
0 - .0008"			



.2500" ≤ DCON ≤ .3750"	DCON = .5000"		
0 - .00035	0 - .00043		

● Impact Miracle corner radius end mill for high feed and efficient machining.

(inch)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VFHVRBD1/8N3DR0.03	.1250	.030	.125	.375	.1211	6.1°	2.25	.2500	4	●	1	9.9	10.3	11	11.9
VFHVRBD1/8N5DR0.03	.1250	.030	.125	.625	.1211	4.3°	2.25	.2500	4	●	1	16.5	17.1	18.3	19.8
VFHVRBD3/16N3DR0.05	.1875	.050	.188	.563	.1835	2.9°	2.25	.2500	4	●	1	14.9	15.4	16.4	*
VFHVRBD3/16N5DR0.05	.1875	.050	.188	.938	.1835	1.8°	2.25	.2500	4	●	1	24.7	25.6	*	*
VFHVRBD1/4N3DR0.06	.2500	.060	.375	.750	.2441	—	2.25	.2500	4	●	2	*	*	*	*
VFHVRBD1/4N5DR0.06	.2500	.060	.375	1.250	.2441	—	3.00	.2500	4	●	2	*	*	*	*
VFHVRBD5/16N3DR0.08	.3125	.080	.469	.938	.3066	—	3.00	.3125	4	●	2	*	*	*	*
VFHVRBD5/16N5DR0.08	.3125	.080	.469	1.563	.3066	—	4.00	.3125	4	●	2	*	*	*	*
VFHVRBD3/8N3DR0.08	.3750	.080	.563	1.125	.3691	—	3.00	.3750	4	●	2	*	*	*	*
VFHVRBD3/8N5DR0.08	.3750	.080	.563	1.875	.3691	—	4.00	.3750	4	●	2	*	*	*	*
VFHVRBD1/2N3DR0.12	.5000	.120	.750	1.500	.4882	—	4.00	.5000	4	●	2	*	*	*	*
VFHVRBD1/2N5DR0.12	.5000	.120	.750	2.500	.4882	—	5.00	.5000	4	●	2	*	*	*	*

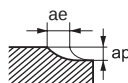
* No interference

RECOMMENDED CUTTING CONDITIONS

High feed conditions

Work Material			Carbon Steel, Cast Iron, Alloy Steel (—30HRC)					Alloy steel, Tool steel, Pre-haedened steel					Hardened Steel (45—55HRC)					Hardened Steel (55—62HRC)				
			AISI 1049, AISI 30, AISI P20					AIAI H13, AISI W1-10, AISI P21					AISI H13					AISI D2				
DC (inch)	RE (inch)	LU (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)
0.1250	0.03	0.375	16000	11000	433.1	.009	.039	13000	7800	307.1	.007	.039	11000	6300	248	.006	.039	8000	2800	110.2	.003	.039
0.1250	0.03	0.625	16000	9000	354.3	.009	.039	13000	6400	252	.007	.039	11000	5100	200.8	.006	.039	8000	2300	90.6	.003	.039
0.1875	0.05	0.563	12000	12000	472.4	.012	.059	10000	8500	334.6	.009	.059	8000	6800	267.7	.007	.059	6000	3000	118.1	.004	.059
0.1875	0.05	0.938	12000	12000	472.4	.011	.059	10000	8500	334.6	.008	.059	8000	6800	267.7	.006	.059	6000	3000	118.1	.003	.059
0.2500	0.06	0.750	8000	13000	511.8	.020	.078	6600	9200	362.2	.016	.078	5400	7400	291.3	.012	.078	4000	3300	129.9	.006	.078
0.2500	0.06	1.250	8000	13000	511.8	.018	.078	6600	9200	362.2	.014	.078	5400	7400	291.3	.011	.078	4000	3300	129.9	.006	.078
0.3125	0.08	0.938	6000	13000	511.8	.024	.118	5000	9200	362.2	.018	.118	4000	7400	291.3	.014	.118	3000	3300	129.9	.007	.118
0.3125	0.08	1.563	6000	13000	511.8	.021	.118	5000	9200	362.2	.017	.118	4000	7400	291.3	.013	.118	3000	3300	129.9	.006	.118
0.3750	0.08	1.125	4800	13000	511.8	.024	.177	4000	9200	362.2	.018	.177	3200	7400	291.3	.014	.177	2400	3300	129.9	.007	.177
0.3750	0.08	1.875	4800	13000	511.8	.021	.177	4000	9200	362.2	.017	.177	3200	7400	291.3	.013	.177	2400	3300	129.9	.006	.177
0.5000	0.12	1.500	4000	12000	472.4	.035	.177	3300	8500	334.6	.028	.177	2700	6800	267.7	.018	.177	2000	3000	118.1	.009	.177
0.5000	0.12	2.500	4000	12000	472.4	.031	.177	3300	8500	334.6	.024	.177	2700	6800	267.7	.016	.177	2000	3000	118.1	.008	.177

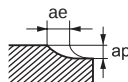
Depth of cut



High depth of cut conditions

Work Material			Carbon Steel, Cast Iron, Alloy Steel (—30HRC)					Alloy steel, Tool steel, Pre-haedened steel					Hardened Steel (45—55HRC)					Hardened Steel (55—62HRC)				
			AISI 1049, AISI 30, AISI P20					AIAI H13, AISI W1-10, AISI P21					AISI H13					AISI D2				
DC (inch)	RE (inch)	LU (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (inch)	Width of cut ae (inch)
0.1250	0.03	0.375	9600	3300	129.9	.020	.039	8000	2300	90.6	.016	.039	6400	1800	70.9	.012	.039	4800	830	32.7	.006	.039
0.1250	0.03	0.625	9600	2700	106.3	.020	.039	8000	1900	74.8	.014	.039	6400	1500	59.1	.010	.039	4800	680	26.8	.005	.039
0.1875	0.05	0.563	7200	3600	141.7	.024	.059	6000	2500	98.4	.020	.059	4800	2000	78.7	.014	.059	3600	900	35.4	.005	.059
0.1875	0.05	0.938	7200	3600	141.7	.024	.059	6000	2500	98.4	.016	.059	4800	2000	78.7	.013	.059	3600	900	35.4	.004	.059
0.2500	0.06	0.750	4000	3300	129.9	.020	.118	3300	2300	90.6	.016	.118	2700	1800	70.9	.012	.118	2000	830	32.7	.004	.118
0.2500	0.06	1.250	4800	3900	153.5	.040	.079	4000	2700	106.3	.031	.079	3200	2200	86.6	.024	.079	2400	980	38.6	.008	.079
0.3125	0.08	0.938	3600	3900	153.5	.047	.118	3000	2700	106.3	.040	.118	2400	2200	86.6	.028	.118	1800	980	38.6	.009	.118
0.3125	0.08	1.563	3600	3900	153.5	.043	.118	3000	2700	106.3	.035	.118	2400	2200	86.6	.028	.118	1800	980	38.6	.009	.118
0.3750	0.08	1.125	2900	3900	153.5	.047	.177	2400	2700	106.3	.040	.177	1900	2200	86.6	.028	.177	1500	980	38.6	.009	.177
0.3750	0.08	1.875	2900	3900	153.5	.043	.177	2400	2700	106.3	.035	.177	1900	2200	86.6	.028	.177	1500	980	38.6	.009	.177
0.5000	0.12	1.500	2400	3600	141.7	.071	.177	2000	2500	98.4	.055	.177	1600	2000	78.7	.043	.177	1200	900	35.4	.016	.177
0.5000	0.12	2.500	2400	3600	141.7	.063	.177	2000	2500	98.4	.051	.177	1600	2000	78.7	.040	.177	1200	900	35.4	.012	.177

Depth of cut



Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Using air blow or mist is recommended.

Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the work material and depth of cut.

Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes



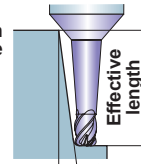
CARBIDE

Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
○	○	○	○	○	○		

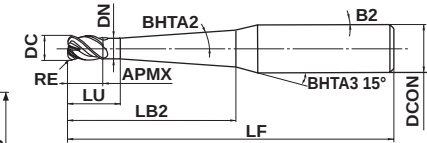
Taper neck type



Effective length
for inclined angle



Inclined angle



DC ≤ 10	DC > 10
±0.007	±0.01



DC ≤ 12
0 - 0.02



DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16
0 - 0.008	0 - 0.009	0 - 0.011

● Impact Miracle corner radius end mill for high feed and efficient machining.

(mm)

Order Number	DC	RE	BHTA2	APMX	LU	LB2	DN	B2	LF	DCON	No. of Flutes	Stock	Effective length for inclined angle			
													0.5°	1°	2°	3°
VFHVRBD010R02N006T09	1	0.2	0.9°	1	2.5	6	0.94	9.3°	60	6	4	●	—	6.6	7.1	7.6
VFHVRBD010R02N010T09	1	0.2	0.9°	1	2.5	10	0.94	7.5°	60	6	4	●	—	10.6	11.4	12.3
VFHVRBD010R02N015T09	1	0.2	0.9°	1	2.5	15	0.94	6.1°	60	6	4	●	—	15.6	16.8	18.1
VFHVRBD010R02N020T09	1	0.2	0.9°	1	2.5	20	0.94	5.1°	80	6	4	★	—	20.6	22.1	23.9
VFHVRBD010R02N025T09	1	0.2	0.9°	1	2.5	25	0.94	4.4°	80	6	4	★	—	25.6	27.5	29.7
VFHVRBD010R02N030T09	1	0.2	0.9°	1	2.5	30	0.94	3.8°	80	6	4	★	—	30.6	32.9	35.5
VFHVRBD010R02N035T09	1	0.2	0.9°	1	2.5	35	0.94	3.4°	90	6	4	★	—	35.6	38.3	41.3
VFHVRBD010R02N040T09	1	0.2	0.9°	1	2.5	40	0.94	3.1°	90	6	4	★	—	40.6	43.6	47.2
VFHVRBD010R02N045T09	1	0.2	0.9°	1	2.5	45	0.94	2.8°	90	6	4	★	—	45.6	49	*
VFHVRBD010R02N050T09	1	0.2	0.9°	1	2.5	50	0.94	2.6°	90	6	4	★	—	50.6	54.4	*
VFHVRBD015R03N010T09	1.5	0.3	0.9°	1.5	3	10	1.44	7.1°	60	6	4	●	—	10.6	11.4	12.3
VFHVRBD015R03N015T09	1.5	0.3	0.9°	1.5	3	15	1.44	5.7°	60	6	4	●	—	15.6	16.8	18.1
VFHVRBD015R03N020T09	1.5	0.3	0.9°	1.5	3	20	1.44	4.7°	80	6	4	●	—	20.6	22.2	23.9
VFHVRBD015R03N030T09	1.5	0.3	0.9°	1.5	3	30	1.44	3.5°	80	6	4	★	—	30.6	32.9	35.6
VFHVRBD015R03N040T09	1.5	0.3	0.9°	1.5	3	40	1.44	2.8°	90	6	4	★	—	40.6	43.7	*
VFHVRBD015R03N050T09	1.5	0.3	0.9°	1.5	3	50	1.44	2.4°	90	6	4	★	—	50.6	54.4	*
VFHVRBD020R05N015T04	2	0.5	0.4°	2	4	15	1.9	5.2°	60	6	4	★	15.6	16.2	17.4	18.7
VFHVRBD020R05N020T04	2	0.5	0.4°	2	4	20	1.9	4.3°	80	6	4	★	20.6	21.3	22.9	24.7
VFHVRBD020R05N025T04	2	0.5	0.4°	2	4	25	1.9	3.6°	80	6	4	★	25.6	26.5	28.5	30.8
VFHVRBD020R05N030T04	2	0.5	0.4°	2	4	30	1.9	3.2°	80	6	4	★	30.6	31.7	34	36.8
VFHVRBD020R05N035T04	2	0.5	0.4°	2	4	35	1.9	2.8°	80	6	4	★	35.6	36.9	39.6	*
VFHVRBD020R05N040T04	2	0.5	0.4°	2	4	40	1.9	2.5°	80	6	4	★	40.6	42	45.2	*
VFHVRBD020R05N020T09	2	0.5	0.9°	2	4	20	1.9	4.4°	80	6	4	●	—	20.8	22.3	24.1
VFHVRBD020R05N025T09	2	0.5	0.9°	2	4	25	1.9	3.7°	90	6	4	●	—	25.8	27.7	29.9
VFHVRBD020R05N030T09	2	0.5	0.9°	2	4	30	1.9	3.2°	90	6	4	●	—	30.8	33	35.7
VFHVRBD020R05N035T09	2	0.5	0.9°	2	4	35	1.9	2.9°	90	6	4	●	—	35.8	38.4	*
VFHVRBD020R05N040T09	2	0.5	0.9°	2	4	40	1.9	2.6°	90	6	4	●	—	40.8	43.8	*
VFHVRBD020R05N045T09	2	0.5	0.9°	2	4	45	1.9	2.3°	90	6	4	★	—	45.8	49.2	*
VFHVRBD020R05N050T09	2	0.5	0.9°	2	4	50	1.9	2.2°	100	6	4	★	—	50.8	54.5	*
VFHVRBD020R05N055T09	2	0.5	0.9°	2	4	55	1.9	2°	100	6	4	★	—	55.8	59.9	*
VFHVRBD020R05N060T09	2	0.5	0.9°	2	4	60	1.9	1.8°	100	6	4	★	—	60.8	*	*

* No interference

(mm)

CARBIDE

Order Number	DC	RE	BHTA2	APMX	LU	LB2	DN	B2	LF	DCON	No. of Flutes	Stock	Effective length for inclined angle			
													0.5°	1°	2°	3°
VFHVRBD030R08N020T09	3	0.8	0.9°	3	6	20	2.9	3.6°	80	6	4	●	—	20.9	22.4	24.1
VFHVRBD030R08N025T09	3	0.8	0.9°	3	6	25	2.9	3°	80	6	4	●	—	25.9	27.8	30
VFHVRBD030R08N030T09	3	0.8	0.9°	3	6	30	2.9	2.6°	80	6	4	●	—	30.9	33.1	*
VFHVRBD030R08N040T09	3	0.8	0.9°	3	6	40	2.9	2°	90	6	4	●	—	40.9	43.9	*
VFHVRBD030R08N050T09	3	0.8	0.9°	3	6	50	2.9	1.7°	90	6	4	●	—	50.9	*	*
VFHVRBD030R08N060T09	3	0.8	0.9°	3	6	60	2.9	1.4°	100	6	4	●	—	60.9	*	*
VFHVRBD040R10N025T04	4	1	0.4°	4	7	25	3.9	2.1°	80	6	4	★	25.7	26.6	28.5	*
VFHVRBD040R10N030T04	4	1	0.4°	4	7	30	3.9	1.8°	80	6	4	★	30.7	31.8	*	*
VFHVRBD040R10N035T04	4	1	0.4°	4	7	35	3.9	1.6°	80	6	4	★	35.7	36.9	*	*
VFHVRBD040R10N040T04	4	1	0.4°	4	7	40	3.9	1.4°	80	6	4	★	40.7	42.1	*	*
VFHVRBD040R10N045T04	4	1	0.4°	4	7	45	3.9	1.3°	90	6	4	★	45.7	47.3	*	*
VFHVRBD040R10N050T04	4	1	0.4°	4	7	50	3.9	1.2°	90	6	4	★	50.7	52.5	*	*
VFHVRBD040R10N025T09	4	1	0.9°	4	7	25	3.9	2.2°	90	6	4	●	—	25.9	27.8	*
VFHVRBD040R10N030T09	4	1	0.9°	4	7	30	3.9	1.9°	90	6	4	●	—	30.9	*	*
VFHVRBD040R10N040T09	4	1	0.9°	4	7	40	3.9	1.4°	100	6	4	●	—	40.9	*	*
VFHVRBD040R10N050T09	4	1	0.9°	4	7	50	3.9	1.2°	100	6	4	●	—	50.9	*	*
VFHVRBD040R10N060T09	4	1	0.9°	4	7	60	3.9	1°	100	6	4	●	—	60.9	*	*
VFHVRBD060R15N040T09	6	1.5	0.9°	9	12	40	5.85	1.4°	110	8	4	●	—	41.4	*	*
VFHVRBD060R15N050T09	6	1.5	0.9°	9	12	50	5.85	1.2°	110	8	4	●	—	51.4	*	*
VFHVRBD060R15N060T09	6	1.5	0.9°	9	12	60	5.85	1°	110	8	4	●	—	61.4	*	*
VFHVRBD060R15N070T09	6	1.5	0.9°	9	12	70	5.85	0.9°	110	8	4	●	—	*	*	*
VFHVRBD080R20N060T09	8	2	0.9°	12	15	60	7.85	1°	150	10	4	★	—	61.5	*	*
VFHVRBD080R20N080T09	8	2	0.9°	12	15	80	7.85	0.8°	150	10	4	★	—	*	*	*
VFHVRBD100R20N080T09	10	2	0.9°	15	18	80	9.7	2°	130	16	4	★	—	82	88	*
VFHVRBD100R20N120T09	10	2	0.9°	15	18	120	9.7	1.4°	180	16	4	★	—	122	*	*
VFHVRBD120R20N080T09	12	2	0.9°	18	21	80	11.7	1.4°	130	16	4	★	—	82.2	*	*
VFHVRBD120R20N120T09	12	2	0.9°	18	21	120	11.7	1°	180	16	4	★	—	122.2	*	*

★ No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes

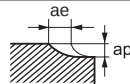
CARBIDE

RECOMMENDED CUTTING CONDITIONS

High depth cut conditions

Work Material				Carbon Steel, Cast Iron, Alloy Steel (—30HRC)					Alloy steel, Tool steel, Pre-hardened steel					Hardened Steel (45—55HRC)					Hardened Steel (55—62HRC)				
				AISI 1050, AISI No 35 B, AISI P20					AISI H13, AISI W1-10, AISI P21					AISI H13					AISI D2				
DC (mm)	RE (mm)	BHTA2	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap(mm)	Width of cut ae(mm)
				(mm/min)	(IPM)				(mm/min)	(IPM)				(mm/min)	(IPM)				(mm/min)	(IPM)			
1	0.2	0.9°	6	40000	6500	255.9	0.03	0.45	33000	4600	181.1	0.022	0.45	27000	3700	145.7	0.018	0.45	20000	1600	63.0	0.01	0.45
1	0.2	0.9°	10	24000	2700	106.3	0.015	0.45	20000	1900	74.8	0.01	0.45	16000	1500	59.1	0.008	0.45	12000	700	27.6	0.006	0.45
1	0.2	0.9°	15	16000	1200	47.2	0.013	0.45	14000	700	27.6	0.008	0.45	12000	500	19.7	0.007	0.45	10000	400	15.7	0.003	0.45
1	0.2	0.9°	20	14000	1000	39.4	0.01	0.45	12000	600	23.6	0.006	0.45	10000	400	15.7	0.005	0.45	9000	300	11.8	0.002	0.45
1	0.2	0.9°	25	9500	610	24.0	0.008	0.45	8000	440	17.3	0.005	0.45	6000	320	12.6	0.004	0.45	4800	160	6.3	0.002	0.45
1	0.2	0.9°	30	4900	320	12.6	0.007	0.45	4100	220	8.7	0.004	0.45	3000	160	6.3	0.003	0.45	2500	80	3.1	0.002	0.45
1	0.2	0.9°	35	4000	260	10.2	0.006	0.45	3400	190	7.5	0.003	0.45	3000	160	6.3	0.003	0.45	2000	70	2.8	0.001	0.45
1	0.2	0.9°	40	3500	180	7.1	0.005	0.45	2900	130	5.1	0.003	0.45	2000	90	3.5	0.003	0.45	1700	50	2.0	0.001	0.45
1	0.2	0.9°	45	2900	150	5.9	0.004	0.45	2400	100	3.9	0.002	0.45	2000	90	3.5	0.002	0.45	1400	40	1.6	0.001	0.45
1	0.2	0.9°	50	2900	110	4.3	0.003	0.45	2400	80	3.1	0.002	0.45	2000	60	2.4	0.002	0.45	1400	30	1.2	0.001	0.45
1.5	0.3	0.9°	10	27000	5700	224.4	0.05	0.65	22000	4000	157.5	0.035	0.65	18000	3000	118.1	0.03	0.65	14000	1400	55.1	0.014	0.65
1.5	0.3	0.9°	15	22000	3200	126.0	0.03	0.65	18000	2300	90.6	0.025	0.65	15000	1700	66.9	0.018	0.65	11000	1000	39.4	0.009	0.65
1.5	0.3	0.9°	20	16000	1400	55.1	0.02	0.65	14000	1200	47.2	0.016	0.65	13000	1000	39.4	0.012	0.65	9000	700	27.6	0.007	0.65
1.5	0.3	0.9°	30	13000	900	35.4	0.01	0.65	11000	700	27.6	0.008	0.65	10000	600	23.6	0.006	0.65	7500	400	15.7	0.004	0.65
1.5	0.3	0.9°	40	4500	230	9.1	0.008	0.65	3700	160	6.3	0.007	0.65	3000	120	4.7	0.005	0.65	2300	70	2.8	0.003	0.65
1.5	0.3	0.9°	50	3700	190	7.5	0.007	0.65	3000	130	5.1	0.006	0.65	3000	120	4.7	0.004	0.65	1900	60	2.4	0.002	0.65
2	0.5	0.4°	15	20000	7000	275.6	0.05	0.75	17000	5000	196.9	0.04	0.75	13000	3200	126.0	0.03	0.75	10000	1800	70.9	0.016	0.75
2	0.5	0.4°	20	20000	3600	141.7	0.04	0.75	17000	2600	102.4	0.03	0.75	13000	1800	70.9	0.025	0.75	10000	900	35.4	0.012	0.75
2	0.5	0.4°	25	16000	1800	70.9	0.03	0.75	14000	1400	55.1	0.025	0.75	12000	1100	43.3	0.02	0.75	9000	720	28.3	0.01	0.75
2	0.5	0.4°	30	16000	1400	55.1	0.025	0.75	14000	1200	47.2	0.02	0.75	12000	900	35.4	0.016	0.75	9000	650	25.6	0.008	0.75
2	0.5	0.4°	35	13000	1100	43.3	0.02	0.75	11000	800	31.5	0.018	0.75	10000	700	27.6	0.014	0.75	7000	500	19.7	0.007	0.75
2	0.5	0.4°	40	13000	1000	39.4	0.02	0.75	11000	700	27.6	0.015	0.75	10000	600	23.6	0.012	0.75	7000	400	15.7	0.006	0.75
2	0.5	0.9°	20	20000	3600	141.7	0.04	0.75	17000	2600	102.4	0.03	0.75	13000	1800	70.9	0.025	0.75	10000	900	35.4	0.012	0.75
2	0.5	0.9°	25	16000	1800	70.9	0.03	0.75	14000	1400	55.1	0.025	0.75	12000	1100	43.3	0.02	0.75	9000	720	28.3	0.01	0.75
2	0.5	0.9°	30	16000	1400	55.1	0.025	0.75	14000	1200	47.2	0.02	0.75	12000	900	35.4	0.016	0.75	9000	650	25.6	0.008	0.75
2	0.5	0.9°	35	13000	1100	43.3	0.02	0.75	11000	800	31.5	0.018	0.75	10000	700	27.6	0.014	0.75	7000	500	19.7	0.007	0.75
2	0.5	0.9°	40	13000	1000	39.4	0.02	0.75	11000	700	27.6	0.015	0.75	10000	600	23.6	0.012	0.75	7000	400	15.7	0.006	0.75
2	0.5	0.9°	45	8000	500	19.7	0.016	0.75	6800	360	14.2	0.012	0.75	5200	250	9.8	0.01	0.75	4000	120	4.7	0.005	0.75
2	0.5	0.9°	50	8000	500	19.7	0.016	0.75	6800	360	14.2	0.012	0.75	5200	250	9.8	0.01	0.75	4000	120	4.7	0.005	0.75
2	0.5	0.9°	55	4100	230	9.1	0.012	0.75	3500	170	6.7	0.009	0.75	2700	120	4.7	0.008	0.75	2000	60	2.4	0.004	0.75
2	0.5	0.9°	60	4100	230	9.1	0.012	0.75	3500	170	6.7	0.009	0.75	2700	120	4.7	0.008	0.75	2000	60	2.4	0.004	0.75
3	0.8	0.9°	20	13000	7200	283.5	0.19	1	11000	5100	200.8	0.15	1	8700	4000	157.5	0.11	1	6500	1800	70.9	0.06	1
3	0.8	0.9°	25	13000	7200	283.5	0.19	1	11000	5100	200.8	0.15	1	8700	4000	157.5	0.11	1	6500	1800	70.9	0.06	1
3	0.8	0.9°	30	13000	5700	224.4	0.12	1	11000	4000	157.5	0.09	1	8700	3000	118.1	0.07	1	6500	1400	55.1	0.04	1
3	0.8	0.9°	40	11000	3600	141.7	0.08	1	9100	2600	102.4	0.06	1	7400	2000	78.7	0.05	1	5500	1000	39.4	0.025	1
3	0.8	0.9°	50	8000	2600	102.4	0.07	1	6600	1800	70.9	0.05	1	5800	1500	59.1	0.04	1	4600	800	31.5	0.02	1
3	0.8	0.9°	60	7800	2480	97.6	0.06	1	6600	1740	68.5	0.05	1	5000	1250	49.2	0.04	1	3900	610	24.0	0.02	1

Depth of cut

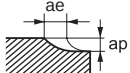


Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 2) Air blow or oil mist is recommended for good chip evacuation.

Note 3) For profile machining such as molds, machining conditions may differ considerably depending on the work material geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a work material.

Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is poor, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

Work Material				Carbon Steel, Cast Iron, Alloy Steel (—30HRC)				Alloy steel, Tool steel, Pre-hardened steel				Hardened Steel (45—55HRC)				Hardened Steel (55—62HRC)							
				AISI 1050, AISI No 35 B, AISI P20				AISI H13, AISI W1-10, AISI P21				AISI H13				AISI D2							
DC (mm)	RE (mm)	BHTA2	LU (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap(mm)	Width of cut ae(mm)
4	1	0.4°	25	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
4	1	0.4°	30	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
4	1	0.4°	35	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	1	0.4°	40	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	1	0.4°	45	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	1	0.4°	50	8100	6300	248.0	0.14	1.5	6700	4420	174.0	0.11	1.5	5400	3500	137.8	0.08	1.5	4000	1600	63.0	0.04	1.5
4	1	0.9°	25	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
4	1	0.9°	30	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	1	0.9°	40	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	1	0.9°	50	8100	6300	248.0	0.14	1.5	6700	4420	174.0	0.11	1.5	5400	3500	137.8	0.08	1.5	4000	1600	63.0	0.04	1.5
4	1	0.9°	60	8100	6300	248.0	0.11	1.5	6700	4420	174.0	0.08	1.5	5400	3500	137.8	0.06	1.5	4000	1600	63.0	0.03	1.5
6	1.5	0.9°	40	6600	11000	433.1	0.4	2	5500	7600	299.2	0.32	2	4500	6100	240.2	0.24	2	3300	2700	106.3	0.12	2
6	1.5	0.9°	50	6600	11000	433.1	0.4	2	5500	7600	299.2	0.32	2	4500	6100	240.2	0.24	2	3300	2700	106.3	0.12	2
6	1.5	0.9°	60	6600	11000	433.1	0.25	2	5500	7600	299.2	0.2	2	4500	6100	240.2	0.15	2	3300	2700	106.3	0.08	2
6	1.5	0.9°	70	5400	8700	342.5	0.23	2	4400	6200	244.1	0.18	2	3600	5000	196.9	0.14	2	2700	2200	86.6	0.07	2
8	2	0.9°	60	5000	11000	433.1	0.48	3	4200	7600	299.2	0.37	3	3300	6100	240.2	0.29	3	2500	2700	106.3	0.14	3
8	2	0.9°	80	5000	11000	433.1	0.3	3	4200	7600	299.2	0.23	3	3300	6100	240.2	0.18	3	2500	2700	106.3	0.09	3
10	2	0.9°	80	4000	11000	433.1	0.48	4.5	3300	7600	299.2	0.37	4.5	2700	6100	240.2	0.29	4.5	2000	2700	106.3	0.14	4.5
10	2	0.9°	120	3200	8700	342.5	0.27	4.5	2700	6200	244.1	0.21	4.5	2100	5000	196.9	0.16	4.5	1600	2200	86.6	0.08	4.5
12	2	0.9°	80	3300	10000	393.7	0.72	6	2700	7100	279.5	0.56	6	2200	5600	220.5	0.36	6	1700	2500	98.4	0.18	6
12	2	0.9°	120	3300	10000	393.7	0.45	6	2700	7100	279.5	0.35	6	2200	5600	220.5	0.23	6	1700	2500	98.4	0.12	6
Depth of cut																							

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

Note 2) Air blow or oil mist is recommended for good chip evacuation.

Note 3) For profile machining such as molds, machining conditions may differ considerably depending on the work material geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a work material.

Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is poor, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

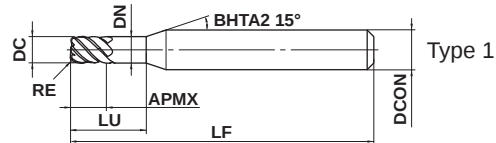
VFSDRB

Corner radius, Short cut length, 6 flute

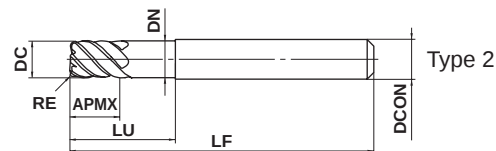


CARBIDE

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



Type 1



Type 2



3 ≤ DC ≤ 12				
0 - 0.02				
DCON=6	8 ≤ DCON ≤ 10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 6 flute end mill with Impact Miracle coating for high hardened materials.

(mm)

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFSDRBD0300R030	3	0.3	3	9	2.9	45	6	6	★	1
VFSDRBD0400R030	4	0.3	4	12	3.9	45	6	6	★	1
VFSDRBD0500R030	5	0.3	5	15	4.9	50	6	6	★	1
VFSDRBD0600R030	6	0.3	6	18	5.85	50	6	6	★	2
VFSDRBD0600R050	6	0.5	6	18	5.85	50	6	6	★	2
VFSDRBD0600R100	6	1	6	18	5.85	50	6	6	★	2
VFSDRBD0800R030	8	0.3	8	24	7.85	60	8	6	★	2
VFSDRBD0800R050	8	0.5	8	24	7.85	60	8	6	★	2
VFSDRBD0800R100	8	1	8	24	7.85	60	8	6	★	2
VFSDRBD1000R050	10	0.5	10	30	9.7	70	10	6	★	2
VFSDRBD1000R100	10	1	10	30	9.7	70	10	6	★	2
VFSDRBD1200R050	12	0.5	12	36	11.7	75	12	6	★	2
VFSDRBD1200R100	12	1	12	36	11.7	75	12	6	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC)				Hardened steel (55—62HRC)				Hardened steel (62—70HRC)			
	AISI H13 etc.				AISI D2 etc.				AISI W1, AISI M2 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)			(mm/min)	(IPM)	
1	40000	1200	47.2	0.05	40000	800	31.5	0.03	32000	500	19.7	0.02
2	40000	2000	78.7	0.1	24000	1000	39.4	0.05	16000	600	23.6	0.05
3	32000	3800	149.6	0.2	16000	1900	74.8	0.1	11000	1200	47.2	0.05
4	24000	4400	173.2	0.2	12000	2200	86.6	0.1	8000	1300	51.2	0.05
6	16000	5800	228.3	0.3	8000	2900	114.2	0.2	5300	1800	70.9	0.1
8	12000	5800	228.3	0.4	6000	2900	114.2	0.2	4000	1800	70.9	0.1
10	9600	5800	228.3	0.5	4800	2900	114.2	0.3	3200	1800	70.9	0.2
12	8000	4800	189.0	0.6	4000	2400	94.5	0.3	2700	1500	59.1	0.2
16	6000	3600	141.7	0.8	3000	1800	70.9	0.5	2000	1100	43.3	0.3
20	4800	2900	114.2	1.0	2400	1400	55.1	0.5	1600	880	34.6	0.3
25	3800	2300	90.6	1.0	1900	1100	43.3	0.5	1300	720	28.3	0.3

Depth of cut

Depth of cut

DC : Dia.

Slot milling with small diameter tools

Work Material	Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
	AISI H13 etc.				AISI D2 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
1	15000	300	11.8	0.1	9500	110	4.3	0.05
2	8000	320	12.6	0.2	4800	190	7.5	0.1

Depth of cut

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

IMPACT MIRACLE END MILLS

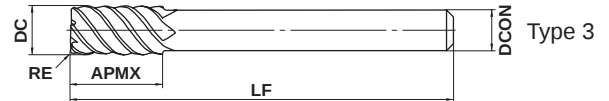
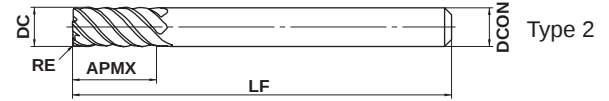
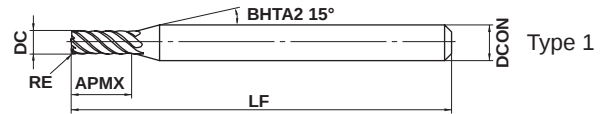
VFMDRDB

Corner radius, Medium cut length, 6 flute, For hardened materials



CARBIDE

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



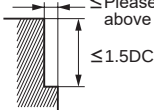
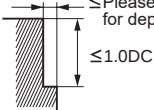
DC ≤ 12	DC > 12		
0 - 0.02	0 - 0.03		
DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

● 6 flute corner radius end mill with Impact Miracle coating for high hardened materials.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMDRBD0300R030	3	0.3	10	60	6	6	★	1
VFMDRBD0400R030	4	0.3	12	60	6	6	★	1
VFMDRBD0500R030	5	0.3	15	60	6	6	★	1
VFMDRBD0600R030	6	0.3	15	60	6	6	★	2
VFMDRBD0600R050	6	0.5	15	60	6	6	★	2
VFMDRBD0600R100	6	1	15	60	6	6	★	2
VFMDRBD0800R030	8	0.3	20	75	8	6	★	2
VFMDRBD0800R050	8	0.5	20	75	8	6	★	2
VFMDRBD0800R100	8	1	20	75	8	6	★	2
VFMDRBD1000R030	10	0.3	25	80	10	6	★	2
VFMDRBD1000R050	10	0.5	25	80	10	6	★	2
VFMDRBD1000R100	10	1	25	80	10	6	★	2
VFMDRBD1200R050	12	0.5	30	100	12	6	★	2
VFMDRBD1200R100	12	1	30	100	12	6	★	2
VFMDRBD1600R100	16	1	40	110	16	6	★	2
VFMDRBD1600R150	16	1.5	40	110	16	6	★	2
VFMDRBD1800R100	18	1	40	120	16	6	★	3
VFMDRBD1800R150	18	1.5	40	120	16	6	★	3
VFMDRBD2000R100	20	1	45	125	20	6	★	2
VFMDRBD2000R150	20	1.5	45	125	20	6	★	2
VFMDRBD2000R200	20	2	45	125	20	6	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC)				Hardened steel (55—62HRC)				Hardened steel (62—70HRC)			
	AISI H13 etc.				AISI D2 etc.				AISI W1, AISI M2 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)			(mm/min)	(IPM)	
1	40000	1200	47.2	0.05	40000	800	31.5	0.03	32000	500	19.7	0.02
2	40000	2000	78.7	0.1	24000	1000	39.4	0.05	16000	600	23.6	0.05
3	32000	3800	149.6	0.2	16000	1900	74.8	0.1	11000	1200	47.2	0.05
4	24000	4400	173.2	0.2	12000	2200	86.6	0.1	8000	1300	51.2	0.05
6	16000	5800	228.3	0.3	8000	2900	114.2	0.2	5300	1800	70.9	0.1
8	12000	5800	228.3	0.4	6000	2900	114.2	0.2	4000	1800	70.9	0.1
10	9600	5800	228.3	0.5	4800	2900	114.2	0.3	3200	1800	70.9	0.2
12	8000	4800	189.0	0.6	4000	2400	94.5	0.3	2700	1500	59.1	0.2
16	6000	3600	141.7	0.8	3000	1800	70.9	0.5	2000	1100	43.3	0.3
20	4800	2900	114.2	1.0	2400	1400	55.1	0.5	1600	880	34.6	0.3
25	3800	2300	90.6	1.0	1900	1100	43.3	0.5	1300	720	28.3	0.3
Depth of cut												
	≤Please refer to the list above for depth of cut.				≤Please refer to the list above for depth of cut.							

DC : Dia.

Slot milling with small diameter tools

Work Material	Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
	AISI H13 etc.				AISI D2 etc.			
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
1	15000	300	11.8	0.1	9500	110	4.3	0.05
2	8000	320	12.6	0.2	4800	190	7.5	0.1

Depth of cut

DC

Please refer to the list above for depth of cut.

DC : Dia.

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) If the rigidity of the machine or the work material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

IMPACT MIRACLE END MILLS

VFMHVRBCH

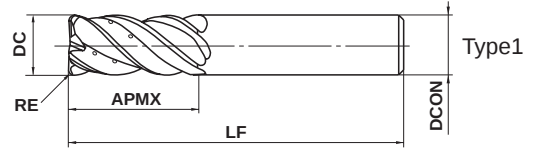
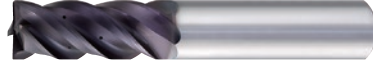
Corner radius, Medium cut length, 4 flute, Irregular helix flutes, with multiple thru-coolant



CARBIDE

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

CoolStar



Type1



$1 \leq RE \leq 3$				
± 0.015				



$16 \leq DC \leq 20$				
0 $- 0.03$				



DCON=16	DCON=20			
0 $- 0.011$	0 $- 0.013$			

- Vibration control corner radius end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

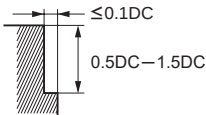
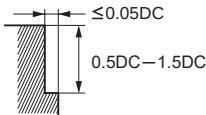
(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMHVRBCHD1600R100	16	1	35	90	16	4	★	1
VFMHVRBCHD1600R300	16	3	35	90	16	4	★	1
VFMHVRBCHD2000R100	20	1	45	110	20	4	★	1
VFMHVRBCHD2000R300	20	3	45	110	20	4	★	1

SOLID END MILLS

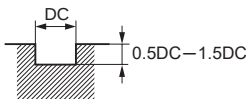
RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel (— 45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
	DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)
16		3000	1140 44.9	2000	560 22.0	800	110 4.3		
20		2400	860 33.9	1600	510 20.1	600	100 3.9		
Depth of cut									

DC: Dia.

Slotting

Work Material	Carbon steel, Cast iron, Alloy steel (— 30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy steel, Tool steel, Pre-hardened steel (— 45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
	DC (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)
16		2400	670 26.4	1400	380 15.0	1400	170 6.7		
20		1900	610 24.0	1100	350 13.8	1100	130 5.1		
Depth of cut									

DC: Dia.

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

Note 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 work material installation is poor, vibration or abnormal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

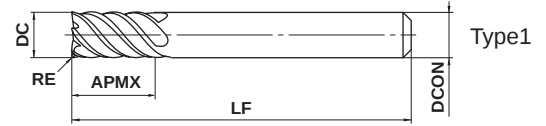
VF6MHVRB

Corner radius, Medium cut length, 6 flute, Irregular helix flutes



CARBIDE

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



Type1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	0.5 ≤ RE ≤ 2				
	±0.015				
	DC ≤ 12	DC > 12			
	$\begin{smallmatrix} 0 \\ -0.020 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$			
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	$\begin{smallmatrix} 0 \\ -0.008 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.009 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.011 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.013 \end{smallmatrix}$	

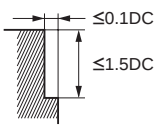
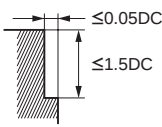
- Irregular helix 6 flute geometry reduces vibrations and achieves high efficiency machining.
- Suitable for machining of difficult-to-cut materials such as stainless steel, titanium alloy and inconel.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6MHVRBD0600R050	6	0.5	13	50	6	6	★	1
VF6MHVRBD0600R100	6	1	13	50	6	6	★	1
VF6MHVRBD0800R050	8	0.5	19	60	8	6	★	1
VF6MHVRBD0800R100	8	1	19	60	8	6	★	1
VF6MHVRBD1000R050	10	0.5	22	70	10	6	★	1
VF6MHVRBD1000R100	10	1	22	70	10	6	★	1
VF6MHVRBD1200R050	12	0.5	26	75	12	6	★	1
VF6MHVRBD1200R100	12	1	26	75	12	6	★	1
VF6MHVRBD1600R100	16	1	32	90	16	6	★	1
VF6MHVRBD1600R200	16	2	32	90	16	6	★	1
VF6MHVRBD2000R100	20	1	38	100	20	6	★	1
VF6MHVRBD2000R200	20	2	38	100	20	6	★	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
6	10600	2900	114.2	8000	2000	78.7	2100	320	12.6
8	8000	2900	114.2	6000	2000	78.7	1600	300	11.8
10	6400	2700	106.3	4800	2000	78.7	1300	260	10.2
12	5300	2700	106.3	4000	2000	78.7	1100	230	9.1
16	4000	2200	86.6	3000	1600	63.0	800	180	7.1
20	3200	1900	74.8	2400	1400	55.1	640	150	5.9
Depth of cut									

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.

Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the work material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE END MILLS

VF8MHVRBCH

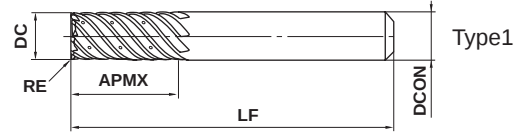
Corner radius, Medium cut length, 8 flute, Irregular helix flutes, with multiple thru-coolant



CARBIDE

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

CoolStar



Type1



$1 \leq RE \leq 3$				
± 0.015				



$16 \leq DC \leq 20$				
0 $- 0.03$				



DCON=16	DCON=20			
0 $- 0.011$	0 $- 0.013$			

- Vibration control corner radius end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

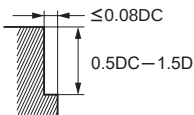
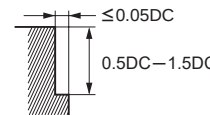
(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VF8MHVRBCHD1600R100	16	1	32	90	16	8	★	1
VF8MHVRBCHD1600R300	16	3	32	90	16	8	★	1
VF8MHVRBCHD2000R100	20	1	38	100	20	8	★	1
VF8MHVRBCHD2000R300	20	3	38	100	20	8	★	1

SOLID END MILLS

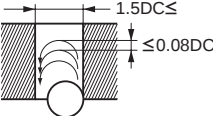
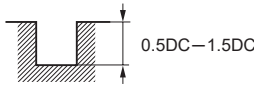
RECOMMENDED CUTTING CONDITIONS

Shoulder milling

DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	4000	2400	94.5	3000	2100	82.7	800	240	9.4
20	3200	1900	74.8	2400	1900	74.8	640	200	7.9
Depth of cut									

DC: Dia.

Trochoidal milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel			Austenitic stainless steel, Titanium alloy		
	AISI H13, AISI W1-10, AISI P21			AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	Revolution (min ⁻¹)	Table feed		Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)
16	4000	1900	74.8	3000	1400	55.1
20	3200	1500	59.1	2400	1200	47.2
Depth of cut	 					

DC: Dia.

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

Note 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 work material installation is poor, vibration or abnormal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE REVOLUTION END MILLS

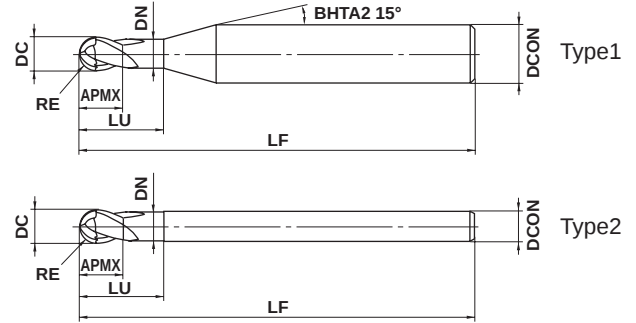
VFR2SSB NEW

Ball nose, Short cut length, 2 flute, Short shank



CARBIDE

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



RE ≤ 6			
±0.005			
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12	
0 - 0.005	0 - 0.006	0 - 0.008	



- Optimization of the cutting edge curve, helix angle, and rake angle have improved the edge strength at all areas of the ball blades.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFR2SSBR0050S04	0.5	1	1	2	0.94	40	4	2	●	1
VFR2SSBR0050	0.5	1	1	2	0.94	40	6	2	●	1
VFR2SSBR0075S04	0.75	1.5	1.5	3	1.44	40	4	2	●	1
VFR2SSBR0075	0.75	1.5	1.5	3	1.44	40	6	2	●	1
VFR2SSBR0100	1	2	2	4	1.9	45	6	2	●	1
VFR2SSBR0150	1.5	3	3	6	2.9	45	6	2	●	1
VFR2SSBR0200	2	4	4	8	3.9	45	6	2	●	1
VFR2SSBR0250	2.5	5	5	10	4.9	50	6	2	●	1
VFR2SSBR0300	3	6	6	12	5.85	50	6	2	●	2
VFR2SSBR0400	4	8	8	14	7.85	60	8	2	●	2
VFR2SSBR0500	5	10	10	18	9.7	70	10	2	●	2
VFR2SSBR0600	6	12	12	22	11.7	75	12	2	●	2

SOLID END MILLS

ROUGHING

TAPER

RADIUS

BALL

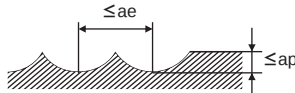
SQUARE

CARBIDE

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC)						Hardened steel (55—62HRC)						Hardened steel (62—70HRC)					
	AISI H13						AISI D2						AISI W1, AISI M2					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)
RE (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)		
R 0.1	40000	320	40000	240	0.003	0.02	40000	320	40000	160	0.003	0.02	40000	320	40000	160	0.002	0.02
R 0.15	40000	640	40000	560	0.01	0.03	40000	640	40000	400	0.007	0.03	40000	640	40000	400	0.005	0.03
R 0.2	40000	1600	40000	1200	0.02	0.04	40000	1400	40000	1000	0.015	0.04	40000	1200	40000	1000	0.01	0.04
R 0.3	40000	3200	40000	1600	0.03	0.06	40000	2800	40000	1200	0.025	0.06	40000	2000	40000	1200	0.02	0.06
R 0.4	40000	6400	40000	2400	0.05	0.08	40000	4000	40000	1600	0.04	0.08	40000	2800	40000	1600	0.03	0.08
R 0.5	40000	8000	40000	3200	0.06	0.10	40000	5600	40000	2400	0.05	0.10	40000	3600	32000	1300	0.04	0.10
R 0.75	40000	9600	40000	4000	0.09	0.15	40000	7200	32000	2500	0.075	0.15	32000	4500	21000	1200	0.05	0.15
R 1	40000	9600	39000	4700	0.11	0.20	40000	8000	24000	2400	0.1	0.20	24000	3800	16000	1000	0.07	0.20
R 1.25	40000	10400	32000	4500	0.12	0.25	37000	8100	19000	2300	0.11	0.25	19000	3400	13000	1000	0.08	0.25
R 1.5	40000	12000	27000	4300	0.13	0.30	32000	7700	16000	2200	0.12	0.30	16000	3200	11000	880	0.09	0.30
R 2	32000	10880	20000	3600	0.15	0.40	24000	6200	12000	1900	0.13	0.40	12000	2400	8000	800	0.1	0.40
R 2.5	25000	9000	16000	2900	0.20	0.50	19000	5300	9600	1700	0.15	0.50	9600	2100	6000	600	0.1	0.50
R 3	21000	8400	13000	2600	0.25	0.60	16000	4800	8000	1600	0.2	0.60	8000	1700	5000	600	0.11	0.60
R 4	16000	6400	10000	2000	0.30	0.80	12000	3600	6000	1200	0.2	0.80	6000	1400	4000	480	0.11	0.80
R 5	13000	5200	8000	1700	0.50	1.00	10000	3200	4800	960	0.2	1.00	4800	1100	3000	420	0.12	1.00
R 6	9000	3600	6000	1300	0.50	1.20	7000	2200	3600	720	0.3	1.20	3600	860	2200	310	0.12	1.20

Depth of cut

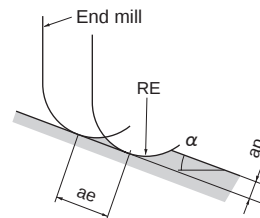


Note 1) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.

Please reduce the feed rate when the surface finish is important.

Note 3) α is the inclination angle of the machined surface.



ae: Pick Feed

IMPACT MIRACLE REVOLUTION END MILLS

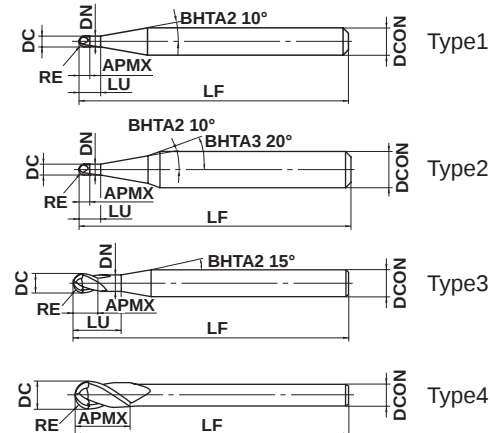
VFR2SB

Ball nose, Short cut length, 2 flute



CARBIDE

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



RE≤6	RE>6			
±0.005	±0.010			
DCON=3	4≤DCON≤6	8≤DCON≤10	DCON=12	DCON=20
0 - 0.004	0 - 0.005	0 - 0.006	0 - 0.008	0 - 0.009

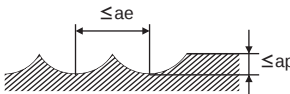


- Optimization of the cutting edge curve, helix angle, and rake angle have improved the edge strength at all areas of the ball blades.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFR2SBR0010	0.1	0.2	0.2	0.4	0.17	45	4	2	●	1
VFR2SBR0010S06	0.1	0.2	0.2	0.4	0.17	50	6	2	●	2
VFR2SBR0015	0.15	0.3	0.3	0.6	0.27	45	4	2	●	1
VFR2SBR0015S06	0.15	0.3	0.3	0.6	0.27	50	6	2	●	2
VFR2SBR0020	0.2	0.4	0.4	0.8	0.36	45	4	2	●	1
VFR2SBR0020S06	0.2	0.4	0.4	0.8	0.36	50	6	2	●	2
VFR2SBR0030	0.3	0.6	0.6	1.2	0.56	45	4	2	●	3
VFR2SBR0030S06	0.3	0.6	0.6	1.2	0.56	50	6	2	●	3
VFR2SBR0040	0.4	0.8	0.8	1.6	0.76	45	4	2	●	3
VFR2SBR0040S06	0.4	0.8	0.8	1.6	0.76	50	6	2	●	3
VFR2SBR0050	0.5	1	1	2	0.94	45	4	2	●	3
VFR2SBR0050S06	0.5	1	1	2	0.94	50	6	2	●	3
VFR2SBR0060	0.6	1.2	1.2	2.4	1.14	45	4	2	●	3
VFR2SBR0060S06	0.6	1.2	1.2	2.4	1.14	50	6	2	●	3
VFR2SBR0070	0.7	1.4	1.4	2.8	1.34	45	4	2	●	3
VFR2SBR0070S06	0.7	1.4	1.4	2.8	1.34	50	6	2	●	3
VFR2SBR0075	0.75	1.5	1.5	3	1.44	45	4	2	●	3
VFR2SBR0075S06	0.75	1.5	1.5	3	1.44	50	6	2	●	3
VFR2SBR0080	0.8	1.6	1.6	3.2	1.54	45	4	2	●	3
VFR2SBR0080S06	0.8	1.6	1.6	3.2	1.54	50	6	2	●	3
VFR2SBR0090	0.9	1.8	1.8	3.6	1.74	45	4	2	●	3
VFR2SBR0090S06	0.9	1.8	1.8	3.6	1.74	50	6	2	●	3
VFR2SBR0100	1	2	2	4	1.9	50	4	2	●	3
VFR2SBR0100S06	1	2	2	4	1.9	60	6	2	●	3
VFR2SBR0125S06	1.25	2.5	2.5	5	2.4	60	6	2	●	3
VFR2SBR0150S03	1.5	3	3	—	—	60	3	2	●	4
VFR2SBR0150	1.5	3	3	6	2.9	70	6	2	●	3
VFR2SBR0200S04	2	4	4	—	—	60	4	2	●	4
VFR2SBR0200	2	4	4	8	3.9	70	6	2	●	3
VFR2SBR0250	2.5	5	5	10	4.9	80	6	2	●	3
VFR2SBR0300	3	6	12	—	—	80	6	2	●	4
VFR2SBR0400	4	8	14	—	—	90	8	2	●	4
VFR2SBR0500	5	10	18	—	—	100	10	2	●	4
VFR2SBR0600	6	12	22	—	—	110	12	2	●	4
VFR2SBR0800	8	16	30	—	—	140	16	2	★	4
VFR2SBR1000	10	20	38	—	—	160	20	2	★	4

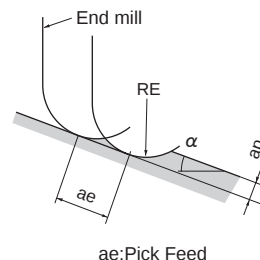
RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC)						Hardened steel (55—62HRC)						Hardened steel (62—70HRC)					
	AISI H13						AISI D2						AISI W1, AISI M2					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)	Depth of cut ae (mm)
RE (mm)	Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)			Revolution (min ⁻¹)	Table feed (mm/min)	Revolution (min ⁻¹)	Table feed (mm/min)		
R 0.1	40000	320	40000	240	0.003	0.02	40000	320	40000	160	0.003	0.02	40000	320	40000	160	0.002	0.02
R 0.15	40000	640	40000	560	0.01	0.03	40000	640	40000	400	0.007	0.03	40000	640	40000	400	0.005	0.03
R 0.2	40000	1600	40000	1200	0.02	0.04	40000	1400	40000	1000	0.015	0.04	40000	1200	40000	1000	0.01	0.04
R 0.3	40000	3200	40000	1600	0.03	0.06	40000	2800	40000	1200	0.025	0.06	40000	2000	40000	1200	0.02	0.06
R 0.4	40000	6400	40000	2400	0.05	0.08	40000	4000	40000	1600	0.04	0.08	40000	2800	40000	1600	0.03	0.08
R 0.5	40000	8000	40000	3200	0.06	0.10	40000	5600	40000	2400	0.05	0.10	40000	3600	32000	1300	0.04	0.10
R 0.75	40000	9600	40000	4000	0.09	0.15	40000	7200	32000	2500	0.075	0.15	32000	4500	21000	1200	0.05	0.15
R 1	40000	9600	39000	4700	0.11	0.20	40000	8000	24000	2400	0.1	0.20	24000	3800	16000	1000	0.07	0.20
R 1.25	40000	10400	32000	4500	0.12	0.25	37000	8100	19000	2300	0.11	0.25	19000	3400	13000	1000	0.08	0.25
R 1.5	40000	12000	27000	4300	0.13	0.30	32000	7700	16000	2200	0.12	0.30	16000	3200	11000	880	0.09	0.30
R 2	32000	10880	20000	3600	0.15	0.40	24000	6200	12000	1900	0.13	0.40	12000	2400	8000	800	0.1	0.40
R 2.5	25000	9000	16000	2900	0.20	0.50	19000	5300	9600	1700	0.15	0.50	9600	2100	6000	600	0.1	0.50
R 3	21000	8400	13000	2600	0.25	0.60	16000	4800	8000	1600	0.2	0.60	8000	1700	5000	600	0.11	0.60
R 4	16000	6400	10000	2000	0.30	0.80	12000	3600	6000	1200	0.2	0.80	6000	1400	4000	480	0.11	0.80
R 5	13000	5200	8000	1700	0.50	1.00	10000	3200	4800	960	0.2	1.00	4800	1100	3000	420	0.12	1.00
R 6	9000	3600	6000	1300	0.50	1.20	7000	2200	3600	720	0.3	1.20	3600	860	2200	310	0.12	1.20
R 8	6000	2400	4000	1000	0.50	1.60	5000	1600	2500	500	0.3	1.60	2500	650	1500	240	0.15	1.60
R10	4500	1800	3000	780	0.50	2.00	4000	1300	1800	360	0.3	2.00	1800	470	1000	160	0.15	2.00
Depth of cut																		

Note 1) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Please reduce the feed rate when the surface finish is important.

Note 3) α is the inclination angle of the machined surface.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

IMPACT MIRACLE REVOLUTION END MILLS

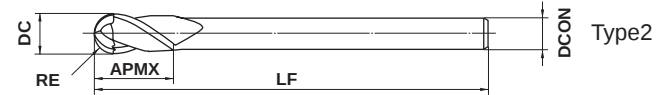
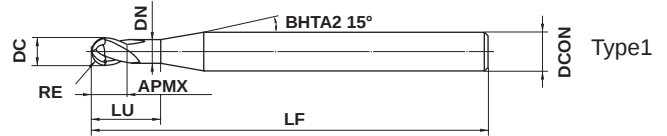
VFR2SBF

Ball nose, Short cut length, 2 flute, For Mirror finish cutting



CARBIDE

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



RE ≤ 3

±0.010



4 ≤ DCON ≤ 6

0

- 0.005

● New ball geometry for mirror finish cutting.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFR2SBFR0050	0.5	1	1	2	0.94	45	4	2	●	1
VFR2SBFR0075	0.75	1.5	1.5	3	1.44	45	4	2	●	1
VFR2SBFR0100	1	2	2	4	1.9	60	6	2	●	1
VFR2SBFR0125	1.25	2.5	2.5	5	2.4	60	6	2	●	1
VFR2SBFR0150	1.5	3	3	6	2.9	70	6	2	●	1
VFR2SBFR0200	2	4	4	8	3.9	70	6	2	●	1
VFR2SBFR0250	2.5	5	5	10	4.9	80	6	2	●	1
VFR2SBFR0300	3	6	6	—	—	80	6	2	●	2

SQUARE

BALL

RADIUS

TAPER

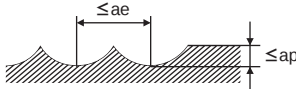
BARREL

ROUGHING

—

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Alloy steel (180—280HB) Alloy tool steel ($\leq 350\text{HB}$), Pre-hardened steel (35—45HRC) Hardened steel (45—52HRC), Hardened steel (55—62HRC)						Hardened steel (62—70HRC)					
	AISI 1045, AISI 4140, AISI P21, AISI P20, SKD, SKT, AISI H13, AISI L6, AISI D2						AISI W1, AISI M2					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p (mm)	Depth of cut a_e (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut a_p (mm)	Depth of cut a_e (mm)
RE (mm)	Revolution (min^{-1})	Table feed (mm/min)	Revolution (min^{-1})	Table feed (mm/min)			Revolution (min^{-1})	Table feed (mm/min)	Revolution (min^{-1})	Table feed (mm/min)		
R 0.5	40000	800	40000	800	0.007	0.007	40000	560	40000	560	0.005	0.005
R 0.75	40000	800	40000	800	0.009	0.009	40000	560	40000	560	0.007	0.007
R 1.0	35000	1050	35000	1050	0.011	0.011	35000	700	35000	700	0.009	0.009
R 1.25	35000	1050	35000	1050	0.013	0.013	35000	700	35000	700	0.011	0.011
R 1.5	35000	1050	35000	1050	0.015	0.015	35000	700	35000	700	0.013	0.013
R 2.0	25000	1000	25000	1000	0.017	0.017	25000	750	25000	750	0.015	0.015
R 2.5	25000	1000	25000	1000	0.020	0.020	25000	750	25000	750	0.015	0.015
R 3.0	25000	1000	25000	1000	0.020	0.020	25000	750	25000	750	0.015	0.015
Depth of cut												

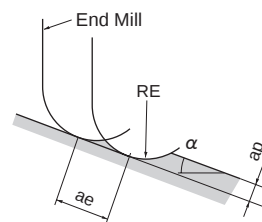
Note 1) The tools are recommended for use only in finish machining.

Note 2) Air blowing and oil mist are recommended as coolants.

Note 3) Note the following points when using the tools.

- Avoid using equipment abruptly without proper preparation. After sufficiently energizing equipment, ensure that there will be no changes to the depth of cut such as due to elongation of the main axis during machining.
- If the tools are used immediately after rough machining of a surface, large uneven areas (cusp heights) will cause deflection of the tools and waviness of the machined surface. Therefore, it is recommended to add a medium finish machining process which uses the same value of a_e as indicated in the table above.

Note 4) α is the inclination angle of the machined surface.



DIAMOND COATED END MILLS FOR CFRP

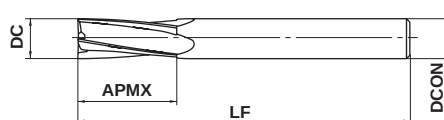
DFC4JC

End mill, 4 flute, For CFRP



CARBIDE

CFRP



Type1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



$6 \leq DC \leq 12$

$\begin{matrix} 0 \\ - 0.03 \end{matrix}$



DCON=6

$\begin{matrix} 0 \\ - 0.008 \end{matrix}$

$8 \leq DCON \leq 10$

$\begin{matrix} 0 \\ - 0.009 \end{matrix}$

DCON=12

$\begin{matrix} 0 \\ - 0.011 \end{matrix}$

● 4 flute end mill with original CVD diamond coating for CFRP machining.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DFC4JCD0600	6	20	70	6	4	●	1
DFC4JCD0800	8	30	80	8	4	●	1
DFC4JCD1000	10	30	90	10	4	●	1
DFC4JCD1200	12	30	100	12	4	●	1

Note 1) Please contact Mitsubishi Materials for geometries and through coolant types that are non-standard.

RECOMMENDED CUTTING CONDITIONS

Work Material	CFRP		
DC (mm)	Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)
6	11000	950	37.4
8	8000	780	30.7
10	6400	700	27.6
12	5300	650	25.6

Note 1) Cutting conditions may differ considerably due to the kind of CFRP, the rigidity of the machine, or the clamping and geometry of the work material. Please use the above table as a guideline.

Note 2) When high machining accuracy is needed or if large burrs or delamination occur, we recommend reducing the feed rate.

Note 3) When the depth of cut is greater than 0.8DC, we recommend reducing the feed rate.

Note 4) Please take precautions against dust.

DFCJRT

End mill with cross-nick, For CFRP



CFRP



Type1



DCON=6	8≤DCON≤10	DCON=12		
$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$		

● Cross-nick type end mill with original CVD diamond coating for CFRP machining.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DFCJRTD0600	6	20	70	6	10	●	1
DFCJRTD0800	8	30	80	8	10	●	1
DFCJRTD1000	10	30	90	10	12	●	1
DFCJRTD1200	12	30	100	12	12	●	1

(mm)

Note 1) Please contact Mitsubishi Materials for geometries and through coolant types that are non-standard.

RECOMMENDED CUTTING CONDITIONS

Work Material	CFRP		
DC (mm)	Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)
6	11000	1200	47.2
8	8000	1000	39.4
10	6400	900	35.4
12	5300	850	33.4

Note 1) Cutting conditions may differ considerably due to the kind of CFRP, the rigidity of the machine, or the clamping and geometry of the work material. Please use the above table as a guideline.

Note 2) When high machining accuracy is needed or if large burrs or delamination occur, we recommend reducing the feed rate.

Note 3) When the depth of cut is greater than 0.8DC, we recommend reducing the feed rate.

Note 4) Please take precautions against dust.

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

DIAMOND COATED END MILLS

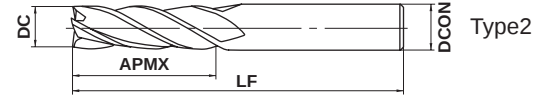
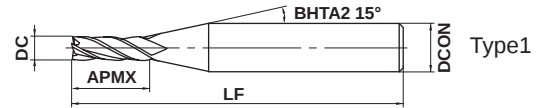
DF4JC

End mill, Semi long cut length, 4 flute, For graphite



CARBIDE

Aluminum Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	$3 \leq DC \leq 12$				
	$\begin{matrix} 0 \\ -0.02 \end{matrix}$				
	DCON=6	$8 \leq DCON \leq 10$	DCON=12		
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$		

● 4 flute end mill with original diamond coating for graphite machining.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DF4JCD0300	3	12	60	6	4	★	1
DF4JCD0400	4	16	60	6	4	★	1
DF4JCD0600	6	24	60	6	4	★	2
DF4JCD0800	8	28	70	8	4	★	2
DF4JCD1000	10	35	90	10	4	★	2
DF4JCD1200	12	36	110	12	4	★	2

(mm)

RECOMMENDED CUTTING CONDITIONS

Work Material	Graphite					Copper, Copper alloy				
DC (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Width of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Width of cut (mm)
		(mm/min)	(IPM)				(mm/min)	(IPM)		
3	22000	2500	98.4	6	0.15	10600	280	11.0	6	0.15
4	18000	2900	114.2	8	0.2	8000	330	13.0	8	0.2
6	14000	3200	126.0	12	0.3	6400	380	15.0	12	0.3
8	10500	2900	114.2	16	0.4	4000	420	16.5	16	0.4
10	8700	2600	102.4	20	0.5	3200	460	18.1	20	0.5
12	7200	2200	86.6	24	0.6	2700	460	18.1	24	0.6
Depth of cut										

DC : Dia.

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DF4XL

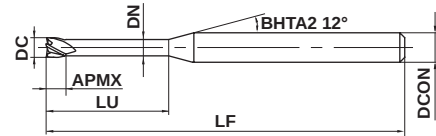
End mill, Long neck, 4 flute, For graphite



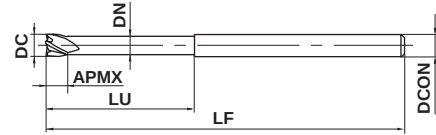
DC<3

DC≥3

Aluminum Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



Type1



Type2



1 ≤ DC ≤ 12				
0 - 0.02				
4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
0 - 0.008	0 - 0.009	0 - 0.011		

● 4 flute long neck end mill with original diamond coating for graphite machining.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
DF4XLD0100N060	1	1.5	6	0.94	50	4	4	★	1
DF4XLD0100N080	1	1.5	8	0.94	50	4	4	★	1
DF4XLD0100N100	1	1.5	10	0.94	50	4	4	★	1
DF4XLD0150N100	1.5	2.3	10	1.44	60	4	4	★	1
DF4XLD0150N160	1.5	2.3	16	1.44	60	4	4	★	1
DF4XLD0200N100	2	3	10	1.9	60	4	4	★	1
DF4XLD0200N160	2	3	16	1.9	60	4	4	★	1
DF4XLD0200N200	2	3	20	1.9	60	4	4	★	1
DF4XLD0300N160	3	4.5	16	2.9	70	4	4	★	1
DF4XLD0300N200	3	4.5	20	2.9	70	4	4	★	1
DF4XLD0300N300	3	4.5	30	2.9	70	4	4	★	1
DF4XLD0400N200	4	6	20	3.9	80	4	4	★	2
DF4XLD0400N400	4	6	40	3.9	80	4	4	★	2
DF4XLD0600N300	6	9	30	5.85	70	6	4	★	2
DF4XLD0800N300	8	12	30	7.85	90	8	4	★	2
DF4XLD1000N300	10	15	30	9.7	90	10	4	★	2
DF4XLD1200N300	12	18	30	11.7	110	12	4	★	2

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

DIAMOND COATED END MILLS

DF4XL

End mill, Long neck, 4 flute, For graphite

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

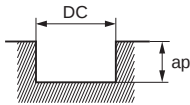
Work Material		Graphite					Copper, Copper alloy				
DC (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Width of cut (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut (mm)	Width of cut (mm)
			(mm/min)	(IPM)				(mm/min)	(IPM)		
1	6	30000	1300	51.2	1	0.05	30000	1300	51.2	1	0.05
	8	25000	1000	39.4	1	0.05	25000	1000	39.4	1	0.05
	10	22000	700	27.6	1	0.05	22000	700	27.6	1	0.05
1.5	10	25000	1200	47.2	1.5	0.075	21000	1000	39.4	1.5	0.075
	16	18000	800	31.5	1.5	0.075	18000	800	31.5	1.5	0.075
2	10	22000	1500	59.1	2	0.1	16000	1100	43.3	2	0.1
	16	19000	1100	43.3	2	0.1	16000	930	36.6	2	0.1
	20	16000	800	31.5	2	0.1	16000	800	31.5	2	0.1
3	16	21000	1900	74.8	3	0.15	10600	960	37.8	3	0.15
	20	18000	1500	59.1	3	0.15	10600	890	35.0	3	0.15
	30	14000	1000	39.4	3	0.15	10600	760	29.9	3	0.15
4	20	18000	2400	94.5	4	0.4	8000	1100	43.3	4	0.4
	40	13000	1500	59.1	4	0.4	8000	920	36.2	4	0.4
6	30	14000	3200	126.0	6	0.6	5300	1200	47.2	6	0.6
8	30	10500	2900	114.2	8	0.8	4000	1100	43.3	8	0.8
10	30	8700	2600	102.4	10	1.0	3200	960	37.8	10	1.0
12	30	7200	2200	86.6	12	1.2	2650	800	31.5	12	1.2
Depth of cut		</									

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

Slotting

Work Material		Graphite				Copper, Copper alloy			
DC (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPM)			(mm/min)	(IPM)	
1	6	30000	1000	39.4	0.1	30000	980	38.6	0.1
	8	25000	700	27.6	0.08	25000	700	27.6	0.08
	10	22000	500	19.7	0.06	22000	500	19.7	0.06
1.5	10	25000	1100	43.3	0.14	21000	750	29.5	0.14
	16	18000	600	23.6	0.1	18000	600	23.6	0.1
2	10	22000	1200	47.2	0.2	16000	820	32.3	0.2
	16	19000	800	31.5	0.16	16000	700	27.6	0.16
	20	16000	600	23.6	0.12	16000	600	23.6	0.12
3	16	21000	1400	55.1	0.3	10600	720	28.3	0.3
	20	18000	1100	43.3	0.25	10600	670	26.4	0.25
	30	14000	700	27.6	0.2	10600	570	22.4	0.2
4	20	18000	1800	70.9	0.5	8000	820	32.3	0.5
	40	13000	900	35.4	0.4	8000	690	27.2	0.4
6	30	14000	2300	90.6	1.2	5300	900	35.4	1.2
8	30	10500	2000	78.7	2.0	4000	820	32.3	2.0
10	30	8700	1900	74.8	3.0	3200	720	28.3	3.0
12	30	7200	1700	66.9	4.0	2650	600	23.6	4.0
Depth of cut									

DC : Dia.

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

DIAMOND COATED END MILLS

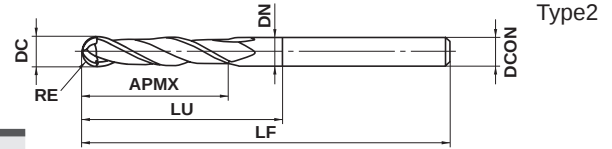
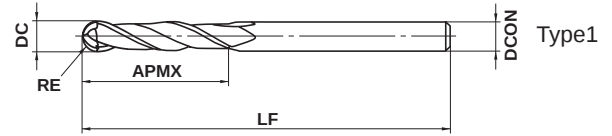
DF2MB

Ball nose, Medium cut length, 2 flute, For graphite



CARBIDE

Aluminum Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



$3 \leq RE \leq 6$				
± 0.01				



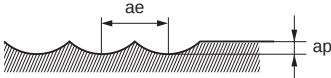
DCON=6	$8 \leq DCON \leq 10$	DCON=12		
$\begin{smallmatrix} 0 \\ -0.008 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.009 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.011 \end{smallmatrix}$		

● 2 flute ball nose end mill with original diamond coating for graphite machining.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
DF2MBR0300	3	6	30	—	—	100	6	2	★	1
DF2MBR0300A100	3	6	30	50	5.85	100	6	2	★	2
DF2MBR0300A150	3	6	30	50	5.85	150	6	2	★	2
DF2MBR0300N100A150	3	6	30	100	5.85	150	6	2	★	2
DF2MBR0400A110	4	8	40	60	7.85	110	8	2	★	2
DF2MBR0400A150	4	8	40	60	7.85	150	8	2	★	2
DF2MBR0500A120	5	10	50	70	9.7	120	10	2	★	2
DF2MBR0500A180	5	10	50	70	9.7	180	10	2	★	2
DF2MBR0500N140A180	5	10	50	140	9.7	180	10	2	★	2
DF2MBR0600A130	6	12	55	75	11.7	130	12	2	★	2
DF2MBR0600A200	6	12	55	75	11.7	200	12	2	★	2
DF2MBR0600N150A200	6	12	55	150	11.7	200	12	2	★	2

RECOMMENDED CUTTING CONDITIONS

Work Material		Graphite					Copper, Copper alloy				
RE (mm)	LF (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
			(mm/min)	(IPM)				(mm/min)	(IPM)		
R3	100	16000	1900	74.8	0.6	1.5	16000	1500	59.1	0.6	1.5
	150	12000	1200	47.2	0.4	1.2	12000	960	37.8	0.4	1.2
R4	110	12000	2000	78.7	0.8	2.0	12000	1600	63	0.8	2.0
	150	9200	1400	55.1	0.6	1.6	9200	1100	43.3	0.6	1.6
R5	120	9500	2200	86.6	1.0	2.5	9500	1800	70.9	1.0	2.5
	180	7300	1500	59.1	0.8	2.0	7300	1200	47.2	0.8	2.0
R6	130	8000	1800	70.9	1.2	3.0	8000	1400	55.1	1.2	3.0
	200	6100	1200	47.2	1.0	2.5	6100	960	37.8	1.0	2.5
Depth of cut											

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DIAMOND COATED END MILLS

DF2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For graphite

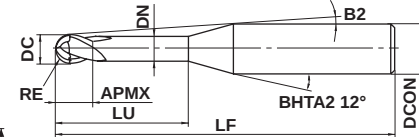
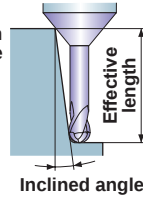


CARBIDE

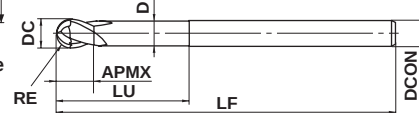
Aluminum Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



Effective length
for inclined angle



Type1



Type2



$0.1 \leq RE \leq 3$				
± 0.01				
DCON=4,6				
$\begin{matrix} 0 \\ -0.008 \end{matrix}$				

● 2 flute long neck ball nose end mill with Mitsubishi's unique diamond coating for graphite machining.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
DF2XLBR0010N005	0.1	0.2	0.2	0.5	0.18	11.5°	50	4	2	★	1	0.5	0.5	0.6	0.7
DF2XLBR0015N020	0.15	0.3	0.3	2	0.27	9.9°	50	4	2	★	1	2.1	2.2	2.4	2.6
DF2XLBR0015N030	0.15	0.3	0.3	3	0.27	9.1°	50	4	2	★	1	3.1	3.2	3.6	3.9
DF2XLBR0020N010	0.2	0.4	0.6	1	0.36	11.0°	50	4	2	★	1	1.0	1.0	1.1	1.2
DF2XLBR0020N020	0.2	0.4	0.6	2	0.36	10.0°	50	4	2	★	1	2.0	2.1	2.3	2.6
DF2XLBR0020N030	0.2	0.4	0.6	3	0.36	9.1°	50	4	2	★	1	3.1	3.2	3.5	3.9
DF2XLBR0020N040	0.2	0.4	0.6	4	0.36	8.4°	60	4	2	★	1	4.1	4.3	4.7	5.2
DF2XLBR0020N080	0.2	0.4	0.6	8	0.36	6.4°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0020N120	0.2	0.4	0.6	12	0.36	5.1°	60	4	2	★	1	12.5	13.0	14.3	15.8
DF2XLBR0025N040	0.25	0.5	0.6	4	0.46	8.3°	60	4	2	★	1	4.1	4.3	4.7	5.2
DF2XLBR0025N050	0.25	0.5	0.6	5	0.46	7.7°	60	4	2	★	1	5.2	5.4	5.9	6.5
DF2XLBR0025N080	0.25	0.5	0.6	8	0.46	6.3°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0030N020	0.3	0.6	0.9	2	0.56	9.9°	60	4	2	★	1	2.1	2.2	2.4	2.6
DF2XLBR0030N040	0.3	0.6	0.9	4	0.56	8.3°	60	4	2	★	1	4.2	4.4	4.8	5.2
DF2XLBR0030N050	0.3	0.6	0.9	5	0.56	7.6°	60	4	2	★	1	5.2	5.4	6.0	6.6
DF2XLBR0030N060	0.3	0.6	0.9	6	0.56	7.1°	60	4	2	★	1	6.3	6.5	7.1	7.9
DF2XLBR0030N080	0.3	0.6	0.9	8	0.56	6.2°	60	4	2	★	1	8.3	8.7	9.5	10.6
DF2XLBR0030N100	0.3	0.6	0.9	10	0.56	5.5°	60	4	2	★	1	10.4	10.9	11.9	13.2
DF2XLBR0030N160	0.3	0.6	0.9	16	0.56	4.1°	60	4	2	★	1	16.7	17.4	19.1	21.2
DF2XLBR0040N060	0.4	0.8	1.2	6	0.76	7.0°	60	4	2	★	1	6.3	6.5	7.1	7.9
DF2XLBR0040N080	0.4	0.8	1.2	8	0.76	6.1°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0050N040	0.5	1	1.5	4	0.94	8.0°	60	4	2	★	1	4.2	4.4	4.8	5.3
DF2XLBR0050N060	0.5	1	1.5	6	0.94	6.8°	60	4	2	★	1	6.3	6.6	7.2	8.0
DF2XLBR0050N080	0.5	1	1.5	8	0.94	5.9°	60	4	2	★	1	8.4	8.8	9.6	10.6
DF2XLBR0050N100	0.5	1	1.5	10	0.94	5.2°	60	4	2	★	1	10.5	11.0	12.0	13.3
DF2XLBR0050N120	0.5	1	1.5	12	0.94	4.6°	60	4	2	★	1	12.6	13.2	14.4	15.9
NEW DF2XLBR0050N160	0.5	1	1.5	16	0.94	3.8°	80	4	2	★	1	16.8	17.5	19.2	21.3
DF2XLBR0050N200	0.5	1	1.5	20	0.94	3.3°	80	4	2	★	1	21.0	21.9	24.0	26.6
DF2XLBR0050N300	0.5	1	1.5	30	0.94	2.4°	80	4	2	★	1	31.4	32.8	36.0	*
DF2XLBR0050N400	0.5	1	1.5	40	0.94	1.9°	80	4	2	★	1	41.8	43.7	*	*
DF2XLBR0075N080	0.75	1.5	2.3	8	1.44	5.4°	60	4	2	★	1	8.4	8.8	9.6	10.6

★ No interference

Unit : mm

CARBIDE

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
DF2XLBR0075N100	0.75	1.5	2.3	10	1.44	4.7°	60	4	2	★	1	10.5	11.0	12.0	13.2
DF2XLBR0075N160	0.75	1.5	2.3	16	1.44	3.4°	80	4	2	★	1	16.8	17.5	19.2	21.2
NEW DF2XLBR0075N200	0.75	1.5	2.3	20	1.44	2.8°	80	4	2	★	1	21.0	21.9	23.9	26.5
DF2XLBR0075N300	0.75	1.5	2.3	30	1.44	2.1°	80	4	2	★	1	31.4	32.8	35.9	*
DF2XLBR0075N400	0.75	1.5	2.3	40	1.44	1.6°	80	4	2	★	1	41.8	43.7	*	*
DF2XLBR0100N080	1	2	3	8	1.9	4.9°	60	4	2	★	1	8.3	8.7	9.4	10.4
DF2XLBR0100N100	1	2	3	10	1.9	4.2°	60	4	2	★	1	10.4	10.9	11.8	13.0
DF2XLBR0100N120	1	2	3	12	1.9	3.7°	60	4	2	★	1	12.5	13.0	14.2	15.7
DF2XLBR0100N160	1	2	3	16	1.9	2.9°	80	4	2	★	1	16.7	17.4	19.0	*
DF2XLBR0100N200	1	2	3	20	1.9	2.5°	80	4	2	★	1	20.9	21.8	23.8	*
DF2XLBR0100N250	1	2	3	25	1.9	2.0°	80	4	2	★	1	26.1	27.2	*	*
DF2XLBR0100N400	1	2	3	40	1.9	1.4°	100	4	2	★	1	41.7	43.5	*	*
DF2XLBR0100N600	1	2	3	60	1.9	0.9°	100	4	2	★	1	62.6	*	*	*
DF2XLBR0150N160	1.5	3	4.5	16	2.9	1.7°	80	4	2	★	1	16.7	17.3	*	*
DF2XLBR0150N250	1.5	3	4.5	25	2.9	1.2°	80	4	2	★	1	26.1	27.2	*	*
DF2XLBR0150N400	1.5	3	4.5	40	2.9	0.7°	100	4	2	★	1	41.7	*	*	*
DF2XLBR0150N600	1.5	3	4.5	60	2.9	0.5°	100	4	2	★	1	*	*	*	*
DF2XLBR0200N080	2	4	6	8	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N200	2	4	6	20	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N300	2	4	6	30	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N400	2	4	6	40	3.9	—	100	4	2	★	2	*	*	*	*
DF2XLBR0200N600	2	4	6	60	3.9	—	100	4	2	★	2	*	*	*	*
DF2XLBR0300N120	3	6	9	12	5.85	—	100	6	2	★	2	*	*	*	*

* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

DIAMOND COATED END MILLS

DF2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For graphite

CARBIDE

SQUARE

BALL

RADIUS

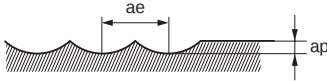
TAPER

BARREL

ROUGHING

SOLID END MILLS

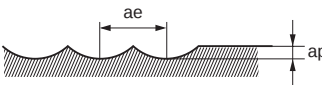
RECOMMENDED CUTTING CONDITIONS

Work Material		Graphite					Copper, Copper alloy				
RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
			(mm/min)	(IPM)				(mm/min)	(IPM)		
R0.1	0.5	40000	800	31.5	0.01	0.03	40000	800	31.5	0.003	0.02
R0.15	2	40000	1200	47.2	0.03	0.08	40000	800	31.5	0.003	0.03
	3	40000	1200	47.2	0.03	0.08	40000	600	23.6	0.002	0.03
R0.2	1	40000	1500	59.1	0.05	0.15	40000	2000	78.7	0.015	0.04
	2	40000	1500	59.1	0.05	0.12	40000	1300	51.2	0.01	0.04
	3	40000	1300	51.2	0.04	0.12	40000	800	31.5	0.005	0.04
	4	40000	1300	51.2	0.04	0.1	32000	600	23.6	0.004	0.04
	8	30000	800	31.5	0.03	0.1	—	—	—	—	—
	12	20000	450	17.7	0.03	0.08	—	—	—	—	—
R0.25	4	40000	1500	59.1	0.05	0.15	40000	800	31.5	0.01	0.05
	5	38000	1300	51.2	0.05	0.15	36000	700	27.6	0.008	0.05
	8	30000	1000	39.4	0.04	0.12	28000	500	19.7	0.002	0.05
R0.3	2	40000	1800	70.9	0.07	0.2	40000	1500	59.1	0.03	0.06
	4	40000	1500	59.1	0.06	0.18	40000	1200	47.2	0.02	0.06
	5	40000	1500	59.1	0.06	0.17	40000	1100	43.3	0.015	0.06
	6	40000	1500	59.1	0.06	0.15	40000	1000	39.4	0.008	0.06
	8	37000	1200	47.2	0.05	0.15	35000	800	31.5	0.005	0.06
	10	35000	1000	39.4	0.05	0.15	—	—	—	—	—
	16	22000	530	20.9	0.04	0.12	—	—	—	—	—
R0.4	6	40000	1700	66.9	0.08	0.2	40000	1500	59.1	0.02	0.08
	8	40000	1700	66.9	0.08	0.15	30000	1200	47.2	0.008	0.08
R0.5	4	40000	2500	98.4	0.12	0.3	40000	2000	78.7	0.05	0.1
	6	40000	2500	98.4	0.1	0.3	40000	2000	78.7	0.03	0.1
	8	40000	2000	78.7	0.1	0.25	40000	1800	70.9	0.02	0.1
	10	40000	2000	78.7	0.1	0.2	33000	1400	55.1	0.01	0.1
	12	40000	2000	78.7	0.1	0.2	30000	1000	39.4	0.007	0.1
	20	30000	1100	43.3	0.08	0.2	—	—	—	—	—
	30	20000	600	23.6	0.06	0.15	—	—	—	—	—
	40	15000	400	15.7	0.04	0.12	—	—	—	—	—
Depth of cut											

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

Work Material		Graphite					Copper, Copper alloy				
RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
			(mm/min)	(IPM)				(mm/min)	(IPM)		
R0.75	8	40000	2800	110.2	0.15	0.45	40000	2400	94.5	0.07	0.15
	10	40000	2800	110.2	0.15	0.45	32000	1800	70.9	0.05	0.15
	16	35000	2000	78.7	0.15	0.3	20000	900	35.4	0.03	0.15
	30	27000	1000	39.4	0.1	0.3	—	—	—	—	—
	40	21000	700	27.6	0.08	0.25	—	—	—	—	—
R1	8	40000	3000	118.1	0.23	0.7	40000	3000	118.1	0.1	0.2
	10	40000	3000	118.1	0.2	0.6	40000	2800	110.2	0.08	0.2
	12	35000	2500	98.4	0.2	0.6	35000	2300	90.6	0.08	0.2
	16	30000	2000	78.7	0.2	0.5	30000	1800	70.9	0.05	0.2
	20	30000	2000	78.7	0.2	0.5	20000	1200	47.2	0.04	0.2
	25	25000	1500	59.1	0.18	0.45	20000	1000	39.4	0.03	0.2
	40	20000	1000	39.4	0.15	0.4	—	—	—	—	—
R1.5	16	28000	3000	118.1	0.3	0.9	28000	3000	118.1	0.3	0.3
	25	20000	2000	78.7	0.25	0.75	20000	2000	78.7	0.25	0.3
	40	16000	1500	59.1	0.2	0.6	16000	1500	59.1	0.2	0.3
	60	14000	1000	39.4	0.17	0.45	—	—	—	—	—
R2	8	24000	3800	149.6	0.5	1.5	24000	3800	149.6	0.5	0.4
	20	21000	3300	129.9	0.5	1.5	21000	3300	129.9	0.4	0.4
	30	15000	2000	78.7	0.4	1.2	15000	2000	78.7	0.3	0.4
	40	13000	1600	63.0	0.35	1.0	13000	1600	63.0	0.25	0.4
	60	12000	1400	55.1	0.3	0.9	12000	1400	55.1	0.2	0.4
R3	12	17000	2800	110.2	0.6	2.0	17000	2800	110.2	0.6	0.6
Depth of cut											

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DIAMOND COATED END MILLS

DF2XLBF (For Finishing)

NEW

Ball nose, Medium cut length, 2 flute, Long neck, For graphite

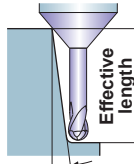


CARBIDE

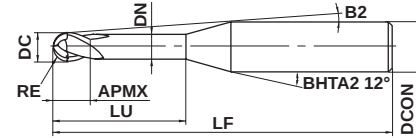
Aluminum Alloy	Copper Alloy	Graphite	Zirconia (Before Sintering)	Rigid Composite Resin (Composite Resin)	Machineable Ceramics
○	◎	◎	◎	◎	○



Effective length
for inclined angle



Inclined angle



Type1



$0.3 \leq RE \leq 1$	$1.5 \leq RE$			
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± 0.005

± 0.01



DCON=4				
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$\begin{matrix} 0 \\ -0.008 \end{matrix}$

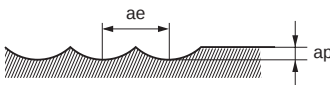
- Diamond coated long-neck ball end mills are ideal for finished surfaces of non-ferrous metals.

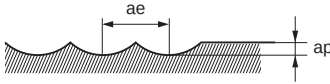
(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
DF2XLBFR0030N100	0.3	0.6	0.45	10	0.57	5.5°	50	4	2	●	1	10.4	10.9	11.9	13.2
DF2XLBFR0050N120	0.5	1	1.5	12	0.86	4.6°	50	4	2	●	1	12.6	13.2	14.4	15.9
DF2XLBFR0050N160	0.5	1	1.5	16	0.86	3.8°	50	4	2	●	1	16.8	17.5	19.2	21.3
DF2XLBFR0050N200	0.5	1	1.5	20	0.86	3.2°	50	4	2	●	1	21	21.9	24	26.6
DF2XLBFR0100N160	1	2	3	16	1.86	2.9°	50	4	2	●	1	16.7	17.4	19	★
DF2XLBFR0100N200	1	2	3	20	1.86	2.4°	50	4	2	●	1	20.9	21.8	23.9	★
DF2XLBFR0150N160	1.5	3	4.5	16	2.86	1.7°	50	4	2	●	1	16.7	17.3	18.9	20.8
DF2XLBFR0150N200	1.5	3	4.5	20	2.86	1.4°	50	4	2	●	1	20.8	21.7	23.7	26.1

★ No interference

RECOMMENDED CUTTING CONDITIONS

Work Material			Graphite					Zirconia (Before Sintering)				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)
				(mm/min)	(IPR)				(mm/min)	(IPR)		
0.6	R0.3	10	35000	1000	39.4	0.05	0.015	26000	600	23.6	0.06	0.03
1	R0.5	10	40000	2000	78.7	0.10	0.200	26000	600	23.6	0.10	0.05
		16	35000	1500	59.1	0.09	0.200	26000	600	23.6	0.08	0.04
		20	30000	1100	43.3	0.08	0.200	26000	600	23.6	0.08	0.04
2	R1	16	30000	2000	78.7	0.20	0.500	18000	1400	55.1	0.06	0.80
		20	30000	2000	78.7	0.20	0.500	18000	1200	47.2	0.50	0.60
3	R1.5	16	28000	3000	118.1	0.30	0.900	15000	1600	63.0	0.90	0.90
		20	25000	2500	98.4	0.20	0.900	15000	1400	55.1	0.60	0.80
Depth of cut												

Work Material			Copper, Copper alloy					Rigid Composite Resin (Composite Resin)				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)
				(mm/min)	(IPR)				(mm/min)	(IPR)		
0.6	R0.3	10	30000	600	23.6	0.005	0.040	28000	450	17.7	0.050	0.050
1	R0.5	10	33000	1400	55.1	0.010	0.100	25000	900	35.4	0.100	0.100
		16	25000	800	31.5	0.007	0.080	25000	700	27.6	0.080	0.080
		20	20000	500	19.7	0.005	0.050	25000	600	23.6	0.080	0.080
2	R1	16	30000	1800	70.9	0.050	0.200	25000	2100	82.7	0.800	0.800
		20	20000	1200	47.2	0.040	0.200	25000	1800	70.9	0.500	0.500
3	R1.5	16	28000	3000	118.1	0.300	0.300	25000	2400	94.5	1.000	1.000
		20	25000	2500	98.4	0.200	0.300	25000	2100	82.7	0.800	0.800
Depth of cut												

Note 1) When high machining accuracy is needed, or the work material becomes chipped, we recommend lowering the feed rate and depth of cut.

Note 2) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

Note 3) When work on dry machining material that contain resin, be careful of tool breakage and mechanical problems (as there is a possibility of blockage caused by cutting chips).

Note 4) Use a milling machine dedicated for graphite.

DIAMOND COATED END MILLS

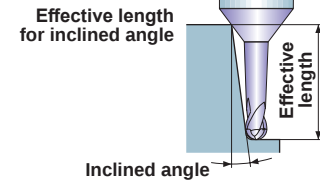
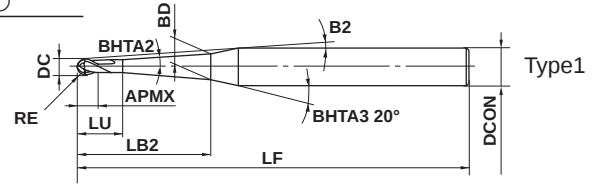
DF3XB

Ball nose, Medium cut length, 3 flute, Taper neck, For graphite



CARBIDE

Aluminum Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



$0.5 \leq RE \leq 2$				
± 0.01				
DCON=6				
$\begin{matrix} 0 \\ -0.008 \end{matrix}$				



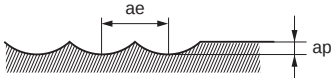
● Ball nose taper end mill with Mitsubishi's unique diamond coating for graphite machining.

(mm)

Order Number	RE	DC	BHTA2	APMX	LU	LB2	B2	DN	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
DF3XBR0050L030	0.5	1	0.5°	1.5	3	30	4°	1.42	100	6	3	★	1	30.4	32.1	32.8	34.6
DF3XBR0050L040	0.5	1	0.5°	1.5	3	40	3.2°	1.60	100	6	3	★	1	40.4	41.4	43.6	46.0
DF3XBR0050L050	0.5	1	0.5°	1.5	3	50	2.6°	1.77	100	6	3	★	1	50.4	51.7	54.4	*
DF3XBR0100L040	1	2	0.5°	3	5	40	2.6°	2.52	100	6	3	★	1	40.7	41.7	43.9	*
DF3XBR0100L060	1	2	0.5°	3	5	60	1.8°	2.86	130	6	3	★	1	60.7	62.2	*	*
DF3XBR0100L080	1	2	0.5°	3	5	80	1.4°	3.21	130	6	3	★	1	80.7	82.7	*	*
DF3XBR0150L060	1.5	3	0.5°	4.5	7.5	60	1.4°	3.82	130	6	3	★	1	60.8	62.2	*	*
DF3XBR0150L080	1.5	3	0.5°	4.5	7.5	80	1.1°	4.17	130	6	3	★	1	80.8	82.8	*	*
DF3XBR0200L100	2	4	0.5°	6	9	100	0.6°	5.49	160	6	3	★	1	100.8	*	*	*

★ No interference

RECOMMENDED CUTTING CONDITIONS

Work Material		Graphite					Copper, Copper alloy				
RE (mm)	LB2 (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
			(mm/min)	(IPM)				(mm/min)	(IPM)		
R0.5	30	20000	1100	43.3	0.05	0.13	16000	700	27.6	0.04	0.13
	40	15000	750	29.5	0.04	0.11	12000	480	18.9	0.03	0.11
	50	12000	500	19.7	0.03	0.10	9600	320	12.6	0.02	0.10
R1	40	20000	1800	70.9	0.13	0.40	16000	1100	43.3	0.10	0.40
	60	15000	900	35.4	0.09	0.27	12000	580	22.8	0.07	0.27
	80	12000	600	23.6	0.07	0.20	9600	380	15	0.06	0.20
R1.5	60	14000	1700	66.9	0.15	0.45	11000	1100	43.3	0.12	0.45
	80	12000	1200	47.2	0.12	0.35	9600	770	30.3	0.10	0.35
R2	100	10000	1100	43.3	0.20	0.50	8000	700	27.6	0.16	0.50
Depth of cut											

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DIAMOND COATED END MILLS

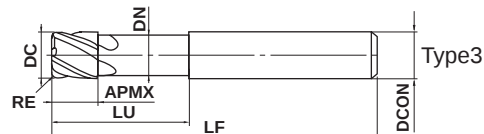
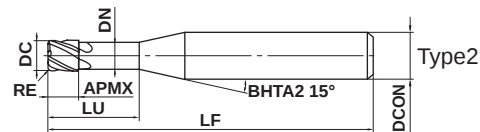
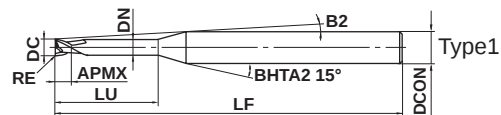
DFPSRB

Corner radius, Short cut length, 2-4 flute, High precision, For graphite

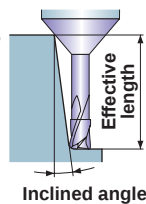


CARBIDE

Aluminum Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



Effective length
for inclined angle



$0.1 \leq RE \leq 1$

± 0.01



$0.5 \leq DC \leq 12$

$0 - 0.02$



$4 \leq DCON \leq 6$ $8 \leq DCON \leq 10$ $DCON = 12$

$0 - 0.008$ $0 - 0.009$ $0 - 0.011$

● ± 0.01 mm corner radius tolerance, $0 - 0.02$ mm outer diameter tolerance.

Corner radius end mill with original diamond coating for precise and efficient graphite machining.

(mm)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
DFPSRBD0050R010N04	0.5	0.1	0.75	4	0.46	9.5°	60	4	2	★	1	4.1	4.3	4.6	5.0
DFPSRBD0050R010N05	0.5	0.1	0.75	5	0.46	8.7°	60	4	2	★	1	5.2	5.4	5.7	6.2
DFPSRBD0050R010N06	0.5	0.1	0.75	6	0.46	8.0°	60	4	2	★	1	6.2	6.4	6.9	7.5
DFPSRBD0050R010N10	0.5	0.1	0.75	10	0.46	6.1°	60	4	2	★	1	10.3	10.7	11.5	12.4
DFPSRBD0050R010N15	0.5	0.1	0.75	15	0.46	4.7°	60	4	2	★	1	15.5	16.0	17.2	18.6
DFPSRBD0080R010N06	0.8	0.1	1	6	0.76	7.7°	60	4	2	★	1	6.2	6.4	6.9	7.5
DFPSRBD0080R010N08	0.8	0.1	1	8	0.76	6.6°	60	4	2	★	1	8.3	8.6	9.2	9.9
DFPSRBD0100R010N08	1	0.1	1.5	8	0.94	6.3°	60	4	2	★	1	8.5	8.8	9.5	10.2
DFPSRBD0100R010N12	1	0.1	1.5	12	0.94	4.9°	60	4	2	★	1	12.6	13.1	14.1	15.2
DFPSRBD0100R020N08	1	0.2	1.5	8	0.94	6.3°	60	4	2	★	1	8.5	8.8	9.5	10.2
DFPSRBD0100R020N12	1	0.2	1.5	12	0.94	4.9°	60	4	2	★	1	12.6	13.1	14.1	15.2
DFPSRBD0100R020N16	1	0.2	1.5	16	0.94	4.0°	70	4	2	★	1	16.8	17.4	18.7	20.2
DFPSRBD0100R020N20	1	0.2	1.5	20	0.94	3.4°	70	4	2	★	1	20.9	21.7	23.3	25.1
DFPSRBD0100R020N30	1	0.2	1.5	30	0.94	2.5°	70	4	2	★	1	31.3	32.4	34.8	*
DFPSRBD0150R020N10	1.5	0.2	2.3	10	1.44	4.9°	70	4	2	★	1	10.5	11.0	11.8	12.7
DFPSRBD0150R020N20	1.5	0.2	2.3	20	1.44	2.9°	70	4	2	★	1	20.9	21.7	23.3	*
DFPSRBD0200R010N08	2	0.1	3	8	1.9	4.9°	70	4	4	★	2	8.4	8.7	9.4	10.1
DFPSRBD0200R020N12	2	0.2	3	12	1.9	3.7°	70	4	4	★	2	12.5	13.0	14.0	15.1
DFPSRBD0200R020N16	2	0.2	3	16	1.9	2.9°	70	4	4	★	2	16.7	17.3	18.6	*
DFPSRBD0200R020N20	2	0.2	3	20	1.9	2.5°	80	4	4	★	2	20.8	21.5	23.2	*
DFPSRBD0200R020N30	2	0.2	3	30	1.9	1.7°	80	4	4	★	2	31.2	32.2	*	*
DFPSRBD0200R020N40	2	0.2	3	40	1.9	1.4°	80	4	4	★	2	41.5	42.9	*	*
DFPSRBD0200R030N08	2	0.3	3	8	1.9	5.0°	70	4	4	★	2	8.4	8.7	9.3	10.1
DFPSRBD0300R020N20	3	0.2	4.5	20	2.9	1.4°	80	4	4	★	2	20.8	21.5	*	*
DFPSRBD0300R020N40	3	0.2	4.5	40	2.9	0.7°	80	4	4	★	2	41.5	*	*	*
DFPSRBD0300R030N12	3	0.3	4.5	12	2.9	2.1°	80	4	4	★	2	12.5	13.0	13.9	*
DFPSRBD0300R050N20	3	0.5	4.5	20	2.9	1.4°	80	4	4	★	2	20.8	21.5	*	*
DFPSRBD0400R020N20	4	0.2	6	20	3.9	—	80	4	4	★	3	*	*	*	*
DFPSRBD0400R020N40	4	0.2	6	40	3.9	—	80	4	4	★	3	*	*	*	*
DFPSRBD0400R050N20	4	0.5	6	20	3.9	—	80	4	4	★	3	*	*	*	*
DFPSRBD0400R050N40	4	0.5	6	40	3.9	—	80	4	4	★	3	*	*	*	*

★ No interference

(mm)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
DFPSRBD0600R010N24	6	0.1	9	24	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R030N24	6	0.3	9	24	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R050N24	6	0.5	9	24	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R050N30	6	0.5	9	30	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0600R100N30	6	1	9	30	5.85	—	90	6	4	★	3	*	*	*	*
DFPSRBD0800R050N30	8	0.5	12	30	7.85	—	90	8	4	★	3	*	*	*	*
DFPSRBD0800R100N30	8	1	12	30	7.85	—	90	8	4	★	3	*	*	*	*
DFPSRBD1000R050N40	10	0.5	15	40	9.7	—	130	10	4	★	3	*	*	*	*
DFPSRBD1000R100N40	10	1	15	40	9.7	—	130	10	4	★	3	*	*	*	*
DFPSRBD1200R050N40	12	0.5	18	40	11.7	—	130	12	4	★	3	*	*	*	*

★ No interference

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

—

SOLID END MILLS

DIAMOND COATED END MILLS

DFPSRB

Corner radius, Short cut length, 2-4 flute, High precision, For graphite

CARBIDE

SQUARE

BALL

RADIUS

TAPER

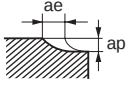
BARREL

ROUGHING

—

SOLID END MILLS

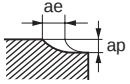
RECOMMENDED CUTTING CONDITIONS

Work Material			Graphite					Copper, Copper alloy				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
				(mm/min)	(IPM)				(mm/min)	(IPM)		
0.5	0.1	4	30000	1100	43.3	0.05	0.23	24000	700	27.6	0.04	0.23
	0.1	5	28000	960	37.8	0.05	0.23	22000	600	23.6	0.04	0.23
	0.1	6	25000	850	33.5	0.05	0.23	20000	540	21.3	0.04	0.23
	0.1	10	22000	600	23.6	0.04	0.21	—	—	—	—	—
	0.1	15	20000	500	19.7	0.03	0.18	—	—	—	—	—
0.8	0.1	6	28000	1300	51.2	0.08	0.45	22000	830	32.7	0.06	0.45
	0.1	8	22000	900	35.4	0.08	0.45	18000	580	22.8	0.06	0.45
1	0.1	8	25000	1500	59.1	0.1	0.6	20000	960	37.8	0.08	0.6
	0.1	12	22000	1300	51.2	0.1	0.6	18000	830	32.7	0.08	0.6
	0.2	8	25000	1500	59.1	0.1	0.45	20000	960	37.8	0.08	0.45
	0.2	12	22000	1300	51.2	0.1	0.45	18000	830	32.7	0.08	0.45
	0.2	16	18000	1000	39.4	0.08	0.4	14000	640	25.2	0.06	0.4
	0.2	20	15000	800	31.5	0.08	0.4	—	—	—	—	—
	0.2	30	12000	600	23.6	0.07	0.35	—	—	—	—	—
1.5	0.2	10	18000	1400	55.1	0.15	0.8	14000	900	35.4	0.12	0.8
	0.2	20	12000	900	35.4	0.12	0.65	9600	580	22.8	0.1	0.65
2	0.1	8	24000	3300	129.9	0.2	1.2	19000	2100	82.7	0.16	1.2
	0.2	12	22000	3000	118.1	0.2	1.2	18000	1900	74.8	0.16	1.2
	0.2	16	19000	2500	98.4	0.2	1.2	15000	1600	63.0	0.16	1.2
	0.2	20	16000	2000	78.7	0.2	1.2	13000	1300	51.2	0.16	1.2
	0.2	30	13000	1600	63.0	0.16	1.0	—	—	—	—	—
	0.2	40	11000	1200	47.2	0.14	0.8	—	—	—	—	—
	0.3	8	24000	3300	129.9	0.3	1.2	19000	2100	82.7	0.24	1.2
3	0.2	20	18000	3000	118.1	0.3	2.0	14000	1900	74.8	0.24	2.0
	0.2	40	12000	1800	70.9	0.25	1.7	9600	1100	43.3	0.2	1.7
	0.5	20	18000	3000	118.1	0.3	1.5	14000	1900	74.8	0.24	1.5
	0.3	12	20000	4500	177.2	0.3	1.5	16000	2900	114.2	0.24	1.5
4	0.2	20	18000	4200	165.4	0.4	2.7	14000	2700	106.3	0.3	2.7
	0.2	40	13000	2800	110.2	0.4	2.7	10000	1800	70.9	0.3	2.7
	0.5	20	18000	4200	165.4	0.4	2.3	14000	2700	106.3	0.3	2.3
	0.5	40	13000	2800	110.2	0.4	2.3	10000	1800	70.9	0.3	2.3
Depth of cut												

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

Work Material			Graphite					Copper, Copper alloy				
DC (mm)	RE (mm)	LU (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
				(mm/min)	(IPM)				(mm/min)	(IPM)		
6	0.1	24	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	0.3	24	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	0.5	24	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	0.5	30	14000	4600	181.1	0.6	3.8	11000	2900	114.2	0.5	3.8
	1	30	14000	4600	181.1	0.6	3.0	11000	2900	114.2	0.5	3.0
8	0.5	30	10500	4000	157.5	0.8	5.3	8400	2600	102.4	0.6	5.3
	1	30	10500	4000	157.5	0.8	4.5	8400	2600	102.4	0.6	4.5
10	0.5	40	8700	3500	137.8	1.0	6.8	7000	2200	86.6	0.8	6.8
	1	40	8700	3500	137.8	1.0	6.0	7000	2200	86.6	0.8	6.0
12	0.5	40	7200	3000	118.1	1.2	8.0	5800	1900	74.8	1.0	8.0
Depth of cut												

Note 1) When high machining accuracy is needed, or work material becomes chipped, we recommend lowering feed rate.

Note 2) Use a milling machine dedicated for graphite.

Note 3) If rigidity of machine or work materials installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

DIAMOND COATED END MILLS FOR HARD BRITTLE MATERIALS

DC2SB

Ball nose, Short cut length, 2 flute, For hard brittle materials



CARBIDE

Cemented carbide	Alumina Zirconia	Silicon carbide Silicon nitride	Quartz glass
○	○	○	○

SQUARE

BALL

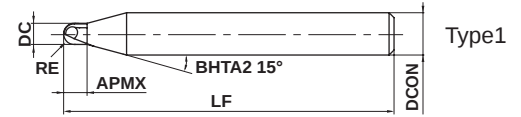
RADIUS

TAPER

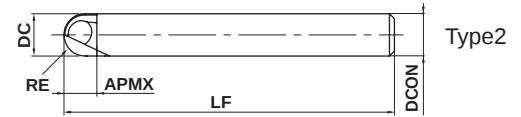
BARREL

ROUGHING

SOLID END MILLS



Type1



Type2



$0.1 \leq RE \leq 3$				
± 0.01				



$4 \leq DCON \leq 6$				
$\begin{matrix} 0 \\ -0.008 \end{matrix}$				

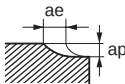
- Suitable DC ball end mill for cemented carbide and other hard brittle materials processing.

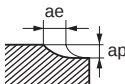
(mm)

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DC2SBR0010	0.1	0.2	0.12	50	4	2	★	1
DC2SBR0020	0.2	0.4	0.24	50	4	2	★	1
DC2SBR0030	0.3	0.6	0.42	50	4	2	★	1
DC2SBR0040	0.4	0.8	0.56	50	4	2	★	1
DC2SBR0050	0.5	1	0.7	50	4	2	★	1
DC2SBR0075	0.75	1.5	1	50	4	2	★	1
DC2SBR0100	1	2	1.4	50	4	2	★	1
DC2SBR0150	1.5	3	2.1	60	6	2	★	1
DC2SBR0200	2	4	2.8	60	6	2	★	1
DC2SBR0250	2.5	5	3.5	60	6	2	★	1
DC2SBR0300	3	6	4.2	60	6	2	★	2

RECOMMENDED CUTTING CONDITIONS

(mm)

Work Material		Cemented carbide					Alumina Zirconia				
		Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)
DC (mm)	RE (mm)		(mm/min)	(IPM)				(mm/min)	(IPM)		
0.2	0.1	30000	100	3.9	0.01	0.01	30000	100	3.9	0.01	0.01
0.4	0.2	30000	150	5.9	0.02	0.08	30000	150	5.9	0.02	0.08
0.6	0.3	30000	200	7.9	0.03	0.14	30000	200	7.9	0.03	0.14
0.8	0.4	30000	250	9.8	0.04	0.19	30000	250	9.8	0.04	0.19
1	0.5	30000	300	11.8	0.05	0.25	30000	300	11.8	0.05	0.25
1.5	0.75	30000	300	11.8	0.075	0.275	30000	300	11.8	0.075	0.275
2	1	30000	300	11.8	0.1	0.3	30000	300	11.8	0.1	0.3
3	1.5	27500	275	10.8	0.125	0.33	27500	275	10.8	0.125	0.33
4	2	24000	240	9.4	0.15	0.35	24000	240	9.4	0.15	0.35
5	2.5	22000	220	8.7	0.175	0.37	22000	220	8.7	0.175	0.37
6	3	20000	200	7.9	0.2	0.4	20000	200	7.9	0.2	0.4
Depth of cut											

Work Material		Silicon carbide Silicon nitride					Quartz glass				
		Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)
DC (mm)	RE (mm)		(mm/min)	(IPM)				(mm/min)	(IPM)		
0.2	0.1	30000	50	2.0	0.005	0.005	30000	150	5.9	0.015	0.015
0.4	0.2	30000	75	3.0	0.01	0.04	30000	225	8.9	0.03	0.12
0.6	0.3	30000	100	3.9	0.015	0.07	30000	300	11.8	0.045	0.21
0.8	0.4	30000	125	4.9	0.02	0.095	30000	375	14.8	0.06	0.285
1	0.5	30000	150	5.9	0.025	0.125	30000	450	17.7	0.075	0.375
1.5	0.75	30000	150	5.9	0.038	0.138	30000	450	17.7	0.113	0.413
2	1	30000	150	5.9	0.05	0.15	30000	450	17.7	0.15	0.45
3	1.5	27500	138	5.4	0.063	0.165	27500	413	16.3	0.188	0.495
4	2	24000	120	4.7	0.075	0.175	24000	360	14.2	0.225	0.525
5	2.5	22000	110	4.3	0.088	0.185	22000	330	13.0	0.263	0.555
6	3	20000	100	3.9	0.1	0.2	20000	300	11.8	0.3	0.6
Depth of cut											

Note 1) The cemented carbide in the above mentioned cutting conditions table is based on CIS standard VM-40(90HRA).

Note 2) Air blow or dry processing is recommended with cemented carbide processing.

★Note: Using coolants or oil mists may decrease tool longevity.

Note 3) The use of a water soluble cutting oil is recommended with the processing of hard brittle materials other than the cemented carbide mentioned in the above table. Be sure to refuel the oil and eliminate any chip discharge that adheres to the tool.

Note 4) Cutting conditions may need adjustments depending on the type of work material.

Note 5) Reduce the rotation speed and feed rate shown in the above table at a similar ratio when no rigidity in the machinery or work mounting and occurrence of chatter or abnormal sound.

Note 6) Implementation of special countermeasures is recommended since fine chip discharge may enter gaps in the processing machinery.

DIAMOND COATED END MILLS FOR HARD BRITTLE MATERIALS

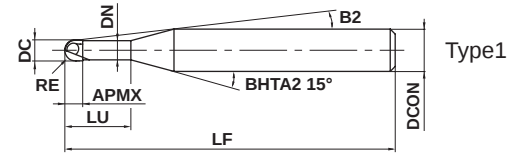
DC2XLB

Ball nose, Short cut length, 2 flute, For hard brittle materials

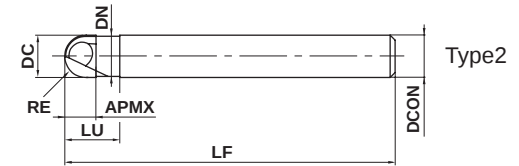


CARBIDE

Cemented carbide	Alumina Zirconia	Silicon carbide Silicon nitride	Quartz glass
○	○	○	○



Type1



Type2



$0.1 \leq RE \leq 3$				
± 0.01				
$4 \leq DCON \leq 6$				
$\begin{matrix} h6 \\ 0 \\ -0.008 \end{matrix}$				



- Suitable DC long neck ball end mill for cemented carbide and other hard brittle materials processing.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	B2	DCON	No. of Flutes	Stock	Type
DC2XLBR0010N005	0.1	0.2	0.12	0.5	0.18	50	11.5°	4	2	★	1
DC2XLBR0020N010	0.2	0.4	0.24	1	0.36	50	11°	4	2	★	1
DC2XLBR0030N015	0.3	0.6	0.36	1.5	0.56	50	10.4°	4	2	★	1
DC2XLBR0040N020	0.4	0.8	0.48	2	0.76	50	9.9°	4	2	★	1
DC2XLBR0050N025	0.5	1	0.6	2.5	0.96	50	9.2°	4	2	★	1
DC2XLBR0050N050	0.5	1	0.6	5	0.96	50	7.3°	4	2	★	1
DC2XLBR0075N038	0.75	1.5	0.9	3.8	1.44	50	7.8°	4	2	★	1
DC2XLBR0100N060	1	2	1.2	6	1.94	50	5.8°	4	2	★	1
DC2XLBR0100N100	1	2	1.2	10	1.94	50	4.2°	4	2	★	1
DC2XLBR0150N080	1.5	3	1.8	8	2.9	60	6.3°	6	2	★	1
DC2XLBR0200N100	2	4	2.4	10	3.9	60	4.5°	6	2	★	1
DC2XLBR0250N100	2.5	5	3	10	4.9	60	2.9°	6	2	★	1
DC2XLBR0300N100	3	6	3.6	10	5.85	60	—	6	2	★	2

SOLID END MILLS

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ROUGHING

BARREL

TAPER

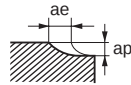
RADIUS

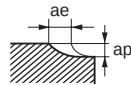
BALL

SQUARE

RECOMMENDED CUTTING CONDITIONS

(mm)

Work Material			Cemented carbide					Alumina Zirconia				
			Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)
DC (mm)	RE (mm)	LU (mm)		(mm/min)	(IPM)				(mm/min)	(IPM)		
0.2	0.1	0.5	30000	30	1.2	0.005	0.01	30000	30	1.2	0.005	0.01
0.4	0.2	1	30000	100	3.9	0.015	0.08	30000	100	3.9	0.015	0.08
0.6	0.3	1.5	30000	200	7.9	0.03	0.14	30000	200	7.9	0.03	0.14
0.8	0.4	2	30000	250	9.8	0.04	0.19	30000	250	9.8	0.04	0.19
1	0.5	2.5	30000	300	11.8	0.05	0.25	30000	300	11.8	0.05	0.25
1	0.5	5	30000	300	11.8	0.05	0.25	30000	300	11.8	0.05	0.25
1.5	0.75	3.8	30000	300	11.8	0.075	0.275	30000	300	11.8	0.075	0.275
2	1	6	30000	300	11.8	0.1	0.3	30000	300	11.8	0.1	0.3
2	1	10	30000	300	11.8	0.1	0.3	30000	300	11.8	0.1	0.3
3	1.5	8	27500	275	10.8	0.125	0.33	27500	275	10.8	0.125	0.33
4	2	10	24000	240	9.4	0.15	0.35	24000	240	9.4	0.15	0.35
5	2.5	10	22000	220	8.7	0.175	0.37	22000	220	8.7	0.175	0.37
6	3	10	20000	200	7.9	0.2	0.4	20000	200	7.9	0.2	0.4
Depth of cut												

Work Material			Silicon carbide Silicon nitride				Quartz glass					
			Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Depth of cut ae (mm)
(mm/min)	(IPM)	(mm/min)		(IPM)								
DC (mm)	RE (mm)	LU (mm)										
0.2	0.1	0.5	30000	15	.6	0.003	0.005	30000	45	1.8	0.008	0.015
0.4	0.2	1	30000	50	2.0	0.008	0.04	30000	150	5.9	0.023	0.12
0.6	0.3	1.5	30000	100	3.9	0.015	0.07	30000	300	11.8	0.045	0.21
0.8	0.4	2	30000	125	4.9	0.02	0.095	30000	375	14.8	0.06	0.285
1	0.5	2.5	30000	150	5.9	0.025	0.125	30000	450	17.7	0.075	0.375
1	0.5	5	30000	150	5.9	0.025	0.125	30000	450	17.7	0.075	0.375
1.5	0.75	3.8	30000	150	5.9	0.038	0.138	30000	450	17.7	0.113	0.413
2	1	6	30000	150	5.9	0.05	0.15	30000	450	17.7	0.15	0.45
2	1	10	30000	150	5.9	0.05	0.15	30000	450	17.7	0.15	0.45
3	1.5	8	27500	138	5.4	0.063	0.165	27500	413	16.3	0.188	0.495
4	2	10	24000	120	4.7	0.075	0.175	24000	360	14.2	0.225	0.525
5	2.5	10	22000	110	4.3	0.088	0.185	22000	330	13.0	0.263	0.555
6	3	10	20000	100	3.9	0.1	0.2	20000	300	11.8	0.3	0.6
Depth of cut												

Note 1) The cemented carbide in the above mentioned cutting conditions table is based on CIS standard VM-40(90HRA).

Note 2) Air blow or dry processing is recommended with cemented carbide processing.

★Note: Using coolants or oil mists may decrease tool longevity.

Note 3) The use of a water soluble cutting oil is recommended with the processing of hard brittle materials other than the cemented carbide mentioned in the above table. Be sure to refuel the oil and eliminate any chip discharge that adheres to the tool.

Note 4) Cutting conditions may need adjustments depending on the type of work material.

Note 5) Reduce the rotation speed and feed rate shown in the above table at a similar ratio when no rigidity in the machinery or work mounting and occurrence of chatter or abnormal sound.

Note 6) Implementation of special countermeasures is recommended since fine chip discharge may enter gaps in the processing machinery.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

CBN END MILLS

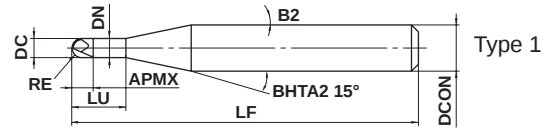
CBN2XLB

Ball nose, Short cut length, 2 flute, Long neck

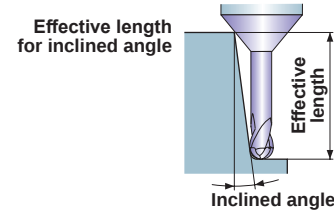


CBN

Carbon Steel, Alloy Steel, Cast Iron ($\leq 30\text{HRC}$)	Tool Steel, Pre-Hardened Steel, Hardened Steel ($\leq 45\text{HRC}$)	Hardened Steel ($\leq 55\text{HRC}$)	Hardened Steel ($> 55\text{HRC}$)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
	◎	◎	◎				



$0.2 \leq RE \leq 1$				
± 0.005				
$4 \leq DCON \leq 6$				
0 $- 0.005$				



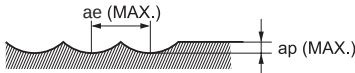
● Solid CBN ball nose. A wide variation of neck lengths available.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
CBN2XLBR0020N010S04	0.2	0.4	0.3	1	0.36	13.4°	51	4	2	★	1	1	1	1.1	1.2
CBN2XLBR0020N010S06	0.2	0.4	0.3	1	0.36	13.9°	51	6	2	★	1	1	1	1.1	1.2
CBN2XLBR0020N016S04	0.2	0.4	0.3	1.6	0.36	12.4°	51	4	2	★	1	1.6	1.7	1.8	2
CBN2XLBR0020N016S06	0.2	0.4	0.3	1.6	0.36	13.3°	51	6	2	★	1	1.6	1.7	1.8	2
* CBN2XLBR0030N009S06	0.3	0.6	0.4	0.9	0.56	14.1°	62	6	2	★	1	0.9	0.9	1.0	1.1
CBN2XLBR0030N015S04	0.3	0.6	0.5	1.5	0.56	12.6°	51	4	2	★	1	1.5	1.6	1.7	1.8
CBN2XLBR0030N015S06	0.3	0.6	0.5	1.5	0.56	13.4°	51	6	2	★	1	1.5	1.6	1.7	1.8
CBN2XLBR0030N024S04	0.3	0.6	0.5	2.4	0.56	11.3°	51	4	2	★	1	2.5	2.6	2.7	2.9
CBN2XLBR0030N024S06	0.3	0.6	0.5	2.4	0.56	12.5°	51	6	2	★	1	2.5	2.6	2.7	2.9
* CBN2XLBR0040N010S06	0.4	0.8	0.5	1	0.76	14.1°	62	6	2	★	1	1	1	1.1	1.2
CBN2XLBR0040N020S04	0.4	0.8	0.6	2	0.76	11.8°	51	4	2	★	1	2	2.1	2.3	2.4
CBN2XLBR0040N020S06	0.4	0.8	0.6	2	0.76	12.9°	51	6	2	★	1	2	2.1	2.3	2.4
CBN2XLBR0040N032S04	0.4	0.8	0.6	3.2	0.76	10.3°	51	4	2	★	1	3.3	3.4	3.6	3.9
CBN2XLBR0040N032S06	0.4	0.8	0.6	3.2	0.76	11.7°	51	6	2	★	1	3.3	3.4	3.6	3.9
* CBN2XLBR0050N011S06	0.5	1	0.6	1.1	0.94	14.1°	62	6	2	★	1	1.1	1.1	1.2	1.2
CBN2XLBR0050N025S04	0.5	1	0.8	2.5	0.94	11°	51	4	2	★	1	2.6	2.7	2.8	3
CBN2XLBR0050N025S06	0.5	1	0.8	2.5	0.94	12.3°	51	6	2	●	1	2.6	2.7	2.8	3
CBN2XLBR0050N040S04	0.5	1	0.8	4	0.94	9.3°	51	4	2	★	1	4.1	4.3	4.6	4.9
CBN2XLBR0050N040S06	0.5	1	0.8	4	0.94	11°	51	6	2	●	1	4.1	4.3	4.6	4.9
CBN2XLBR0075N038S04	0.75	1.5	1.1	3.8	1.44	9.1°	52	4	2	★	1	3.9	4.1	4.3	4.6
CBN2XLBR0075N038S06	0.75	1.5	1.1	3.8	1.44	11°	52	6	2	★	1	3.9	4.1	4.3	4.6
CBN2XLBR0075N060S04	0.75	1.5	1.1	6	1.44	7.1°	52	4	2	★	1	6.2	6.4	6.8	7.3
CBN2XLBR0075N060S06	0.75	1.5	1.1	6	1.44	9.3°	52	6	2	★	1	6.2	6.4	6.8	7.3
* CBN2XLBR0100N017S06	1	2	1.2	1.7	1.9	13.6°	62	6	2	★	1	1.7	1.7	1.8	1.9
CBN2XLBR0100N050S04	1	2	1.5	5	1.9	7.3°	52	4	2	★	1	5.1	5.3	5.6	6
CBN2XLBR0100N050S06	1	2	1.5	5	1.9	9.8°	52	6	2	★	1	5.1	5.3	5.6	6
CBN2XLBR0100N080S04	1	2	1.5	8	1.9	5.3°	52	4	2	★	1	8.2	8.5	9	9.7
CBN2XLBR0100N080S06	1	2	1.5	8	1.9	7.9°	52	6	2	★	1	8.2	8.5	9	9.7

★ Short edge and neck lengths for high rigidity.

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC)					Hardened steel (55—62HRC)					Hardened steel (62—70HRC)				
	AISI H13 etc.					AISI D2 etc.					AISI W1, AISI M2 etc.				
RE (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
		(mm/min)	(IPM)				(mm/min)	(IPM)				(mm/min)	(IPM)		
R0.2	50000	1500	59.1	0.006	0.01	50000	1200	47.2	0.006	0.01	50000	1200	47.2	0.004	0.008
R0.3	50000	2000	78.7	0.01	0.02	50000	1500	59.1	0.01	0.02	50000	1500	59.1	0.008	0.015
R0.4	50000	3000	118.1	0.02	0.05	50000	2000	78.7	0.02	0.04	50000	2000	78.7	0.015	0.03
R0.5	50000	3000	118.1	0.03	0.06	50000	2000	78.7	0.03	0.05	50000	2000	78.7	0.02	0.03
R0.75	50000	3500	137.8	0.04	0.08	50000	2500	98.4	0.03	0.06	50000	2500	98.4	0.02	0.04
R1	50000	4000	157.5	0.05	0.1	50000	3000	118.1	0.04	0.07	50000	3000	118.1	0.03	0.05
Depth of cut															

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Oil mist coolant is recommended.

Note 3) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

CBN END MILLS

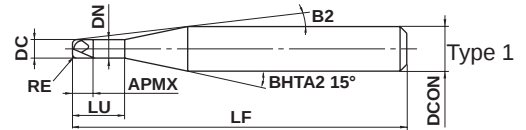
CBN2XLRB

Corner radius, Medium cut length, 2 flute, Long neck

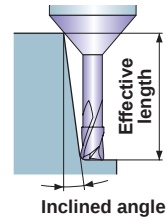


CBN

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



Effective length
for inclined angle



$0.05 \leq RE \leq 0.5$

± 0.005



$0.5 \leq DC \leq 2$

0
 $- 0.010$



$DCON = 4$

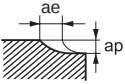
0
 $- 0.005$

● CBN long neck radius end mill. A wide variation of neck lengths available.

(mm)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
CBN2XLRBD0050R005N02	0.5	0.05	0.3	2	0.46	11.6°	51	4	2	★	1	2.1	2.1	2.3	2.5
CBN2XLRBD0050R005N03	0.5	0.05	0.3	3	0.46	10.4°	51	4	2	★	1	3.1	3.2	3.5	3.7
CBN2XLRBD0050R010N02	0.5	0.1	0.3	2	0.46	11.7°	51	4	2	★	1	2.1	2.1	2.3	2.5
CBN2XLRBD0050R010N03	0.5	0.1	0.3	3	0.46	10.5°	51	4	2	★	1	3.1	3.2	3.4	3.7
CBN2XLRBD0100R005N03	1	0.05	0.6	3	0.94	9.7°	51	4	2	★	1	3.2	3.4	3.7	4
CBN2XLRBD0100R005N05	1	0.05	0.6	5	0.94	7.9°	51	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0100R010N03	1	0.1	0.6	3	0.94	9.7°	51	4	2	★	1	3.2	3.4	3.6	4
CBN2XLRBD0100R010N05	1	0.1	0.6	5	0.94	8°	51	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0100R020N03	1	0.2	0.6	3	0.94	9.8°	51	4	2	★	1	3.2	3.4	3.5	4
CBN2XLRBD0100R020N05	1	0.2	0.6	5	0.94	8°	51	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0100R030N03	1	0.3	0.6	3	0.94	9.9°	51	4	2	★	1	3.2	3.4	3.4	4
CBN2XLRBD0100R030N05	1	0.3	0.6	5	0.94	8.1°	51	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0150R010N05	1.5	0.1	0.9	5	1.44	7.3°	52	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0150R010N08	1.5	0.1	0.9	8	1.44	5.6°	52	4	2	★	1	8.5	8.8	9.5	10.2
CBN2XLRBD0150R020N05	1.5	0.2	0.9	5	1.44	7.3°	52	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0150R020N08	1.5	0.2	0.9	8	1.44	5.6°	52	4	2	★	1	8.5	8.8	9.5	10.2
CBN2XLRBD0150R030N05	1.5	0.3	0.9	5	1.44	7.4°	52	4	2	★	1	5.3	5.6	6	6.5
CBN2XLRBD0150R030N08	1.5	0.3	0.9	8	1.44	5.7°	52	4	2	★	1	8.5	8.8	9.5	10.2
CBN2XLRBD0200R010N06	2	0.1	1.2	6	1.9	5.9°	52	4	2	★	1	6.3	6.6	7.1	7.6
CBN2XLRBD0200R010N10	2	0.1	1.2	10	1.9	4.2°	52	4	2	★	1	10.5	10.9	11.7	12.6
CBN2XLRBD0200R020N06	2	0.2	1.2	6	1.9	5.9°	52	4	2	★	1	6.3	6.6	7.1	7.6
CBN2XLRBD0200R020N10	2	0.2	1.2	10	1.9	4.2°	52	4	2	★	1	10.5	10.9	11.7	12.6
CBN2XLRBD0200R030N06	2	0.3	1.2	6	1.9	6°	52	4	2	★	1	6.3	6.6	7	7.6
CBN2XLRBD0200R030N10	2	0.3	1.2	10	1.9	4.2°	52	4	2	★	1	10.5	10.8	11.6	12.6
CBN2XLRBD0200R050N06	2	0.5	1.2	6	1.9	6.1°	52	4	2	★	1	6.3	6.5	7	7.5
CBN2XLRBD0200R050N10	2	0.5	1.2	10	1.9	4.3°	52	4	2	★	1	10.5	10.8	11.6	12.5

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC) AISI H13 etc.					Hardened steel (55—62HRC) AISI D2 etc.					Hardened steel (62—70HRC) AISI W1, AISI M2 etc.				
	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min ⁻¹)	Table feed (mm/min) (IPM)		Depth of cut ap (mm)	Width of cut ae (mm)
0.5	50000	750	29.5	0.01	0.2	50000	600	23.6	0.01	0.1	40000	400	15.7	0.005	0.06
1	38000	1100	43.3	0.02	0.3	38000	760	29.9	0.01	0.2	25000	400	15.7	0.01	0.1
1.5	25000	900	35.4	0.03	0.5	25000	700	27.6	0.02	0.4	17000	340	13.4	0.02	0.2
2	20000	800	31.5	0.04	0.7	20000	600	23.6	0.03	0.6	12000	300	11.8	0.02	0.3
Depth of cut															

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.

Note 2) Oil mist coolant is recommended.

Note 3) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

CERAMIC END MILLS

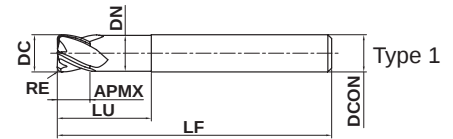
CE4SRB

Corner radius, short cut length, 4 flute



CERAMIC

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



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	DC≤12 0.02 - 0.02				
	DC=6 - 0.008 - 0.028	DC=8,10 - 0.009 - 0.029	DC=12 - 0.011 - 0.031		
	DCON=6 0 - 0.008	DCON=8,10 0 - 0.009	DCON=12 0 - 0.011		

- Ceramic corner radius end mill with high heat resistance.
- Capable of softening Ni based alloys by generating heat during machining

(mm)

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CE4SRBD0600R050	6	0.5	4.5	12	5.85	50	6	4	●	1
CE4SRBD0800R100	8	1.0	6.0	16	7.85	60	8	4	●	1
CE4SRBD1000R100	10	1.0	7.5	20	9.70	65	10	4	●	1
CE4SRBD1200R150	12	1.5	9.0	24	11.70	70	12	4	●	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Inconel			
DC (mm)	Vc=1970SFM (1150-3300) RPM	fz=.0016IPT IPM	Depth of cut ap (inch)	Depth of cut ae (inch)
6	32000	151.2	.177	.047
8	24000	113.4	.236	.063
10	19000	89.8	.295	.079
12	16000	75.6	.354	.094
Cutting Condition				

Slotting

Work Material	Inconel		
DC (mm)	Vc=1970SFM (1150-3300) RPM	fz=.0008IPT IPM	Depth of cut ap (inch)
6	32000	100.8	.059
8	24000	75.6	.098
10	19000	59.8	.118
12	16000	50.4	.157
Cutting Condition			

DC:Dia.

*Leave .012" of material on bottom and side

- * Note 1) The outermost layer of the material may be affected by heat. Ensure a minimum of 0.012" final machining allowance remains.
- Note 2) The recommended ramping angle is 1.5 degree. When conducting ramping it is recommended to reduce the feed rate by 50% from the cutting conditions shown.
- Note 3) Gradually increase the width of cut starting from 0.05 x DC (cutter diameter) to maximum width of cut, this will help maintain tool life.

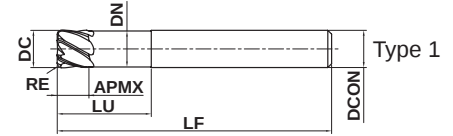
CERAMIC END MILLS

CE6SRB

Corner radius, short cut length, 6 flute



Carbon Steel, Alloy Steel, Cast Iron (≤30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (≥55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
					☉		



DC ≤ 12				
0.02 - 0.02				



DC = 6	DC = 8, 10	DC = 12		
- 0.008 - 0.028	- 0.009 - 0.029	- 0.011 - 0.031		



DCON = 6	DCON = 8, 10	DCON = 12		
0 - 0.008	0 - 0.009	0 - 0.011		

- Ceramic corner radius end mill with high heat resistance.
- Capable of softening Ni based alloys by generating heat during machining

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CE6SRBD0600R050	6	0.5	4.5	12	5.85	50	6	6	●	1
CE6SRBD0800R100	8	1.0	6.0	16	7.85	60	8	6	●	1
CE6SRBD1000R100	10	1.0	7.5	20	9.70	65	10	6	●	1
CE6SRBD1200R150	12	1.5	9.0	24	11.70	70	12	6	●	1

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Inconel			
DC (mm)	Vc=1970SFM (1150-3300)	fz=.0016IPT	Depth of cut ap (inch)	Depth of cut ae (inch)
	RPM	IPM		
6	32000	226.8	.177	.047
8	24000	170.1	.236	.063
10	19000	134.6	.295	.079
12	16000	113.4	.354	.094
Cutting Condition				

- Note 1) The outermost layer of the material may be affected by heat. Ensure a minimum of 0.012" final machining allowance remains.
- Note 2) The recommended ramping angle is 1.5 degree. When conducting ramping it is recommended to reduce the feed rate by 50% from the cutting conditions shown.
- Note 3) Gradually increase the width of cut starting from 0.05 x DC (cutter diameter) to maximum width of cut, this will help maintain tool life.

CERAMIC

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

UNCOATED CARBIDE END MILLS

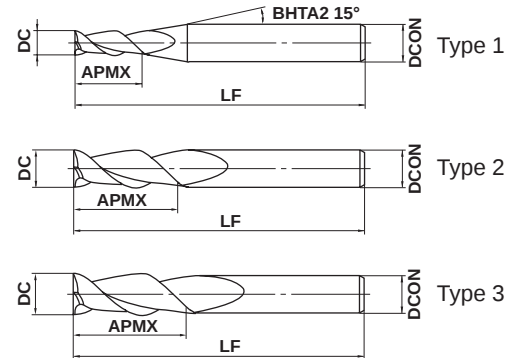
C2MHA

End mill, Medium cut length, 2 flute, For aluminum alloy



CERAMIC

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



DC ≤ 12	DC > 12			
0 - 0.020	0 - 0.030			
DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● High efficiency machining for aluminum alloys.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2MHAD0300	3	9	60	6	2	★	1
C2MHAD0400	4	12	60	6	2	★	1
C2MHAD0500	5	15	60	6	2	★	1
C2MHAD0600	6	18	60	6	2	★	2
C2MHAD0800	8	20	75	8	2	★	2
C2MHAD1000	10	25	75	10	2	★	2
C2MHAD1200	12	25	75	12	2	★	2
C2MHAD1400	14	32	75	12	2	★	3
C2MHAD1600	16	32	100	16	2	★	2
C2MHAD2000	20	38	125	20	2	★	2
C2MHAD2500	25	38	125	25	2	★	2

SOLID END MILLS

ROUGHING

BARREL

TAPER

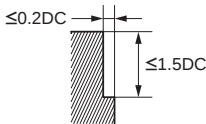
RADIUS

BALL

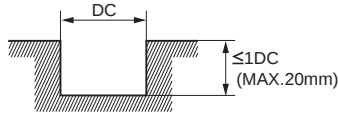
SQUARE

RECOMMENDED CUTTING CONDITIONS

Shoulder milling

Work Material	Aluminum alloy		
DC (mm)	Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)
3	40000	2400	94.5
4	36000	2600	102.4
5	30000	4000	157.5
6	27000	4000	157.5
8	20000	4000	157.5
10	16000	4500	177.2
12	13000	4500	177.2
16	10000	4500	177.2
20	8000	4300	169.3
25	6000	3600	141.7
Depth of cut	 DC: Dia.		

Slotting

Work Material	Aluminum alloy		
DC (mm)	Revolution (min ⁻¹)	Table feed	
		(mm/min)	(IPM)
3	40000	1500	59.1
4	36000	1800	70.9
5	30000	2800	110.2
6	27000	2800	110.2
8	20000	2800	110.2
10	16000	3200	126.0
12	13000	3200	126.0
16	10000	3200	126.0
20	8000	3000	118.1
25	6000	2500	98.4
Depth of cut	 DC: Dia.		

Note 1) Water-soluble cutting fluid is recommended.

Note 2) Climb cutting is recommended for shoulder milling.

Note 3) If the tooling clamping is insufficient, the tool can be pulled out of the holder therefore ensure that it is securely located.

Note 4) If the rigidity of the machine or the work material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

I

SOLID END MILLS

UNCOATED CARBIDE END MILLS

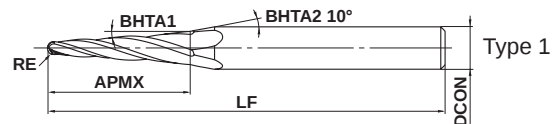
C4LATB

Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers



CARBIDE

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



Type 1



Type 2



RE ≤ 2				
± 0.010				



± 5'				
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DCON=6	DCON=8			
$\begin{smallmatrix} 0 \\ -0.008 \end{smallmatrix}$	$\begin{smallmatrix} 0 \\ -0.009 \end{smallmatrix}$			

● High-efficiency roughing for aluminum impellers.

(mm)

Order Number	RE	BHTA1	APMX	LF	DCON	No. of Flutes	Stock	Type
C4LATBR050T040AP20	0.5	4°	20	70	6	4	●	1
C4LATBR100T040AP20	1	4°	20	70	6	4	●	1
C4LATBR150T040AP20	1.5	4°	20	75	8	4	●	1
C4LATBR200T040AP30	2	4°	30	75	8	4	●	2

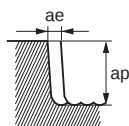
Note 1) Please inquire with us regarding non-standard special shapes (ex.: RE sizes starting from a minimum of R0.3, half included taper angles) or coatings.

RECOMMENDED CUTTING CONDITIONS

Shoulder Milling

Work Material	Aluminum alloy				
	RE (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPR)	
R0.5		20000	2000	78.7	15
R1		20000	4000	157.5	15
R1.5		20000	5200	204.7	15
R2		20000	5200	204.7	23

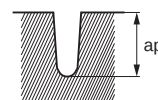
Depth of cut



Slotting

Work Material	Aluminum alloy			
	RE (mm)	Revolution (min ⁻¹)	Table feed	
			(mm/min)	(IPR)
R0.5		20000	600	23.6
R1		20000	2800	110.2
R1.5		20000	4000	157.5
R2		20000	4000	157.5

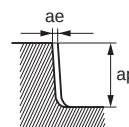
Depth of cut



Shoulder Milling (For Finishing)

Work Material	Aluminum alloy				
	RE (mm)	Revolution (min ⁻¹)	Table feed		Depth of cut ap (mm)
			(mm/min)	(IPR)	
R0.5		20000	800	31.5	18
R1		20000	2000	78.7	18
R1.5		20000	2400	94.5	18
R2		20000	2400	94.5	27

Depth of cut



Note 1) Water-soluble cutting fluid is recommended.

Note 2) Climb cutting is recommended for side milling.

Note 3) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately, or set the depth of cut smaller.