

# HOW TO READ THE STANDARD OF SOLID END MILLS

## ● How this section page is organised

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

**CUTTING EDGE GEOMETRY**

**PHOTO OF PRODUCT**

**PRODUCT TITLE**

**ITEM NUMBER**

**PRODUCT BLOCK**

**SOLID END MILLS**

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

**PRODUCT INFORMATION ICONS**

**GEOMETRY**

**PRODUCT FEATURES**

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

Order Number	RE	DC	APMX	LF	DCON	Flute of Shank	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
MP2SSBR0060S06	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

**LEGEND FOR STOCK STATUS MARK**  
is shown on the left hand page of each double-page spread.

**PRODUCT STANDARDS**  
indicates order numbers, dimensions, and stock status.

J196 : Inventory maintained in Japan.

### ● To Order:

For solid end mills, please specify ① order number.

# MILLING TOOLS

## SOLID END MILLS

IDENTIFICATION .....	J002
SYMBOL DESCRIPTIONS .....	J003
COATING TECHNOLOGY .....	J004
TOOL NAVI .....	J006
END MILLS SELECTION CHART CARBIDE...	J024
END MILLS SELECTION CHART HSS...	J044

### SOLID END MILLS STANDARD

#### CARBIDE

SQUARE .....	J048
BALL .....	J196
RADIUS .....	J274
TAPER BALL .....	J352
BARREL .....	J358
ROUGHING .....	J362

#### HSS

SQUARE .....	J378
ROUGHING .....	J402

\*Arranged by Alphabetical order

J379	1LA	J244	DF2MB	J140	MSJHD	J072	VF2XL
J378	1MA	J246	DF2XLB	J137	MSMHD	J222	VF2XLB
J388	2LS	J250	DF2XLBF	J112	MSMHZD	J220	VF2XLBS
J391	2MK	J266	DF3XB	J136	MSSHD	J260	VF3XB
J386	2MS	J176	DF4JC	J392	S2SDA	J272	VF4MB
J384	2SS	J177	DF4XL	J091	SED2KMG	J164	VF4MD
J400	4LC	J180	DFC4JC	J092	SED2KPG	J166	VF4MV
J398	4MC	J195	DFCJRT	J110	SEE2L	J189	VF6MHV
J099	C2JS	J335	DFPSRB	J186	SEE4L	J344	VF6MHVRB
J106	C2LA	J089	DLC2MA	J185	SEG4SA	J369	VF6SVRCH
J100	C2LS	J242	DLC2MB	J382	VA2MS	J194	VF8MHVCH
J104	C2MA	J376	GBE	J380	VA2SS	J350	VF8MHVRBCH
J252	C2MB	J198	MP2MB	J396	VA4MC	J316	VFFDRB
J108	C2MHA	J197	MP2SB	J404	VAMFPR	J306, J312	VFHVRB
J095	C2MS	J200	MP2SDB	J393	VAMH	J191	VFMD
J102	C2SA	J196	MP2SSB	J406	VAMR	J348	VFMDRB
J094	C2SS	J202	MP2XLB	J402	VASFPR	J368	VFMFPR
J128	C3SA	J254	MP3XB	J082	VC2C	J167	VFMHVCH
J282	C3SARB	J134	MPJHV	J080	VC2JS	J304	VFMHVRBCH
J182	C4JC	J130	MPMHV	J077	VC2MS	J212	VFR2SB
J356	C4LATB	J284	MPMHVRB	J075	VC2SS	J214	VFR2SBF
J183	C4LC	J288	MPXLRB	J268	VC3MB	J210	VFR2SSB
J181	C4MC	J408	MR	J170	VC4JC	J190	VFSD
J236	CBN2XLB	J066	MS2ES	J326	VC4JRB	J346	VFSDRB
J280	CBN2XLRB	J054	MS2JS	J168	VC4MC	J365	VFSFPR
J338	CE4SRB	J056	MS2LS	J324	VC4SRB	J367	VFSFPRCH
J338	CE6SRB	J052	MS2MD	J352	VC4STB	J270	VQ4SVB
J374	CMRA	J274	MS2MRB	J328, J329	VCHFRB	J188	VQ6MHVCH
J230	CRN2MB	J049	MS2MS	J193	VCLD	J342	VQ6MHVRBCH
J277	CRN2MRB	J048	MS2SS	J172	VCMDSC	J158	VQJHV
J084	CRN2MS	J058	MS2XL	J126	VCMH	J154	VQMHV
J086	CRN2XL	J062	MS2XL6	J332	VCMHDRB	J297	VQMHVRB
J232	CRN2XLB	J114	MS3ES	J318, J322	VCPSRB	J302	VQMHVRBF
J278	CRN2XLRB	J152	MS4EC	J228	VCXB	J116	VQMHZV
J174	CRN4JC	J146	MS4JC	J068	VF2MD	J122	VQMHZVOH
J372	CSRA	J144	MS4MC	J070	VF2MV	J362	VQSVR
J370	CSRARB	J294	MS4MRB	J216	VF2SDB	J340	VQT5MVRB
J238	DC2SB	J142	MS4SC	J217	VF2SDBL	J358	VQT6UR
J240	DC2XLB	J148	MS4XL	J219	VF2WB	J160	VQXL



# IDENTIFICATION

## ORDER NUMBER OF END MILLS



End Mill Names	Number of Flutes	Flute Length	Features	Dimensions	Others
<b>VQ</b> : SMART MIRACLE end mills	<b>1</b> : 1flute	<b>ES</b> : Extra short	<b>S</b> : General-use	<b>D****</b> : Diameter	<b>S**</b> : Shank diameter
<b>VFR</b> : IMPACT MIRACLE REVOLUTION end mills	<b>2</b> : 2flute	<b>S</b> : Short	<b>U</b> : For stainless steel	<b>ex.</b>	<b>N****</b> : Neck length
<b>VF</b> : Impact Miracle end mills	<b>3</b> : 3flute	<b>M</b> : Medium	<b>K</b> : For keyway	D0050 → φ0.5	<b>T****</b> : Taper angle one side
<b>MP</b> : MS plus end mills	<b>4</b> : 4flute	<b>J</b> : Semi long	<b>A</b> : For light alloy	D0500 → φ5	<b>L**</b> : Flute length
<b>MS</b> : Mstar end mills	<b>5</b> : 5flute	<b>L</b> : Long	<b>C</b> : Center cut		<b>A***</b> : Overall Length
<b>MS</b> : Mstar end mills	<b>6</b> : 6flute	<b>XL</b> : Long neck	<b>D</b> : For deep cut	<b>R****</b> : Radius of ball nose	
<b>VC</b> : Miracle end mills	<b>8</b> : 8flute	<b>X</b> : Taper neck	<b>V</b> : Irregular spiral helix angle	<b>ex.</b>	
<b>CRN</b> : CRN coated end mills	<b>•••</b>	<b>SX</b> : Extra long	<b>B</b> : Ball nose	R0050 → R0.5	
<b>DLC</b> : DLC coated end mills		<b>MX</b> : Extra long	<b>VB</b> : Irregular spiral helix angle, Ball nose	R0500 → R5	
<b>DLC</b> : DLC coated end mills			<b>R</b> : Roughing		
<b>DFC</b> : CVD diamond coated end mills			<b>FPR</b> : Fine roughing		
<b>DF</b> : Diamond coated end mills			<b>H</b> : High helix		
<b>DC</b> : Diamond coated end mills			<b>T</b> : Taper		
<b>CBN</b> : CBN end mills			<b>TB</b> : Taper ball nose		
<b>CE</b> : Ceramic end mills			<b>RB</b> : Corner radius		
<b>C</b> : Carbide end mills			<b>CH</b> : Coolant hole		
<b>VA</b> : Violet end mills			<b>UR</b> : Multi step radius		
<b>S</b> : KHAS end mills (High-grade powder high-speed steel)			<b>3</b> : 3mm shank		
<b>None</b> : Cobalt high-speed steel			<b>6</b> : 6mm shank		

\*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.



### High Hardness Powder Metallurgy HSS

High hardness powder metallurgy HSS is used as the substrate material.



### Ultra Micro Grain HSS

Cobalt high speed steel is used as the substrate material.



### High Speed Steel

High speed steel 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.



### CRN Coating

Newly developed CrN coating for Copper Electrodes machining.



### DLC Coating

Hardness similar to that of CVD diamond coating achieved with high adhesion strength. (Jointly developed with SHINMAYWA INDUSTRIES, LTD.)



### CVD Diamond Coated End Mills

Suitable for CFRP



### CVD Diamond Coated End Mills

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



### Diamond Coating

Suitable for graphite machining.



### VIOLET Coating

The original Miracle (Al, Ti)N coating achieves longer tool life.

## Work Application Range

### 1st Recommendation



### 2nd Recommendation



J

SOLID END MILLS



# COATING TECHNOLOGY



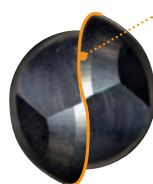
## IMPACT MIRACLE REVOLUTION Coating

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.



★ High Oxidation Temperature  
★ High Lubricity

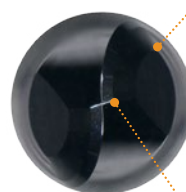
★ Better Wear Resistance  
★ High Adhesion



Strong S Curve



New Negative Cutting Edge Shape and Slow Helix Angle Cutting Edge



New ZERO-μ Surface

Newly-developed Surface Reforming Technology



New Ball Geometry for Mirror Finish Cutting



## 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 of coefficient and as such prevents abnormal damage such as chipping.

SOLID END MILLS



### 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 (°C)	1300	1100	840
Adhesion (N) <sup>1)</sup>	100	80	80
Wear Coefficient <sup>2)</sup> (800°C)	0.48	0.53	0.58

1) Adhesion : Measured by critical load scratch test.

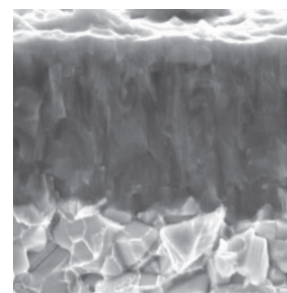
2) Coefficient of friction : Measured by ball-on-disk method.  
(Counter gear : AISI D2 60HRC)



## MS plus Coating

Suitable coating for a broad range of workpiece 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 workpiece materials.

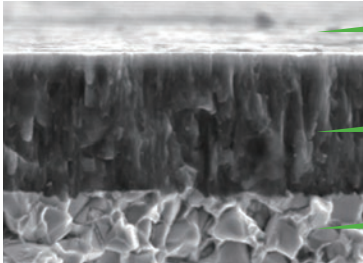


### Properties of MS plus coating

	(Al,Ti,Cr)N multilayer	(Al,Ti)N	(Al,Cr)N
Hardness (HV)	3200	2800	3100
Oxidation Temperature (°C)	1100	800	1100
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- $\mu$  Surface"

Newly Developed (Al,Cr)N Coating

Super Fine Grade Substrate



SMART MIRACLE Coating

**ZERO- $\mu$  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.



## DLC DLC Coating

Newly developed DLC coating.

**Hardness similar to that of CVD diamond coating achieved with high adhesion strength.**

Mitsubishi Materials and SHINMAYWA INDUSTRIES, LTD. have jointly developed a unique DLC coating that has substantially increased "adhesion strength" compared to previous DLC coating.

## 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.

## V VIOLET Coating

**(Al,Ti)N coating, excellent adhesion strength for HSS tools.**

Violet coating is the name of the technology of successfully applying a Miracle type coating to HSS substrate tools. The newly developed technology of applying (Al,Ti)N coating at the low temperatures required for HSS substrates, means that Violet coating has the same level of adhesion strength as Miracle coating. Additionally high film hardness and excellent oxidation resistance properties have also been realised.

# 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	<b>P</b>	Square End Mill	J008
			Short	J008
			Medium	J009
			Semi long	J010
			Long neck	J010
			Long neck / Taper neck	J011
Work Material	Hardened Steel	<b>H</b>	Square End Mill	J013
			Medium	J013
			Long neck	J013
			Radius End Mills	J013
			Short / Medium	J013
			Short / Medium	J013

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	Page
								Upper : 1st Recommendation	
								Under : 2nd Recommendation	
<b>M</b>									
<b>S</b>									
<b>Square End Mill</b>									
Medium (ap=3.5xDC)									
VQMZHJV			DC 1-20	1.6 ~2.5xDC	-	3	F R	M S P N	J116
VQMZHVOH			DC 8-16	1.9 ~2.4xDC	-	3	F R	M S P N	J122
VQMHV			DC 1-25	2 ~2.8xDC	-	4	F R	M S P N	J154
VQSVR			DC 3-20	1.8 ~2.4xDC	-	4	F R	M S P	J362

Recommendation

\*1 Finish

\*2 Rough

STEP3 Choose size and cutting condition.

Size

SOLID END MILLS									
MP2SSB									
Ball nose, Short out length, 2 flute, Short shank									
Order Number	ISE	DC	APXEL	LF	DCON	LF	DCON	LF	DCON
MP2SSB0010	0.1	0.2	0.2	40	4	4	4	4	4
MP2SSB0020	0.2	0.4	0.4	40	4	4	4	4	4
MP2SSB0030	0.3	0.6	0.6	40	4	4	4	4	4
MP2SSB0040	0.4	0.8	0.8	40	4	4	4	4	4
MP2SSB0050	0.5	1	1	40	4	4	4	4	4
MP2SSB00625	0.5	1	1	40	4	4	4	4	4
MP2SSB0075	0.75	1.5	1.5	40	4	4	4	4	4
MP2SSB0100	1	2	2	40	4	4	4	4	4
MP2SSB0150	1.5	3	3	40	4	4	4	4	4
MP2SSB0200	2	4	4	40	4	4	4	4	4
MP2SSB0300	3	6	6	40	4	4	4	4	4
MP2SSB0400	4	8	8	40	4	4	4	4	4
MP2SSB0600	6	12	12	40	4	4	4	4	4
MP2SSB0800	8	16	16	40	4	4	4	4	4

Cutting conditions

SOLID END MILLS									
MP2SSB									
Ball nose, Short out length, 2 flute, Short shank									
Material	Feed	Speed	Depth of Cut	Tool Life	Material	Feed	Speed	Depth of Cut	Tool Life
Aluminum	0.05	1000	0.1	100	Aluminum	0.05	1000	0.1	100
Steel	0.02	800	0.05	80	Steel	0.02	800	0.05	80
Inconel	0.01	600	0.02	60	Inconel	0.01	600	0.02	60
Titanium	0.01	600	0.02	60	Titanium	0.01	600	0.02	60

# INDEX

<p>Carbon Steel Alloy Steel Cast Iron</p>	P	<p><b>Square End Mill</b>  Short ..... J008  Medium ..... J008  Semi long ..... J009  Long neck ..... J010</p> <p><b>Radius End Mills</b>  Short / Medium ..... J010  Long neck / Taper neck ..... J011</p> <p><b>Ball Nose End Mills</b>  Short / Medium ..... J011  Long neck ..... J012  Taper neck ..... J012</p>
<p>Hardened Steel</p>	H	<p><b>Square End Mill</b>  Medium ..... J013  Long neck ..... J013</p> <p><b>Radius End Mills</b>  Short / Medium ..... J013  Long neck / Taper neck ..... J014</p> <p><b>Ball Nose End Mills</b>  Short / Medium ..... J014  Long neck / Taper neck ..... J015</p>
<p>Austenitic Stainless Steel</p>	M	<p><b>Square End Mill</b>  Medium ..... J016  Semi long ..... J017  Long neck ..... J017</p>
<p>Ti Alloy Heat Resistant Alloys</p>	S	<p><b>Radius End Mills</b>  Short / Medium ..... J017</p> <p><b>Ball Nose End Mills</b>  Short / Medium ..... J018  Long neck ..... J018</p>
<p>Ti Alloy Heat Resistant Alloys</p>	S	<p><b>Ceramic Radius End Mills</b>  Short ..... J018</p> <p><b>Barrel End Mills</b>  Medium ..... J018</p>
<p>Copper Alloy Aluminium Alloy</p>	N	<p><b>Square End Mill</b>  Short ..... J019  Medium ..... J019  Semi long ..... J019  Long neck ..... J020</p> <p><b>Radius End Mills</b>  Short / Medium ..... J020  Long neck ..... J020</p> <p><b>Ball Nose End Mills</b>  Short / Medium ..... J021  Long neck ..... J021  Tapered flute ..... J021</p>
<p>Graphite FRP</p>	G	<p><b>Square End Mill</b>  Semi long ..... J022  Long neck ..... J022</p> <p><b>Radius End Mills</b>  Long neck ..... J022</p> <p><b>Ball Nose End Mills</b>  Short / Medium ..... J022  Long neck ..... J023  Taper neck ..... J023</p>

# 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)

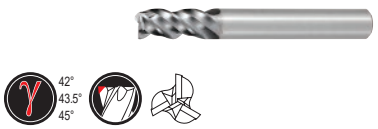





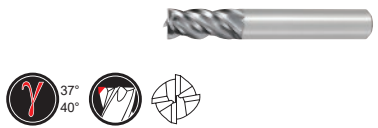


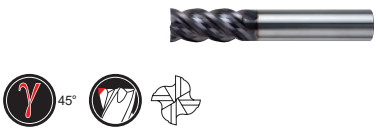





MS2ES			DC 3-12	0.5 -1xDC	-	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J066
MS2SS			DC 0.1-12	1.5xDC	-	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J048
MS3ES			DC 3-12	0.5 -1xDC	-	3	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J114
MS4EC			DC 3-14	0.5 -1xDC	-	4	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J152
MS4SC			DC 1-12	1.5xDC	-	4	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J142
MSSHD			DC 3-20	1.5xDC	-	4	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J136

Medium (ap=3xDC)




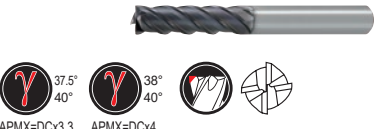





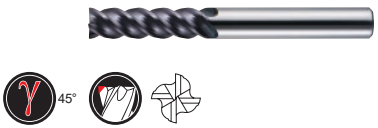





MS2MS			DC 0.2-20	2xDC	-	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J049
MS2JS			DC 0.1-12	3xDC	-	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J054
MPMHV			DC 1-22	2.5xDC	-	4	<b>F</b> <b>R</b>	<b>P M</b> <b>H S N</b>	J130

\* 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
VQMHZV	VQ		DC 1-20	1.6 -2.5xDC	-	3	F  R 	<b>PMS</b> N	J116
MSMHZD	MS		DC 1-20	1.6 -2.5xDC	-	3	F  R 	<b>P</b> HMSN	J112
VQMHV	VQ		DC 1-25	2 -2.8xDC	-	4	F  R 	<b>PMS</b> N	J154
MSMHD	MS		DC 2-25	2 -3.1xDC	-	4	F  R 	<b>P</b> HMSN	J137
VQSVR	VQ		DC 3-20	1.8 -2.4xDC	-	3 4	F  R 	<b>PMS</b> N	J362

**Semi long (ap-4xDC)**

MS2LS	MS		DC 0.2-12	4xDC	-	2	F  R 	<b>P</b> HMSN	J056
MPJHV	MS		DC 1-20	3.3 -4xDC	-	4	F  R 	<b>PM</b> HSN	J134
VQJHV	VQ		DC 1-20	3.3 -4xDC	-	4	F  R 	<b>PMS</b> N	J158
MSJHD	MS		DC 2-20	2.8 -4xDC	-	4	F  R 	<b>P</b> HMSN	J140
MS4JC	MS		DC 1-12	4xDC	-	4	F  R 	<b>P</b> HMSN	J146

J

SOLID END MILLS





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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		 35° DC<0.3 DC≥0.4	DC 0.2-1.0	1.4 -1.67xDC	2.5 -6xDC	3 4	<b>F</b> <b>R</b>	<b>P M S</b> <b>N</b>	J160
VF2XL		 30° DC<3 DC=3	DC 0.1-3	1.5 -1.7xDC	2.5 -12.5xDC	2	<b>F</b> <b>R</b>	<b>H</b> <b>P</b>	J072
MS2XL		 30° DC<0.4 DC≥0.4	DC 0.2-6	1.3 -1.6xDC	2.5 -30xDC	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J058
MS2XL6		 30°	DC 0.3-2.5	1.5 -2.7xDC	2.5 -5xDC	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J062
MS4XL		 30°	DC 1-10	1xDC	2.7 -16.2xDC	4	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J148

### Radius End Mills

Short / Medium (ap~2.8xDC)

MS2MRB		 30° DC<3 DC≥3	DC 1-12	2xDC	-	2	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J274
MPMHVRB		 37° 40°	DC 1-20	2.5xDC	-	4	<b>F</b> <b>R</b>	<b>P M</b> <b>H S N</b>	J284
VQMHRB		 37° 40°	DC 2-20	2 -2.8xDC	-	4	<b>F</b> <b>R</b>	<b>P M S</b> <b>N</b>	J297
MS4MRB		 30°	DC 3-20	1.9 -2.8xDC	-	4	<b>F</b> <b>R</b>	<b>P</b> <b>H M S N</b>	J294

\* 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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**Short / Medium (ap-2.8xDC)**

VFHVRB		  43° 45°	DC 1-16	1 -1.6xDC	-	4			J306
VCPSRB [High precision]		  30° DC≤1.5 DC≥2	DC 0.6-12	1xDC	-	2 4			J318

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

MPXLRB		  30° DC≤0.3 DC≥0.4	DC 0.2-6	1xDC	2.5 -12xDC	2 4			J288
VFHVRB		  43° 45°	DC 1-12	1 -1.6xDC	2.6 -50xDC	4			J312
CBN2XLRB		  0°	DC 0.5-2	0.6xDC	3 -6xDC	2			J280

**Ball Nose End Mills**

**Short / Medium (ap-3xDC)**

MP2SSB		  30°	RE 0.1-6	1xDC	-	2			J196
MP2SB		  30°	RE 0.1-6	1.5 -1.7xDC	-	2			J197
MP2MB		  30°	RE 0.25-6	1.8 -3xDC	-	2			J198
MP2SDB		  30°	RE 0.5-6	1 -2xDC	-	2			J200
VQ4SVB		  45°	RE 1-6	1.5xDC	-	4			J270

J

SOLID END MILLS
































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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**

**Ball Nose End Mills**

Long neck (ap-20xDC)

MP2XLB		  	RE 0.05-3	0.7 -1xDC	1.2 -20xDC	2	<b>F</b>  <b>R</b> 	<b>P</b> <b>H</b> <b>M</b> <b>S</b> <b>N</b>	J202
VF2XLB		  	RE 0.1-3	0.8xDC	2.5 -20xDC	2	<b>F</b>  <b>R</b> 	<b>H</b> <b>P</b>	J222
VF2XLBS		  	RE 0.2-1	0.8xDC	2.5 -12xDC	2	<b>F</b>  <b>R</b> 	<b>H</b> <b>P</b>	J220
VF2WB		 	RE 1-3	220°	2 -3xDC	2	<b>F</b>  <b>R</b> 	<b>M</b> <b>S</b> <b>P</b> <b>H</b>	J219
CBN2XLB		  	RE 0.2-1	0.6 -0.8xDC	0.85 -4xDC	2	<b>F</b>  <b>R</b> 	<b>P</b> <b>H</b>	J236

Taper neck (ap-70xDC)

MP3XB		  	RE 0.5-6	0.8 -1.5xDC	3.3 -50xDC	3	<b>F</b>  <b>R</b> 	<b>P</b> <b>H</b> <b>M</b> <b>S</b> <b>N</b>	J254
VF3XB		  	RE 0.4-2.5	0.6 -0.9xDC	6.7 -70xDC	3	<b>F</b>  <b>R</b> 	<b>P</b> <b>H</b>	J260

- \* 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)

VF2MD		 35° DC<3 DC≥3	DC 0.5-6	2.5xDC	-	2	F R	H P	J068
VF4MD		 35° DC<3 DC≥3	DC 1-20	2.5xDC	-	4	F R	H P	J164
VFSD		 30° 45° DC<3 DC≥3 DC<3 DC≥3	DC 1-12	2xDC	-	4 6	F R	H P	J190
VFMD		 30° 45° DC<3 DC≥3 DC<3 DC≥3	DC 1-25	2 -3.5xDC	-	4 6	F R	H P	J191

Long neck (ap~12.5xDC)

VF2XL		 30° DC<3 DC=3	DC 0.1-3	1.5 -1.7xDC	2.5 -12.5xDC	2	F R	H P	J072
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### Radius End Mills

Short / Medium (ap~3.3xDC)

VFHVRB		 43° 45°	DC 1-16	1 -1.6xDC	-	4	F R	H P M S	J306
VCPSRB [High precision]		 30° DC≤1.5 DC≥2	DC 0.6-12	1xDC	-	2 4	F R	H P M S	J318
VFSDRB		 45°	DC 3-12	1xDC	-	6	F R	H P	J346
VFMDB		 45°	DC 3-20	2.2 -3.3xDC	-	6	F R	H P	J348

J

















































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
<b>H</b>									
<b>Radius End Mills</b>									
<b>Short / Medium (ap-3.3xDC)</b>									
VFFDRB		 40° DC≤6 DC≥8	DC 3-12	0.06DC	-	4 6	F R		J316
<b>Long neck (ap-6xDC) / Taper neck (ap-50xDC)</b>									
VFHVRB		 43° 45°	DC 1-12	1 -1.6xDC	2.6 -50xDC	4	F R		J312
CBN2XLRB		 0°	DC 0.5-2	0.6xDC	3 -6xDC	2	F R		J280
<b>Ball Nose End Mills</b>									
<b>Short / Medium (ap-3xDC)</b>									
VFR2SB		 0° 20° RE<0.3 RE≥0.3	RE 0.1-10	1 -2xDC	-	2	F R		J212
VFR2SBF		 30°	RE 0.5-3	1 -2xDC	-	2	F R		J214
<b>NEW</b> VFR2SSB		 20°	RE 0.5-6	1xDC	-	2	F R		J210
MP2SSB		 30°	RE 0.1-6	1xDC	-	2	F R		J196
MP2SB		 30°	RE 0.1-6	1.5 -1.7xDC	-	2	F R		J197
MP2MB		 30°	RE 0.25-6	1.8 -3xDC	-	2	F R		J198

\* 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
MP2SDB		  	RE 0.5-6	1 -2xDC	-	2	<b>F</b>  <b>R</b> 	<b>H P</b>	J200
VF4MB		  	RE 0.5-6	1.8 -3xDC	-	4	<b>F</b>  <b>R</b> 	<b>H</b> <b>P</b>	J272
<b>Long neck (ap-20xDC) / Taper neck (ap-70xDC)</b>									
MP2XLB		  	RE 0.05-3	0.7 -1xDC	1.2 -20xDC	2	<b>F</b>  <b>R</b> 	<b>H P</b> <b>M S N</b>	J202
VF2XLB		  	RE 0.1-3	0.8xDC	2.5 -20xDC	2	<b>F</b>  <b>R</b> 	<b>H</b> <b>P</b>	J222
VF2XLBS		  	RE 0.2-1	0.8xDC	2.5 -12xDC	2	<b>F</b>  <b>R</b> 	<b>H</b> <b>P</b>	J220
MP3XB		  	RE 0.5-6	0.8 -1.5xDC	3.3 -50xDC	3	<b>F</b>  <b>R</b> 	<b>H P</b> <b>M S N</b>	J254
VF3XB		  	RE 0.4-2.5	0.6 -0.9xDC	6.6 -70xDC	3	<b>F</b>  <b>R</b> 	<b>H P</b>	J260
CBN2XLB		  	RE 0.2-1	0.6 -0.8xDC	0.85 -4xDC	2	<b>F</b>  <b>R</b> 	<b>H P</b>	J236

**J**

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
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M

S

## Square End Mill

Medium (ap-3.5xDC)

VQMHZV			DC 1-20	1.6 -2.5xDC	-	3	F R	M S P N	J116
VQMHZVOH			DC 6-16	1.9 -2.4xDC	-	3	F R	M S P N	J122
VQMHV			DC 1-25	2 -2.8xDC	-	4	F R	M S P N	J154
VQSVR			DC 3-20	1.8 -2.4xDC	-	3 4	F R	M S P N	J362
VFMHVCH			DC 16,20	2.2xDC	-	4	F R	M S P	J167
VF6MHV			DC 6-20	1.9 -2.4xDC	-	6	F R	M S P	J189
VQ6MHVCH			DC 10-20	1.9 -2.2xDC	-	6	F R	M S P N	J188
VF8MHVCH			DC 16,20	1.9 -2xDC	-	8	F R	M S P	J194
VFSFPRCH			DC 16,20	1.9 -2.1xDC	-	4	F R	M S P	J367

\* 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		  $\gamma$ 28.5° 30°	DC 16,20	1.9 -2.1xDC	-	6	F R	<b>M S</b> <b>P</b>	J369
VFMFPR		  $\gamma$ 30°	DC 5-20	2.8 -3.5xDC	-	4	F R	<b>M S</b> <b>P</b>	J368

### Semi long (ap-4xDC)

VQJHV		  $\gamma$ 38° 40° DC≤6 $\gamma$ 37.5° 40° DC>6	DC 1-20	3.3 -4xDC	-	4	F R	<b>M S P</b> <b>N</b>	J158
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### Long neck (ap-6xDC)

VQXL		  $\gamma$ 35° DC≤0.3 DC≥0.4	DC 0.2-1.0	1.4 -1.67xDC	2.5 -6xDC	3 4	F R	<b>M S P</b> <b>N</b>	J160
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## Radius End Mills

### Short / Medium (ap-2.8xDC)

VQMHRB		  $\gamma$ 37° 40°	DC 2-20	2 -2.8xDC	-	4	F R	<b>M S P</b> <b>N</b>	J297
VQMHRBF		  $\gamma$ 37° 40°	DC 6-16	2.2 -2.4xDC	-	4	F R	<b>M S P</b> <b>N</b>	J302
VFMHRBCH		  $\gamma$ 42° 45°	DC 16,20	2.2 -2.3xDC	-	4	F R	<b>M S</b> <b>P</b>	J304
VQT5MVRB		  $\gamma$ 40° 41.5° 43°	DC 16-25	2.2 -2.3xDC	-	5	F R	<b>M S</b>	J340
VF6MHRB		  $\gamma$ 43.5° 45°	DC 6-20	1.9 -2.4xDC	-	6	F R	<b>M S</b> <b>P</b>	J344
VQ6MHRBCH		  $\gamma$ 43.5° 45°	DC 10-20	1.9 -2.2xDC	-	6	F R	<b>M S</b> <b>P N</b>	J342

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SOLID END MILLS





# TOOL NAVI

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## M

## S

### Radius End Mills

Short / Medium (ap-3xDC)

VF8MHVRBCH			DC 16,20	1.9 -2xDC	-	8	F R	M S P	J350
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### Ball Nose End Mills

Short / Medium (ap-1.5xDC)

VQ4SVB			RE 1-6	1.5xDC	-	4	F R	M S P N	J270
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Long neck (ap-3xDC)

VF2WB			RE 1-3	-	2 -3xDC	2	F R	M S P H	J219
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## S

### Ceramic Radius End Mills

Short (ap-0.75xDC)

CE4SRB			DC 6-12	0.75xDC	-	4	F R	S	J338
CE6SRB			DC 6-12	0.75xDC	-	6	F R	S	J338

### Barrel End Mills

Medium (ap-2.6xDC)

VQT6UR			DC 8-12	2 -2.6xDC	-	6	F R	S M N	J358
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




- \* 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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




## N

### Square End Mill









#### Short (ap=2xDC)

C2SA		   	DC 3-20	0.9 -2xDC	-	2	<b>F</b>  <b>R</b> 		J102
C3SA		   	DC 10-26	0.8 -1.3xDC	-	3	<b>F</b>  <b>R</b> 		J128
CSRA		   	DC 10-25	1.1 -1.3xDC	-	3	<b>F</b>  <b>R</b> 		J372

#### Medium (ap=3.2xDC)

CRN2MS		    DC<3 DC≥3	DC 0.2-12	2 -3.2xDC	-	2	<b>F</b>  <b>R</b> 		J084
C2MHA		   	DC 3-25	1.5 -3xDC	-	2	<b>F</b>  <b>R</b> 		J108
CMRA		   	DC 3-25	1.8 -2.8xDC	-	3	<b>F</b>  <b>R</b> 		J374

#### Semi long (ap=4xDC)

CRN4JC		   	DC 3-12	2.5 -4xDC	-	4	<b>F</b>  <b>R</b> 		J174
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SOLID END MILLS











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## N





















### Square End Mill

Long neck (ap~16xDC)









CRN2XL		   	DC 0.2-6	1.5 -1.7xDC	2.5 -16xDC	2	<b>F</b>  <b>R</b> 		J086
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### Radius End Mills

Short / Medium (ap~2.4xDC)

CRN2MRB		 	DC 6-12	2.2 -2.4xDC	-	2	<b>F</b>  <b>R</b> 		J277
C3SARB		  	DC 12-25	0.8 -1.3xDC	-	3	<b>F</b>  <b>R</b> 		J282
CSRARB		  	DC 10-25	1.1 -1.3xDC	-	3	<b>F</b>  <b>R</b> 		J370

Long neck (ap~13xDC)














CRN2XLRB		   	DC 0.5-6	1.5 -1.6xDC	5 -13xDC	2	<b>F</b>  <b>R</b> 		J278
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- \* ap : Depth of Cut
- \* DC : Cutting Diameter
- \* RE : Ball Nose End Mill Radius














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### Ball Nose End Mills








#### Short / Medium (ap-3xDC)

CRN2MB		  	RE 0.2-6	1.8 -3xDC	-	2	<b>F</b>  <b>R</b> 		J230
DC2SB		 	RE 0.1-3	0.6 -0.7xDC	-	2	<b>F</b>  <b>R</b> 	 * For hard brittle materials	J238

#### Long neck (ap-20xDC)

CRN2XLB		  	RE 0.1-3	1xDC	2.5 -20xDC	2	<b>F</b>  <b>R</b> 		J232
DC2XLB		 	RE 0.1-3	0.6xDC	1.7 -5xDC	2	<b>F</b>  <b>R</b> 	 * For hard brittle materials	J240

#### Tapered flute (ap-20xDC)

C4LATB		  	RE 0.5-2	6.7 -20xDC	-	4	<b>F</b>  <b>R</b> 		J356
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SOLID END MILLS


















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**G**

**Square End Mill**

Semi long (ap-4xDC)







DF4JC		  	DC 3-12	3 -4xDC	-	4	<b>F</b>  <b>R</b> 	<b>G</b> <b>N</b>	J176
DFC4JC		  	DC 6-12	2.5 -3.8xDC	-	4	<b>F</b>  <b>R</b> 	<b>G</b>	J180
DFCJRT		 	DC 6-12	2.5 -3.8xDC	-	10 12	<b>F</b>  <b>R</b> 	<b>G</b>	J195

Long neck (ap-10.7xDC)

DF4XL		  	DC 1-12	1.5xDC	2.5 -10.7xDC	4	<b>F</b>  <b>R</b> 	<b>G</b> <b>N</b>	J177
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**Radius End Mills**

Long neck (ap-30xDC)

























DFPSRB		  	DC 0.5-12	1.3 -1.5xDC	3.3 -30xDC	2 4	<b>F</b>  <b>R</b> 	<b>G</b> <b>N</b>	J335
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**Ball Nose End Mills**




















Short / Medium (ap-5xDC)

DF2MB		  	RE 3-6	4.6 -5xDC	-	2	<b>F</b>  <b>R</b> 	<b>G</b> <b>N</b>	J244
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- \* 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
<b>Long neck (ap-40xDC)</b>									
DF2XLB		  	RE 0.1-3	1.2 -1.5xDC	2.5 -40xDC	2	<b>F</b>  <b>R</b> 	 	J246
<b>NEW</b> DF2XLBF		  	RE 0.3-1.5	0.8 -1.5xDC	5 -20xDC	2	<b>F</b>  <b>R</b> 	 	J250
<b>Taper neck (ap-50xDC)</b>									
DF3XB		  	RE 0.5-2	1.5xDC	20 -50xDC	3	<b>F</b>  <b>R</b> 	 	J266

# END MILLS SELECTION CHART CARBIDE(By Shape)

































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	Aluminium Alloy										
<b>SQUARE</b>																								
1	For Hardened Steels		GBE	End mill, 1 flute, Brazed type (CBN)		DC 6-12										J376								
							2	General Use		MS2SS	End mill, Short cut length, 2 flute		DC 0.1-12	⊙	⊙	○		○	○	○		J048		
										MS2MS	End mill, Medium cut length, 2 flute		DC 0.2-20	⊙	⊙	○		○	○	○		J049		
										MS2MD	End mill, Medium cut length, 2 flute, Strong geometry type		DC 1-12	⊙	⊙	○		○	○			J052		
										MS2JS	End mill, Semi long cut length, 2 flute		DC 0.1-12	⊙	⊙	○		○	○	○		J054		
										MS2LS	End mill, Long cut length, 2 flute		DC 0.2-12	⊙	⊙	○		○	○	○		J056		
										VC	VC2SS	End mill, Short cut length, 2 flute		DC 0.3-16	○	⊙	○		○	○			J075	
											VC2MS	End mill, Medium cut length, 2 flute		DC 0.3-25	○	⊙	○		○	○			J077	
											VC2JS	End mill, Semi long cut length, 2 flute		DC 1-25	○	⊙	○		○	○			J080	
											UWC	C2SS	End mill, Short cut length, 2 flute		DC 0.4-6	○	○			○	○	○	○	J094
										C2MS		End mill, Medium cut length, 2 flute		DC 1-20	○	○			○	○	○	○	J095	
										C2JS		End mill, Semi long cut length, 2 flute		DC 1-25	○	○			○	○	○	○	J099	
										C2LS		End mill, Long cut length, 2 flute		DC 1-20	○	○			○	○	○	○	J100	
										High Helix	UWC	SEE2L	End mill, Long cut length, 2 flute		DC 3-20	⊙	○			○	○	○	○	J110
												For Key Way Slotting	MS	SED2KPG	End mill, Medium cut length, 2 flute, + Tolerance		DC 2-16	⊙	⊙			○	○	
SED2KMG	End mill, Medium cut length, 2 flute, + Tolerance		DC 2-16	⊙	⊙			○	○						J091									
For Small Automatic Lathes	MS	MS2ES	End mill, 2 flute, For small automatic lathes		DC 3-12	⊙	⊙	○		○	○	○	J066											

\* 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	Copper Alloy	Aluminium Alloy			
							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	
2	For Hardened Steels	VF	VF2MD	End mill, Medium cut length, 2 flute, For hardened materials		DC 0.5-6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							J068
							<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							J070
	For Aluminium Alloys	UWC	C2SA	End mill, Short cut length, 2 flute, For aluminium alloy		DC 3-20								<input checked="" type="checkbox"/>		J102
														<input checked="" type="checkbox"/>		J104
	For Aluminium Alloys	UWC	C2MA	End mill, Medium cut length, 2 flute, For aluminium alloy		DC 1-20								<input checked="" type="checkbox"/>		J106
														<input checked="" type="checkbox"/>		J108
	For Aluminium Alloys	UWC	C2LA	End mill, Long cut length, 2 flute, For aluminium alloy		DC 1-20								<input checked="" type="checkbox"/>		J112
														<input checked="" type="checkbox"/>		J114
	For Aluminium Alloys	UWC	C2MHA	End mill, Medium cut length, 2 flute, For aluminium alloy		DC 3-25								<input checked="" type="checkbox"/>		J116
														<input checked="" type="checkbox"/>		J122
	General Use	MS	MSMHZD	Slotting, Medium cut length, 3 flute		DC 1-20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J128
							<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J126	
For Small Automatic Lathes	MS	MS3ES	End mill, 3 flute, For small automatic lathes		DC 3-12	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J130	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J134		
For Difficult-to-cut Materials	VQ	VQMZHJV	End mill, Medium cutting length, 3 flute for drilling and slotting		DC 1-20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J142	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		J144		
For Difficult-to-cut Materials	VQ	VQMZHVOH	End mill, Medium cutting length, 3 flute for drilling and slotting with internal through coolant holes		DC 6-16	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J128	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		J126		
For Aluminium Alloys	UWC	C3SA	End mill, Short cut length, 3 flute, For aluminium alloy		DC 10-26								<input checked="" type="checkbox"/>		J128	
													<input checked="" type="checkbox"/>		J126	
General Use	MS+	MPMHV	End mill, Medium cut length, 4 flute, Irregular helix flutes		DC 1-22	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J130	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J134		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J142		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J144		
General Use	MS	MPJHV	End mill, Semi long cut length, 4 flute, Irregular helix flutes		DC 1-20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J130	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J134		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J142		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J144		
General Use	MS	MS4SC	End mill, Short cut length, 4 flute		DC 1-12	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J130	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J134		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J142		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J144		
General Use	MS	MS4MC	End mill, Medium cut length, 4 flute		DC 1-20	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J130	
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J134		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J142		
						<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		J144		

# END MILLS SELECTION CHART CARBIDE(By Shape)

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page			
							P	H	M	S	N					
SQUARE							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	Aluminium Alloy		
4	General Use		MS4JC		End mill, Semi long cut length, 4 flute	DC 1-12	⊙	⊙	○		○	○	○			J146
			MSSHD		High power, Short cut length, 4 flute	DC 3-20	⊙	⊙	○		○	○	○			J136
			MSMHD		High power, Medium cut length, 4 flute	DC 2-25	⊙	⊙	○		○	○	○			J137
			MSJHD		High power, Semi long cut length, 4 flute	DC 2-20	⊙	⊙	○		○	○	○			J140
			VC4MC		End mill, Medium cut length, 4 flute	DC 2-25		⊙	○		○	○				J168
			VC4JC		End mill, Semi long cut length, 4 flute	DC 3-25		⊙	○		○	○				J170
			C4MC		End mill, Medium cut length, 4 flute, Center cutting	DC 3-20		○	○			○	○	○		J181
			C4JC		End mill, Semi long cut length, 4 flute, Center cutting	DC 3-25		○	○			○	○	○		J182
			C4LC		End mill, Long cut length, 4 flute, Center cutting	DC 3-20		○	○			○	○	○		J183
			SEE4L		End mill, Long cut length, 4 flute	DC 3-25		○	○			○	○	○		J186
			MS4EC		End mill, 4 flute, For small automatic lathes	DC 3-14		⊙	⊙	○		○	○	○		J152
			VF4MD		End mill, Medium cut length, 4 flute, For hardened materials	DC 1-20			○	⊙	⊙					J164
			VF4MV		End mill, Medium cut length, 4 flute, Irregular helix flutes	DC 6-20			○	⊙	⊙					J166
			VQMHV		End mill, Medium cutting length, 4 flute, Irregular helix flutes	DC 1-25		⊙	⊙			⊙	⊙	○		J154
			VQJHV		End mill, Medium cut length, 4 flute, Irregular helix flutes	DC 1-20		⊙	⊙			⊙	⊙	○		J158
	VFMHVCH		End mill, Medium cut length, 4 flute, Irregular helix flutes, with multiple internal through coolant holes	DC 16,20		○	○			⊙	⊙			J167		

\* DC : Cutting Diameter

SOLID END MILLS

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material							Page		
							P	H	M	S	N	Copper Alloy	Aluminium Alloy			
4	4	For Copper Electrodes		CRN4JC		DC 3-12							⊙	○	J174	
		For CFRP		DFC4JC	Diamond coating endmill, 4 flute	DC 6-12	CFRP : ⊙							J180		
		For Graphite		DF4JC	End mill, Semi long cut length, 4 flute, For graphite	DC 3-12	Graphite : ⊙	GFRP/CFRP : ○	Machineable Ceramics : ○				⊙	○	J176	
		For Aluminium Alloys		SEG4SA	End mill, Medium cut length, 4 flute, Irregular spiral helix angle, For aluminium alloy	DC 6-25								○	⊙	J185
	6	For Hardened Steels			VFSD	End mill, Short cut length, For hardened materials	DC 1-12	○	⊙	⊙						J190
					VFMD	End mill, Medium cut length, For hardened materials	DC 1-25	○	⊙	⊙						J191
					VCMDSC	End mill, Medium cut length, 4-6 flute	DC 0.5-3	○	⊙	⊙						J172
					VCLD	End mill, Long cut length, 6 flute	DC 6-25	○	⊙	⊙						J193
	6	For Difficult-to-cut Materials			VF6MHV	End mill, Medium cut length, 6 flute, Irregular helix flutes	DC 6-20	○	○			⊙	⊙			J189
					<b>NEW</b> VQ6MHVCH	End mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through coolant	DC 10-20	○	○			⊙	⊙	○		J188
8	For Difficult-to-cut Materials			VF8MHVCH	End mill, Medium cut length, Irregular helix flutes, with multiple internal through coolant holes	DC 16,20	○	○			⊙	⊙			J194	
10 12	For CFRP			DFCJRT	Diamond coating endmill with cross-nick	DC 6-12	CFRP : ⊙							J195		

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SOLID END MILLS







LONG NECK SQUARE

2	3 4	For Difficult-to-cut Materials		VQXL	End mill, Short cut length, 3-4 flute, Long neck	DC 0.2-1	⊙	⊙			⊙	⊙	○	J160
	For Deep Slotting			MS2XL	End mill, Short cut length, 2 flute, Long neck	DC 0.2-6	⊙	⊙	○		○	○	○	J058
				MS2XL6	End mill, Short cut length, 2 flute, 6mm shank	DC 0.3-2.5	⊙	⊙	○		○	○	○	J062
	For Deep Slotting	For Hardened Steels		VF2XL	End mill, 2 flute, Long neck	DC 0.1-3	○	⊙	⊙	⊙				J072
		For Copper Electrodes		CRN2XL	End mill, Medium cut length, 2 flute, Long neck, For copper electrodes	DC 0.2-6							⊙	○

# END MILLS SELECTION CHART CARBIDE(By Shape)

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P	H	M	S	N		
<b>LONG NECK SQUARE</b>													
4	For Deep Slotting General Use		MS4XL		End mill, Short cut length, 4 flute, Long neck	DC 1-10	☉	☉	○	○	○	○	J148
	For Graphite		DF4XL		End mill, Long neck, 4 flute, For graphite	DC 1-12						Graphite : ☉ GFRP/CFRP : ○ Machineable Ceramics : ○	J177
<b>BALL</b>													
2	General Use		MP2SSB		Ball nose, Short cut length, 2 flute, Short shank	RE 0.1-6	☉	☉	☉	○	○	○	J196
			MP2SB		Ball nose, Short cut length, 2 flute	RE 0.1-6	☉	☉	☉	○	○	○	J197
			MP2MB		Ball nose, Medium cutting length, 2 flute	RE 0.25-6	☉	☉	☉	○	○	○	J198
			MP2SDB		Ball nose, Short cut length, 2 flute, High strength	RE 0.5-6	○	☉	☉				J200
	For High Feed Machining		VF2SDB		Ball nose, Short cut length, 2 flute, Strong geometry type	RE 0.5-10	○	☉	☉	○			J216
			VF2SDBL		Ball nose, Short cut length, 2 flute, Strong geometry type, Long shank	RE 0.5-10	○	☉	☉	○			J217
	For Hardened Steels		VFR2SB		Ball nose, Short cut length, 2 flute	RE 0.1-10		○	☉	☉			J212
			<b>NEW</b> VFR2SSB		Ball nose, Short cut length, 2 flute, Short shank	RE 0.5-6		○	☉	☉			J210
			VFR2SBF		Ball nose, Short cut length, 2 flute, For Mirror finish cutting	RE 0.5-3		○	☉	☉			J214
	General Use		C2MB		Ball nose end mill, Medium cut length, 2 flute	RE 0.5-7.5	☉	○		○	○	○	J252
For Copper Electrodes		CRN2MB		Ball nose, Medium cut length, 2 flute, For copper electrodes	RE 0.2-6						☉	○	J230

\* 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	Copper Alloy	Aluminium Alloy		
2	For Hard Brittle Materials	DC	DC2SB		RE 0.1-3	Cemented Carbide : <input checked="" type="checkbox"/>	Alumina / Zirconia : <input type="checkbox"/>	Silicon Carbide / Nitride : <input type="checkbox"/>	Quartz Glass : <input type="checkbox"/>						J238
	For Graphite	DF	DF2MB		RE 3-6	Graphite : <input checked="" type="checkbox"/>	GFRP/CFRP : <input type="checkbox"/>	Machineable Ceramics : <input type="checkbox"/>							J244
	For Aluminium Alloys	DLC	DLC2MB		RE 0.1-10	GFRP : <input type="checkbox"/>	CFRP : <input type="checkbox"/>								J242
3	For High Efficiency Machining	VC	VC3MB		RE 1-10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>							J268
4	For Hardened Steels	VF	VF4MB		RE 0.5-6		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>						J272
	For Difficult-to-cut Materials	VQ	VQ4SVB		RE 1-6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>			J270

LONG NECK BALL
















2	General Use	MS+	MP2XLB		RE 0.05-3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							J202	
	For Hardened Steels	CBN	CBN2XLB		RE 0.2-1		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>						J236	
	For Profiling of Special Geometry	VF	VF2WB		RE 1-3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				J219	
	For Deep Slotting of Hardened Steels	VF	VF2XLBS		RE 0.2-1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							J220
		VF	VF2XLB		RE 0.1-3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							J222
	For Copper Electrodes	CRN	CRN2XLB		RE 0.1-3								<input checked="" type="checkbox"/>	<input type="checkbox"/>	J232	
	For Hard Brittle Materials	DC	DC2XLB		RE 0.1-3	Cemented Carbide : <input checked="" type="checkbox"/>	Alumina / Zirconia : <input type="checkbox"/>	Silicon Carbide / Nitride : <input type="checkbox"/>	Quartz Glass : <input type="checkbox"/>							J240
	For Graphite	DF	DF2XLB		RE 0.1-3	Graphite : <input checked="" type="checkbox"/>	GFRP/CFRP : <input type="checkbox"/>	Machineable Ceramics : <input type="checkbox"/>					<input checked="" type="checkbox"/>	<input type="checkbox"/>		J246
DF		<b>NEW</b> DF2XLBF		RE 0.3-1.5	Graphite : <input checked="" type="checkbox"/>	Zirconia : <input checked="" type="checkbox"/>	Rigid Composite Resin : <input checked="" type="checkbox"/>	Machineable Ceramics : <input type="checkbox"/>				<input checked="" type="checkbox"/>	<input type="checkbox"/>		J250	

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SOLID END MILLS



# END MILLS SELECTION CHART CARBIDE(By Shape)

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page				
							P	H	M	S	N						
<b>TAPER NECK BALL</b>																	
2	For Deep Slotting	For Deep Slotting	VC	VCXB	 Ball nose taper end mill, Medium cut length, Taper neck	RE 0.5-6	○	○	○	○	○	○	J228				
				3	For Deep Slotting	General Use	MS+	MP3XB	 Ball nose, 3 flute, Taper neck	RE 0.5-6	○	○	○	○	○	J254	
							Hardened Steels	VF	VF3XB	 Ball nose, Medium cut length, 3 flute, Taper neck	RE 0.4-2.5	○	○	○	○	○	J260
								Graphite	DF	DF3XB	 Ball nose, Medium cut length, 3 flute, Taper neck, For graphite	RE 0.5-2	Graphite : ○ GFRP/CFRP : ○ Machineable Ceramics : ○				
<b>RADIUS</b>																	
2	General Use	General Use	MS	MS2MRB	 Corner radius end mill, Medium cut length, 2 flute	DC 1-12	○	○	○	○	○	○	J274				
				For Copper Electrodes	CRN	CRN2MRB	 Corner radius, Medium cut length, 2 flute, For copper electrodes	DC 6-12						○	J277		
3	For Aluminium Alloys	UWC	C3SARB	 Corner radius, Short cut length, 3 flute, For aluminium alloy	DC 12-25							○	J282				
2	4	For High-Precision Machining	VC	VCPSRB	 Corner radius end mill, Short cut length, 2-4 flute, High precision	DC 0.6-12	○	○	○	○	○	○	J318				
4	General Use	General Use	MS+	MPMHVRB	 End mill, Medium cut length, 4 flute, Irregular helix flutes	DC 1-20	○	○	○	○	○	○	J284				
				For High Efficiency Machining	VF	VFHVRB	 4 flute, Corner radius, Short cut length, Irregular helix flutes	DC 1-16	○	○	○	○	○	○	J306		
				For High Feed Machining	VC	VCHFRB	 Corner radius, Short flute length, 4 flute, High feed machining	DC 2-16	○	○	○	○			J328		
				General Use	MS	MS4MRB	 Corner radius end mill, Medium cut length, 4 flute	DC 3-20	○	○	○	○	○	○	J294		
					VC	VC4SRB	 Corner radius end mill, Short cut length, 4 flute	DC 4-12	○	○	○	○	○		J324		
VC	VC4JRB	 Corner radius end mill, Semi long cut length, 4 flute	DC 3-20		○	○	○	○	○		J326						
For Difficult-to-cut Materials	VC	VCMHDRB	 Corner radius end mill, Medium cut length, 4 flute, High helix angle	DC 2-25	○	○	○	○	○		J332						

\* 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	Copper Alloy	Aluminium Alloy		
							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
4	4	For Difficult-to-cut Materials		VQMHV RB	 Corner radius end mill, Medium cutting length, 4 flute, Irregular helix flutes	DC 2-20	○	○			○	○			J297
				VQMHV RBF	 Corner radius end mill, Medium cutting length, 4 flute, Irregular helix flutes (for finishing)	DC 6-16	○	○			○	○			J302
				VFMHV RBCH	 Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes, with multiple internal through coolant holes	DC 16,20	○	○			○	○			J304
4	6	For Hardened Steels		VFFDR B	 Multi-task corner radius end mill for impact miracle high speed cutting	DC 3-12		○	○	○					J316
				VFSDR B	 Corner radius end mill, 6 flute (S)	DC 3-12		○	○	○					J346
				VFMDR B	 Corner radius, Medium cut length, 6 flute, For hardened materials	DC 3-20		○	○	○					J348
6	6	For Difficult-to-cut Materials		VF6MHV RB	 Corner radius, Medium cut length, 6 flute, Irregular helix flutes	DC 6-20	○	○			○	○			J344
				<b>NEW</b> VQ6MHV RBCH	 Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes, with multiple internal through coolant holes	DC 10-20	○	○			○	○	○		J342
				<b>NEW</b> VQT5MV RB	 Corner radius, Medium cut length, 5 flute, Irregular helix flutes, With coolant hole	DC 16,20,25					○	○			J340
8	8	For Difficult-to-cut Materials		VF8MHV RBCH	 Corner radius end mill, Medium cut length, 8 flute, Irregular helix flutes, with multiple internal through coolant holes	DC 16,20	○	○			○	○		J350	
4	6	For Heat Resistant Alloy		CE4SR B	 Corner radius end mill, short cut length, 4 flute	DC 6-12						○		J338	
				CE6SR B	 Corner radius end mill, short cut length, 6 flute	DC 6-12						○			J338

















# END MILLS SELECTION CHART CARBIDE(By Shape)

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page	
							P	H	M	S	N			
<b>LONG NECK CORNER RADIUS</b>														
2	For Hardened Steels		CBN2XLRB		Corner radius end mill, Medium cut length, 2 flute, Long neck	DC 0.5-2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				J280	
	For Copper Electrodes		CRN2XLRB		Corner radius, Medium cut length, 2 flute, For copper electrodes	DC 0.5-6						<input checked="" type="checkbox"/>	<input type="checkbox"/>	J278
2 4	For Graphite		DFPSRB		Corner radius end mill, Short cut length, 2-4 flute, High precision, For graphite	DC 0.5-12			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J335
	General Use		MPXLRB		Corner radius, short cut length, long neck	DC 0.2-6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J288
<b>TAPER NECK RADIUS</b>														
2 4	For High-Precision Machining		VCPSRB		Corner radius end mill, Short cut length, 2-4 flute, High precision	DC 1.5-12	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J322
	For High Efficiency Machining		VFHVRB		4 flute, Corner radius, Short cut length, Irregular helix flutes	DC 1-12	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J312
4	For High Feed Machining		VCHFRB		Corner radius, Short flute length, 4 flute, High feed machining	DC 2-12	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J329
<b>TAPER BALL</b>														
4	For Hardened Steels		VC4STB		Ball nose taper end mill, Short cut length, 4 flute	RE 0.3-4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J352
	For Aluminium Alloys		C4LATB		Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers	RE 0.5-2						<input checked="" type="checkbox"/>	<input type="checkbox"/>	J356
<b>BARREL ENDMILL</b>														
6	For Profiling of Special Geometry		<b>NEW</b> VQT6UR		Barrel, Medium cut length, 6 flute	DC 8-12				<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	J358



\* 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		

**ROUGHING**

3 4	For Difficult-to-cut Materials		VQSVR	 Roughing end mill, Short cut length, 3-4 flute, Irregular helix flutes	DC 3-20	⊙	⊙			⊙	⊙	○	J362
			VFSFPR	 Roughing end mill, Short cut length, 3-4 flute	DC 3-20	⊙	⊙			⊙	⊙		J365
4	For Difficult-to-cut Materials		VFMFPR	 Roughing end mill, Medium cut length, 4 flute	DC 5-20	○	○			⊙	⊙		J368
			VFSFPRCH	 Roughing end mill, Short cut length, 4 flute, with multiple internal through coolant holes	DC 16,20	○	○			⊙	⊙		J367
6	For Aluminium Alloys		VF6SVRCH	 Roughing end mill, Short cut length, 6 flute, Irregular helix flutes, with multiple internal through coolant holes	DC 16,20	○	○			⊙	⊙		J369
3			CSRA	 Roughing end mill, Short cut length, 3 flute, For aluminium alloy	DC 10-25								⊙
		CMRA	 Roughing end mill, Medium cut length, 3 flute, For aluminium alloy	DC 3-25								⊙	J374



































**CORNER RADIUS, ROUGHING**

3	For Aluminium Alloys		CSRARB	 Corner radius roughing end mill, Short cut length, 3 flute, For aluminium alloy	DC 10-25								⊙	J370
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**CHAMFER CUTTER**

2	For Chamfering		VC2C	 Chamfer cutter, 2 flute	DC 2-12	⊙	⊙	○		⊙	⊙	○	○	J082
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# END MILLS SELECTION CHART **CARBIDE (By Series)**

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material							Page
							P	H	M	S	N	Copper Alloy	Aluminium Alloy	
<b>MS PLUS END MILL SERIES</b>														
General Use	SQUARE	4		MPMHV		DC 1-22	○	○	○	○	○	○	J130	
				MPJHV		DC 1-20	○	○	○	○	○	○	J134	
	BALL	2		MP2SSB		RE 0.1-6	○	○	○	○	○	○	J196	
				MP2SB		RE 0.1-6	○	○	○	○	○	○	J197	
				MP2MB		RE 0.25-6	○	○	○	○	○	○	J198	
				MP2SDB		RE 0.5-6	○	○	○	○	○	○	J200	
	LONG NECK BALL			MP2XLB		RE 0.05-3	○	○	○	○	○	J202		
	TAPER NECK BALL	3		MP3XB		RE 0.5-6	○	○	○	○	○	J254		
RADIUS	4		MPMHVRB		DC 1-20	○	○	○	○	○	J284			
LONG NECK CORNER RADIUS	2 4		MPXLRB		DC 0.2-6	○	○	○	○	○	J288			
<b>MSTAR END MILL SERIES</b>														
General Use	SQUARE	2		MS2SS		DC 0.1-12	○	○	○	○	○	○	J048	
				MS2MS		DC 0.2-20	○	○	○	○	○	○	J049	
				MS2MD		DC 1-12	○	○	○	○	○	○	J052	
				MS2JS		DC 0.1-12	○	○	○	○	○	○	J054	
				MS2LS		DC 0.2-12	○	○	○	○	○	○	J056	
		3		MSMHZD		DC 1-20	○	○	○	○	○	○	J112	
		4		MS4SC		DC 1-12	○	○	○	○	○	○	J142	

\* DC : Cutting Diameter  
\* RE : Ball Nose End Mill Radius

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material							Page
							P	H	M	S	N	Copper Alloy	Aluminium Alloy	
							Carbon Steel, Alloy Steel, Cast Iron	Tool Steel, Pre-Hardened Steel, Hardened Steel	Hardened Steel(≤55HRC)	Hardened Steel(55HRC-)	Austenitic Stainless Steel			
General Use	SQUARE	4		MS4MC	 End mill, Medium cut length, 4 flute	DC 1-20	◎	◎	○	○	○	○	○	J144
				MS4JC	 End mill, Semi long cut length, 4 flute	DC 1-12	◎	◎	○	○	○	○	○	J146
				MSSHHD	 High power, Short cut length, 4 flute	DC 3-20	◎	◎	○	○	○	○	○	J136
				MSMHD	 High power, Medium cut length, 4 flute	DC 2-25	◎	◎	○	○	○	○	○	J137
				MSJHD	 High power, Semi long cut length, 4 flute	DC 2-20	◎	◎	○	○	○	○	○	J140
For Small Automatic Lathes	SQUARE	2		MS2ES	 End mill, 2 flute, For small automatic lathes	DC 3-12	◎	◎	○	○	○	○	J066	
		3		MS3ES	 End mill, 3 flute, For small automatic lathes	DC 3-12	◎	◎	○	○	○	○	J114	
		4		MS4EC	 End mill, 4 flute, For small automatic lathes	DC 3-14	◎	◎	○	○	○	○	J152	
For Deep Slotting	LONG NECK SQUARE	2		MS2XL	 End mill, Short cut length, 2 flute, Long neck	DC 0.2-6	◎	◎	○	○	○	○	J058	
				MS2XL6	 End mill, Short cut length, 2 flute, 6mm shank	DC 0.3-2.5	◎	◎	○	○	○	○	J062	
		4		MS4XL	 End mill, Short cut length, 4 flute, Long neck	DC 1-10	◎	◎	○	○	○	○	J148	
General Use	RADIUS	2		MS2MRB	 Corner radius end mill, Medium cut length, 2 flute	DC 1-12	◎	◎	○	○	○	○	J274	
		4		MS4MRB	 Corner radius end mill, Medium cut length, 4 flute	DC 3-20	◎	◎	○	○	○	○	J294	

# END MILLS SELECTION CHART **CARBIDE (By Series)**

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P	H	M	S	N		
<b>SMART MIRACLE END MILL SERIES</b>													
For Difficult-to-cut Materials	SQUARE	3		VQMHZV		DC 1-20	○	○		○	○		J116
				VQMHZVOH		DC 6-16	○	○		○	○		J122
		4		VQMHV		DC 1-25	○	○		○	○		J154
		6		<b>NEW</b> VQ6MHVCH		DC 10-20	○	○		○	○		J188
		4		VQJHV		DC 1-20	○	○		○	○		J158
	LONG NECK SQUARE	3-4		VQXL		DC 0.2-1	○	○		○	○		J160
	BALL			VQ4SVB		RE 1-6	○	○		○	○		J270
	RADIUS	4		VQMHRB		DC 2-20	○	○		○	○		J297
				VQMHRBF		DC 6-16	○	○		○	○		J302
		5		<b>NEW</b> VQT5MVRB		DC 16,20,25				○	○		J340
6			<b>NEW</b> VQ6MHRBCH		DC 10-20	○	○		○	○		J342	
For Barrel	BARREL			<b>NEW</b> VQT6UR		DC 8-12				○	○		J358
For Difficult-to-cut Materials	ROUGHING	3-4		VQSVR		DC 3-20	○	○		○	○		J362
<b>IMPACT MIRACLE END MILL SERIES</b>													
For Hardened Steels	SQUARE	2		VF2MD		DC 0.5-6		○	○	○			J068
				VF2MV		DC 0.5-6		○	○	○			J070
	4		VF4MD		DC 1-20		○	○	○			J164	
			VF4MV		DC 6-20		○	○	○			J166	




















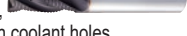

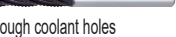









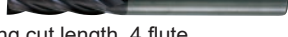
\* DC : Cutting Diameter  
\* RE : Ball Nose End Mill Radius

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P	H	M	S	N		
For Hardened Steels	SQUARE	4		VFSD	End mill, Short cut length, For hardened materials	DC 1-12	○	○	○				J190
				VFMD	End mill, Medium cut length, For hardened materials	DC 1-25	○	○	○				J191
For Profiling of Special Geometry	LONG NECK BALL	2		VF2WB	Wide ball nose, Medium cut length, 2 flute	RE 1-3	○	○	○	○	○		J219
For Hardened Steels	BALL	4		VF4MB	Ball nose, Medium cut length, 4 flute	RE 0.5-6	○	○	○				J272
				VFFDRB	Multi-task corner radius end mill for impact miracle high speed cutting	DC 3-12	○	○	○				J316
	RADIUS	6		VFSDRB	Corner radius end mill, 6 flute (S)	DC 3-12	○	○	○				J346
				VFMDRB	Corner radius, Medium cut length, 6 flute, For hardened materials	DC 3-20	○	○	○				J348
For Deep Slotting of Hardened Steels	LONG NECK SQUARE	2		VF2XL	End mill, 2 flute, Long neck	DC 0.1-3	○	○	○	○			J072
				VF2XLBS	Ball nose, Medium cut length, 2 flute, Short shank	RE 0.2-1	○	○	○	○			J220
	LONG NECK BALL	2		VF2XLB	Ball nose, 2 flute, Long neck	RE 0.1-3	○	○	○	○			J222
				VF3XB	Ball nose, Medium cut length, 3 flute, Taper neck	RE 0.4-2.5	○	○	○	○			J260
For Difficult-to-cut Materials	ROUGHING	3		VFSFPR	Roughing end mill, Short cut length, 3-4 flute	DC 3-20	○	○		○	○		J365
		4		VFMFPR	Roughing end mill, Medium cut length, 4 flute	DC 5-20	○	○		○	○		J368
<b>IMPACT MIRACLE BALL NOSE HIGH POWER END MILL SERIES</b>													
For High Feed Machining	BALL	2		VF2SDB	Ball nose, Short cut length, 2 flute, Strong geometry type	RE 0.5-10	○	○	○	○			J216
				VF2SDBL	Ball nose, Short cut length, 2 flute, Strong geometry type, Long shank	RE 0.5-10	○	○	○	○			J217
<b>IMPACT MIRACLE CORNER RADIUS END MILL SERIES FOR HIGH EFFICIENCY MACHINING, IRREGULAR HELIX</b>													
For High Efficiency Machining	RADIUS	4		VFHVRB	4 flute, Corner radius, Short cut length, Irregular helix flutes	DC 1-16	○	○	○	○	○		J306
	TAPER NECK RADIUS			VFHVRB	4 flute, Corner radius, Short cut length, Irregular helix flutes	DC 1-12	○	○	○	○	○		J312

SOLID END MILLS



# END MILLS SELECTION CHART **CARBIDE (By Series)**

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P <small>Carbon Steel, Alloy Steel, Cast Iron</small>	H <small>Tool Steel, Pre-Hardened Steel, Hardened Steel</small>	M <small>Hardened Steel (&gt;55HRC)</small>	S <small>Hardened Steel (&gt;55HRC)</small>	N <small>Austenitic Stainless Steel</small>	G <small>Titanium Alloy, Heat Resistant Alloy</small>	
<b>IMPACT MIRACLE END MILL SERIES FOR DIFFICULT TO CUT MATERIALS, IRREGULAR HELIX</b>													
For Difficult-to-cut Materials	SQUARE	6		VF6MHV		DC 6-20	○	○			◎	◎	J189
	RADIUS			VF6MHVRB		DC 6-20	○	○			◎	◎	J344
<b>IMPACT MIRACLE REVOLUTION</b>													
For Hardened Steels	BALL	2		VFR2SB		RE 0.1-10		○	◎	◎			J212
				<small>NEW</small> VFR2SSB		RE 0.5-6		○	◎	◎			J210
				VFR2SBF		RE 0.5-3		○	◎	◎			J214
<b>COOL STAR END MILL SERIES</b>													
For Difficult-to-cut Materials	SQUARE	4		VFMHVCH		DC 16,20	○	○			◎	◎	J167
		8		VF8MHVCH		DC 16,20	○	○			◎	◎	J194
	RADIUS	4		VFMHVRBCH		DC 16,20	○	○			◎	◎	J304
		8		VF8MHVRBCH		DC 16,20	○	○			◎	◎	J350
	ROUGHING	4		VFSFPRCH		DC 16,20	○	○			◎	◎	J367
		6		VF6SVRCH		DC 16,20	○	○			◎	◎	J369
<b>MIRACLE END MILL SERIES</b>													
General Use	SQUARE	2		VC2SS		DC 0.3-16	○	◎	○		○	○	J075
				VC2MS		DC 0.3-25	○	◎	○		○	○	J077
				VC2JS		DC 1-25	○	◎	○		○	○	J080
		4		VC4MC		DC 2-25	○	◎	○		○	○	J168
				VC4JC		DC 3-25	○	◎	○		○	○	J170

\* DC : Cutting Diameter  
\* RE : Ball Nose End Mill Radius

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material							Page	
							P	H	M	S	N	Copper Alloy	Aluminium Alloy		
For High Efficiency Machining	BALL	3		VC3MB	 Ball nose end mill, Medium cut length, 3 flute	RE 1-10	○	◎	○	○	○	○			J268
For Deep Slotting	TAPER NECK BALL	2		VCXB	 Ball nose taper end mill, Medium cut length, Taper neck	RE 0.5-6	○	◎	◎	○	○	○			J228
General Use	RADIUS	4		VC4SRB	 Corner radius end mill, Short cut length, 4 flute	DC 4-12	○	◎	○	○	○	○			J324
				VC4JRB	 Corner radius end mill, Semi long cut length, 4 flute	DC 3-20	○	◎	○	○	○	○			J326
For Chamfering	CHAMFERING	2		VC2C	 Chamfer cutter, 2 flute	DC 2-12	◎	◎	○	◎	◎	○	○		J082
<b>MIRACLE ORBIT END MILL SERIES</b>															
For High-Precision Machining	RADIUS	2 4		VCPSRB	 Corner radius end mill, Short cut length, 2-4 flute, High precision	DC 0.6-12	○	◎	◎	○	○	○			J318
	TAPER NECK RADIUS			VCPSRB	 Corner radius end mill, Short cut length, 2-4 flute, High precision	DC 1.5-12	○	◎	◎	○	○	○			J322
<b>MIRACLE CORNER RADIUS END MILL SERIES FOR HIGH FEED MACHINING</b>															
For High Feed Machining	RADIUS	4		VCHF RB	 Corner radius, Short flute length, 4 flute, High feed machining	DC 2-16	○	◎	◎	○					J328
	TAPER NECK RADIUS			VCHF RB	 Corner radius, Short flute length, 4 flute, High feed machining	DC 2-12	○	◎	◎	○					J329
<b>MIRACLE END MILL SERIES FOR HIGH HARDNESS STEEL</b>															
For Hardened Steels	SQUARE	4		VCMDSC	 End mill, Medium cut length, 4-6 flute	DC 0.5-3	○	◎	◎						J172
		6		VCLD	 End mill, Long cut length, 6 flute	DC 6-25	○	◎	◎					J193	
	TAPER BALL	4	VC4STB	 Ball nose taper end mill, Short cut length, 4 flute	RE 0.3-4	○	◎	◎	○	○			J352		
<b>MIRACLE END MILL SERIES FOR DIFFICULT TO CUT MATERIALS</b>															
For Difficult-to-cut Materials	RADIUS SQUARE	3 4		VCMH	 End mill, Medium cut length, 3-4 flute, High helix angle	DC 3-25	○	○	○	◎	◎			J126	
		4		VCMH DRB	 Corner radius end mill, Medium cut length, 4 flute, High helix angle	DC 2-25	○	◎	◎	○	○			J332	



# END MILLS SELECTION CHART **CARBIDE (By Series)**

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page		
							P	H	M	S	N				
<b>END MILL SERIES FOR SLOTTING</b>															
For Key Way Slotting	SQUARE	2		SED2KPG		DC 2-16	☉	☉		○	○		J092		
				SED2KMG		DC 2-16	☉	☉		○	○		J091		
<b>CRN END MILL SERIES</b>															
For Copper Electrodes	SQUARE	2		CRN2MS		DC 0.2-12						☉	○	J084	
	LONG NECK SQUARE			CRN2XL		DC 0.2-6							☉	○	J086
	SQUARE	4		CRN4JC		DC 3-12						☉	○	J174	
	BALL	2		CRN2MB		RE 0.2-6						☉	○	J230	
	LONG NECK BALL			CRN2XLB		RE 0.1-3						☉	○	J232	
	RADIUS			CRN2MRB		DC 6-12							☉	○	J277
	LONG NECK CORNER RADIUS			CRN2XLRB		DC 0.5-6							☉	○	J278
<b>DC END MILL SERIES</b>															
For Hard Brittle Materials	BALL	2		DC2SB		RE 0.1-3							J238		
	LONG NECK BALL			DC2XLB		RE 0.1-3								J240	
<b>DFC END MILL SERIES</b>															
For CFRP	SQUARE	4		DFC4JC		DC 6-12							J180		
	SQUARE WITH CROSS-NICK	10 12		DFCJRT		DC 6-12							J195		

\* DC : Cutting Diameter  
\* RE : Ball Nose End Mill Radius




SOLID END MILLS

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P	H	M	S	N		















**DF END MILL SERIES**

For Graphite	SQUARE	4		DF4JC		DC 3-12								
	LONG NECK SQUARE		DF4XL		DC 1-12									
	BALL	2		DF2MB		RE 3-6								
	LONG NECK BALL		DF2XLB		RE 0.1-3									
	NEW		DF2XLBF		RE 0.3-1.5									
	TAPER NECK BALL	3		DF3XB		RE 0.5-2								
	LONG NECK CORNER RADIUS	4		DFPSRB		DC 0.5-12								

**DLC END MILL SERIES**





























For Aluminium Alloys	SQUARE	2		DLC2MA		DC 1-20								
	BALL		DLC2MB		RE 0.1-10									

**ALIMASTER END MILL SERIES**











For Aluminium Alloys	SQUARE	2		C2SA		DC 3-20								
				C2MA		DC 1-20								
				C2LA		DC 1-20								
				C2MHA		DC 3-25								
		3		C3SA		DC 10-26								
	TAPER BALL	4		C4LATB		RE 0.5-2								
	RADIUS	3		C3SARB		DC 12-25								

J  
SOLID END MILLS

# END MILLS SELECTION CHART **CARBIDE (By Series)**

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material							Page		
							P	H	M	S	N	Copper Alloy	Aluminium Alloy			
<b>ALIMASTER END MILL SERIES</b>																
For Aluminium Alloys	ROUGHING	3		CSRA	 Roughing end mill, Short cut length, 3 flute, For aluminium alloy	DC 10-25								◎	J372	
				CMRA	 Roughing end mill, Medium cut length, 3 flute, For aluminium alloy	DC 3-25									◎	J374
	ROUGHING RADIUS		CSRARB	 Corner radius roughing end mill, Short cut length, 3 flute, For aluminium alloy	DC 10-25									◎	J370	
<b>CARBIDE END MILL SERIES</b>																
General Use	SQUARE	2		C2SS	 End mill, Short cut length, 2 flute	DC 0.4-6	○	○			○	○	○	○	J094	
				C2MS	 End mill, Medium cut length, 2 flute	DC 1-20	○	○			○	○	○	○	J095	
				C2JS	 End mill, Semi long cut length, 2 flute	DC 1-25	○	○			○	○	○	○	J099	
			C2LS	 End mill, Long cut length, 2 flute	DC 1-20	○	○			○	○	○	○	J100		
		4		C4MC	 End mill, Medium cut length, 4 flute, Center cutting	DC 3-20	○	○			○	○	○	○	J181	
				C4JC	 End mill, Semi long cut length, 4 flute, Center cutting	DC 3-25	○	○			○	○	○	○	J182	
				C4LC	 End mill, Long cut length, 4 flute, Center cutting	DC 3-20	○	○			○	○	○	○	J183	
			C2MB	 Ball nose end mill, Medium cut length, 2 flute	RE 0.5-7.5	◎	○			○	○	○	○	J252		
	High Helix	SQUARE	4		SEE2L	 End mill, Long cut length, 2 flute	DC 3-20	◎	○			○	○	○	○	J110
					SEE4L	 End mill, Long cut length, 4 flute	DC 3-25	○	○			○	○	○	○	J186
For Aluminium Alloys			SEG4SA	 End mill, Medium cut length, 4 flute, Irregular spiral helix angle, For aluminium alloy	DC 6-25								○	◎	J185	









\* DC : Cutting Diameter  
\* RE : Ball Nose End Mill Radius

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page
							P	H	M	S	N		
<b>CBN END MILL SERIES</b>													
For Hardened Steels	SQUARE	1		GBE	 End mill, 1 flute, Brazed type (CBN)	DC 6-12							J376
	LONG NECK BALL	2		CBN2XLB	 Ball nose, Short cut length, 2 flute, Long neck	RE 0.2-1		○	○	○			J236
	LONG NECK CORNER RADIUS			CBN2XLRB	 Corner radius end mill, Medium cut length, 2 flute, Long neck	DC 0.5-2		○	○	○			J280
<b>CERAMIC END MILLS</b>													
For Heat Resistant Alloy	RADIUS	4		CE4SRB	 Corner radius end mill, short cut length, 4 flute	DC 6-12						○	J338
		6		CE6SRB	 Corner radius end mill, short cut length, 6 flute	DC 6-12						○	J338



























# END MILLS SELECTION CHART **HSS (By Shape)**

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Work Material						Page												
							P	H	M	S	N														
<b>SQUARE</b>																									
1	For Aluminium Sashes			1MA		DC 3-8							◎	J378											
				1LA		DC 4-12									◎	J379									
2	General Use			VA2SS		DC 3-20	◎	○			○	○			J380										
				VA2MS		DC 3-40	◎	○			○	○				J382									
				2SS		DC 0.5-20	◎	○			○	○		○		J384									
				2MS		DC 1-60	◎	○			○	○		○		J386									
				2LS		DC 1-40	◎	○			○	○		○		J388									
				2MK		DC 3-20	◎	○			○			○		J391									
	For Key Way Slotting			2MS		DC 1-60	◎	○			○	○			J386										
2LS				DC 1-40	◎	○			○	○		○		J388											
2	For Aluminium Alloys			S2SDA		DC 3-20							○	◎	J392										
	3			For Difficult-to-cut Materials		VAMH		DC 5-30	◎	○			◎	○											
4		General Use															VA4MC		DC 3-30	◎	○			○	○
	4				4MC		DC 2.5-40	◎	○			○	○												
																4LC									

\* 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				
<b>ROUGHING</b>							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	Aluminium Alloy	
<b>4 5 6</b>	<b>For Roughing</b>		<b>VASFPR</b>		Roughing end mill, Short cut length, 4–6 flute, Fine pitch form	DC 5–50	⊙	○			⊙	○			<b>J402</b>
			<b>VAMFPR</b>		Roughing end mill, Medium cut length, 4–6 flute, Fine pitch form	DC 5–50	⊙	○			⊙	○			<b>J404</b>
			<b>VAMR</b>		Roughing end mill, Medium cut length, 4–6 flute	DC 5–50	⊙	○			⊙	○			<b>J406</b>
			<b>MR</b>		Roughing end mill, Medium cut length, 4–6 flute	DC 5–50	⊙	○			○	○		○	<b>J408</b>

# END MILLS SELECTION CHART HSS (By Series)

Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material							Page
							P	H	M	S	N			
<b>VIOLET END MILLS</b>														
General Use	SQUARE	2		VA2SS	 End mill, Short cut length, 2 flute	DC 3-20	⊙	○			○	○		J380
				VA2MS	 End mill, Medium cut length, 2 flute	DC 3-40	⊙	○			○	○		J382
		4		VA4MC	 End mill, Medium cut length, 4 flute	DC 3-30	⊙	○			○	○		J396
For Difficult-to-cut Materials	SQUARE	2 3 4		VAMH	 End mill, Medium cut length, 2-4 flute	DC 5-30	⊙	○			⊙	○		J393
			For Roughing	ROUGHING	4 5 6		VASFPR	 Roughing end mill, Short cut length, 4-6 flute, Fine pitch form	DC 5-50	⊙	○			⊙
	VAMFPR	 Roughing end mill, Medium cut length, 4-6 flute, Fine pitch form				DC 5-50	⊙	○			⊙	○	J404	
	VAMR	 Roughing end mill, Medium cut length, 4-6 flute			DC 5-50	⊙	○			⊙	○	J406		
<b>TWO-FLUTE END MILLS</b>														
General Use	SQUARE	2		2SS	 End mill, Short cut length, 2 flute	DC 0.5-20	⊙	○			○	○	○	J384
				2MS	 End mill, Medium cut length, 2 flute	DC 1-60	⊙	○			○	○	○	J386
				2LS	 End mill, Long cut length, 2 flute	DC 1-40	⊙	○			○	○	○	J388
For Key Way Slotting	SQUARE			2MK	 End mill, Short cut length, 2 flute, For key ways	DC 3-20	⊙	○			○		○	J391
<b>FOUR-FLUTE END MILLS</b>														
General Use	SQUARE	4		4MC	 End mill, Medium cut length, 4 flute, Center cutting	DC 2.5-40	⊙	○			○	○	○	J398
				4LC	 End mill, Long cut length, 4 flute, Center cutting	DC 3-40	⊙	○			○	○	○	J400

\* DC : Cutting Diameter



Applications, Features	Type	No. of Flutes	Coating or Substrate	Product Code	Shape	Size Range	Work Material								Page
							P	H	M	S	N	Copper Alloy	Aluminium Alloy		
<b>ROUGHING END MILLS</b>															
For Roughing	ROUGHING	4 5 6		MR	 Roughing end mill, Medium cut length, 4–6 flute	DC 5–50	<input checked="" type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>J408</b>	
<b>LIGHT ALLOY STEEL END MILLS</b>															
For Aluminium Sashes	SQUARE	1		1MA	 End mill, Medium cut length, 1 flute	DC 3–8							<input checked="" type="checkbox"/>	<b>J378</b>	
				1LA	 End mill, Long cut length, 1 flute	DC 4–12								<input checked="" type="checkbox"/>	<b>J379</b>
For Aluminium Alloys		2		S2SDA	 End mill, Short cut length, 2 flute, For aluminium alloy	DC 3–20						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>J392</b>	



# SOLID END MILLS

## MS2SS

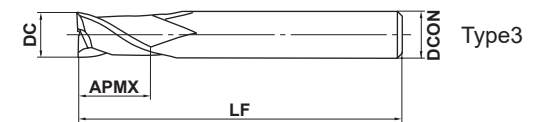
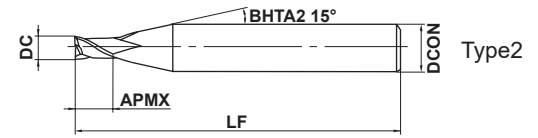
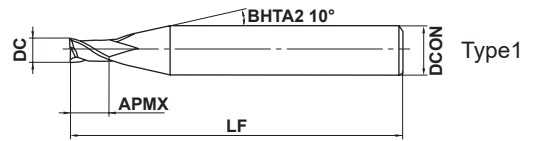
End mill, Short cut length, 2 flute



DC<3

DC≥3

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	Aluminium 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.

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

● : Inventory maintained in Japan.

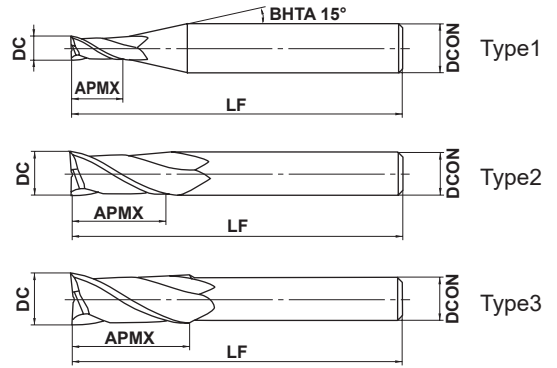
# MS2MS

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	Aluminium Alloy
○	○	○		○	○	○	



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● 2 flute end mill for general use.

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
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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID 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
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

● : Inventory maintained in Japan.

# MS2SS

End mill, Short cut length, 2 flute

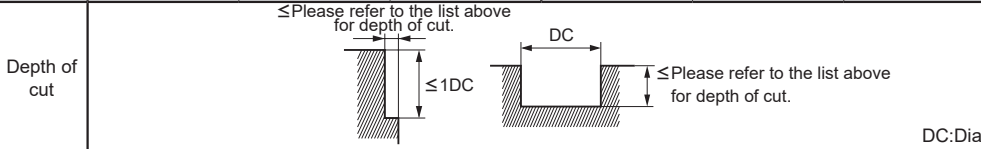
# MS2MS

End mill, Medium cut length, 2 flute

CARBIDE

## RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21			Hardened steel (45—55HRC) AISI H13		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>0.1</b>	40000	40	0.001	40000	40	0.001
<b>0.2</b>	40000	100	0.002	40000	100	0.002
<b>0.3</b>	40000	200	0.005	40000	200	0.005
<b>0.4</b>	40000	600	0.01	40000	600	0.01
<b>0.5</b>	40000	1000	0.015	40000	960	0.015
<b>0.6</b>	40000	1200	0.02	40000	1200	0.02
<b>0.7</b>	40000	1400	0.02	40000	1400	0.02
<b>0.8</b>	40000	1600	0.03	40000	1600	0.03
<b>0.9</b>	40000	1800	0.04	40000	1600	0.04
<b>1</b>	40000	2000	0.06	32000	1600	0.06
<b>1.5</b>	40000	3000	0.12	32000	1900	0.08
<b>2</b>	30000	3000	0.18	24000	1900	0.10
<b>2.5</b>	24000	2600	0.25	19000	1600	0.13
<b>3</b>	20000	2300	0.30	16000	1400	0.15
<b>4</b>	15000	2000	0.40	12000	1200	0.20
<b>5</b>	12000	1600	0.50	9000	900	0.25
<b>6</b>	10000	1400	0.60	7000	700	0.30
<b>8</b>	8000	1000	0.80	5600	550	0.40
<b>10</b>	6400	900	1.00	4500	500	0.50
<b>12</b>	5400	820	1.00	3800	450	0.50
<b>16</b>	2400	380	3.00	1200	100	0.80
<b>20</b>	1900	320	4.00	1000	80	1.00



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

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↵

SOLID END MILLS

# SOLID END MILLS

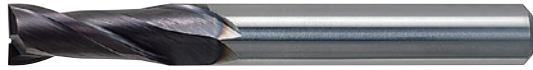
## MS2MD

End mill, Medium cut length, 2 flute



DC < 3 DC ≥ 3

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	Aluminium Alloy
○	○	○		○	○		



	$1 \leq DC \leq 12$				
	$0$ - 0.020				
	$4 \leq DCON \leq 6$	$8 \leq DCON \leq 10$	$DCON = 12$		
	$0$ - 0.008	$0$ - 0.009	$0$ - 0.011		

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

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

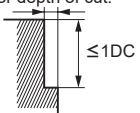
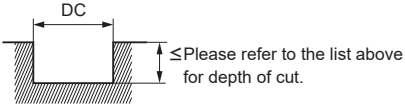
● : Inventory maintained in Japan.

CARBIDE  
 SQUARE  
 BALL  
 RADIUS  
 TAPER  
 BARREL  
 ROUGHING  
 SOLID END MILLS

## 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			AISI H13		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	2000	0.06	32000	1600	0.06
<b>1.5</b>	40000	3000	0.12	32000	1900	0.08
<b>2</b>	30000	3000	0.18	24000	1900	0.10
<b>2.5</b>	24000	2600	0.25	19000	1600	0.13
<b>3</b>	20000	2300	0.30	16000	1400	0.15
<b>4</b>	15000	2000	0.40	12000	1200	0.20
<b>5</b>	12000	1600	0.50	9000	900	0.25
<b>6</b>	10000	1400	0.60	7000	700	0.30
<b>8</b>	8000	1000	0.80	5600	550	0.40
<b>10</b>	6400	900	1.00	4500	500	0.50
<b>12</b>	5400	820	1.00	3800	450	0.50

Depth of cut	<p>≤Please refer to the list above for depth of cut.</p> 	<p>DC</p> 	DC: Dia.

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

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

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.

# SOLID END MILLS

## MS2JS

End mill, Semi long cut length, 2 flute



TOOL NEWS

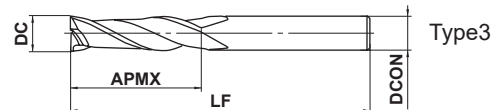
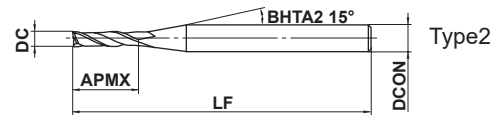
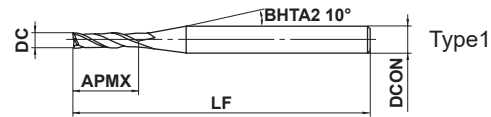
DC<3

DC≥3

DC<3

DC≥3

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	Aluminium 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.

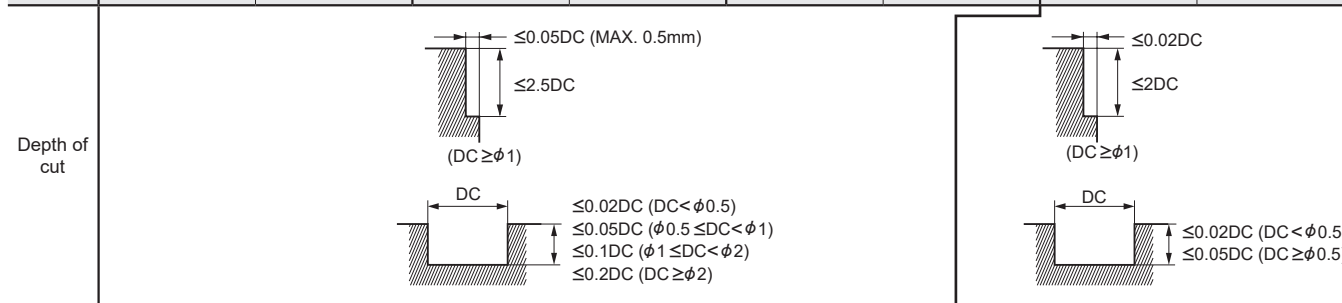
(mm)

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

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
0.1	40000	— (40)	40000	— (40)	40000	— (35)	40000	— (25)
0.2	40000	— (45)	40000	— (45)	40000	— (35)	32000	— (25)
0.3	40000	— (55)	32000	— (45)	27000	— (35)	21000	— (25)
0.4	32000	— (60)	24000	— (45)	20000	— (35)	16000	— (25)
0.5	25000	— (60)	19000	— (45)	16000	— (35)	13000	— (25)
0.6	21000	— (60)	16000	— (45)	13000	— (35)	11000	— (25)
0.7	18000	— (60)	14000	— (45)	11000	— (35)	9100	— (25)
0.8	16000	— (60)	12000	— (45)	9900	— (35)	8000	— (25)
0.9	14000	— (60)	11000	— (45)	8800	— (35)	7100	— (25)
1	13000	60 (60)	9500	45 (45)	8000	35 (35)	6400	25 (25)
1.5	8500	60 (60)	6400	45 (45)	5300	35 (35)	4200	25 (25)
2	6400	60 (60)	4800	45 (45)	4000	35 (35)	3200	25 (25)
2.5	5100	60 (60)	3800	45 (45)	3200	40 (40)	2500	25 (25)
3	4200	65 (60)	3400	55 (45)	2600	40 (40)	2100	25 (25)
4	3400	80 (60)	2700	65 (45)	2100 (1600)	50 (30)	1700	35 (25)
5	2900	100 (60)	2300	80 (45)	1800 (1350)	60 (30)	1500	40 (25)
6	2500	120 (60)	2000	100 (50)	1500 (1100)	75 (30)	1300	50 (25)
8	1900	130 (60)	1500	100 (50)	1200 (900)	80 (30)	1000	50 (25)
10	1600	130 (60)	1300	100 (50)	950 (710)	75 (30)	800	50 (25)
12	1300	120 (60)	1100	100 (50)	800 (600)	75 (30)	670	50 (25)



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

DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



# SOLID END MILLS

## MS2LS

End mill, Long cut length, 2 flute



TOOL NEWS

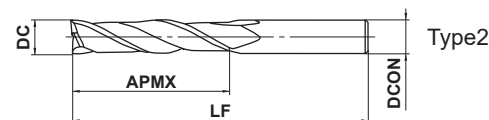
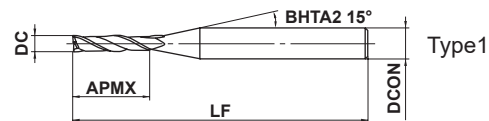
DC<3

DC≥3

DC<3

DC≥3

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	Aluminium Alloy
○	○	○	○	○	○	○	○



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

● 2 flute end mill for general use.

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

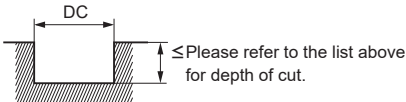
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Slotting

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
0.2	40000	400	0.001	30000	250	0.001
0.3	40000	600	0.005	35000	420	0.005
0.4	40000	700	0.007	30000	420	0.007
0.5	40000	800	0.01	24000	380	0.01
0.6	33000	800	0.015	21000	480	0.01
0.7	28000	800	0.015	18000	480	0.015
0.8	25000	800	0.02	16000	480	0.02
0.9	22000	800	0.03	15000	500	0.03
1	20000	800	0.04	13000	500	0.04
1.5	13000	800	0.10	9000	500	0.10
2	10000	800	0.15	6700	500	0.15
2.5	9000	800	0.20	6000	500	0.20
3	8000	800	0.20	5200	460	0.20
4	6000	600	0.20	4000	340	0.20
5	4800	480	0.30	3200	280	0.20
6	4000	400	0.30	2600	210	0.20
8	3000	300	0.30	2000	170	0.30
10	2400	240	0.30	1600	140	0.30
12	2000	200	0.30	1300	110	0.30

Depth of cut



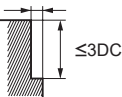
DC: Dia.

### ■ Side milling

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel (–30HRC)			Alloy steel, Tool steel, Pre-hardened steel		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
3	3500	370	0.05	2600	250	0.03
4	2800	370	0.06	2100	200	0.03
5	2200	330	0.06	1700	160	0.03
6	1800	300	0.06	1500	140	0.03
8	1600	270	0.08	1100	140	0.04
10	1400	240	0.10	900	140	0.05
12	1200	200	0.10	750	120	0.06

Depth of cut

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



DC: Dia.

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

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

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.

# SOLID END MILLS

## MS2XL

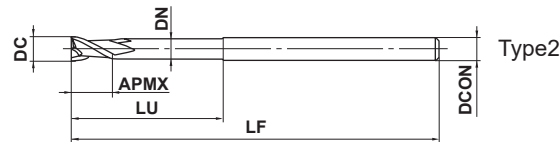
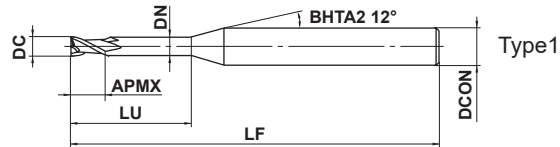
End mill, Short cut length, 2 flute, Long neck



TOOL NEWS

DC<0.4 DC≥0.4

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	Aluminium Alloy
○	○	○		○	○	○	



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

● 2 flute long neck end mill.

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
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

● : Inventory maintained in Japan.

(mm)

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## MS2XL

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

(mm)

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

● : Inventory maintained in Japan.

CARBIDE

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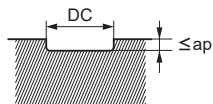
ROUGHING

SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
0.2	0.5	40000	600	0.004
	1	40000	400	0.001
0.3	1	40000	650	0.007
	3	40000	500	0.002
	9	22000	150	0.001
0.4	2	40000	800	0.007
	4	40000	800	0.003
	12	17000	150	0.001
0.5	2	40000	950	0.01
	6	40000	700	0.003
	10	25000	400	0.002
	15	14000	150	0.001
0.6	2	40000	950	0.01
	6	40000	800	0.005
	10	25000	450	0.003
	18	12000	150	0.001
0.7	2	40000	1000	0.02
	6	40000	900	0.01
	8	30000	700	0.005
	10	11000	300	0.005
0.8	4	40000	1200	0.02
	8	40000	1000	0.01
	12	25000	400	0.003
	24	10000	150	0.001
0.9	6	40000	1300	0.02
	10	35000	1000	0.01
	15	9000	400	0.003
1	6	40000	1600	0.04
	8	40000	1600	0.03
	12	30000	1000	0.02
	20	15000	400	0.005
	30	8000	150	0.001
1.2	6	40000	1900	0.06
	8	40000	1900	0.04
	12	25000	1000	0.03
	20	6500	150	0.01

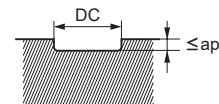
Depth of cut



DC:Dia.

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
1.5	6	40000	2400	0.10
	10	30000	1800	0.05
	20	15000	600	0.02
	30	7500	300	0.005
1.6	45	5000	150	0.001
	6	40000	2400	0.12
	10	30000	1800	0.07
	16	20000	1000	0.04
2	6	40000	2400	0.18
	10	30000	1800	0.10
	16	20000	1000	0.06
	30	8000	500	0.04
	40	6000	250	0.01
	60	4200	150	0.003
2.5	8	25000	2500	0.20
	16	18000	1700	0.10
	20	12000	1000	0.08
	40	8000	400	0.03
3	50	4000	150	0.015
	8	20000	2000	0.30
	16	15000	1400	0.15
	20	10000	800	0.10
4	40	5000	250	0.02
	50	3700	150	0.010
	12	15000	3000	0.30
	20	11000	2200	0.22
5	30	6400	1200	0.12
	40	4500	400	0.05
	50	2800	150	0.018
	60	1800	60	0.005
6	16	12000	2500	0.35
	35	5100	750	0.15
	60	2200	150	0.02
6	20	10000	2000	0.40
	40	4200	800	0.20
	60	1900	150	0.10

Depth of cut



DC:Dia.

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SOLID END MILLS

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

Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

# SOLID END MILLS

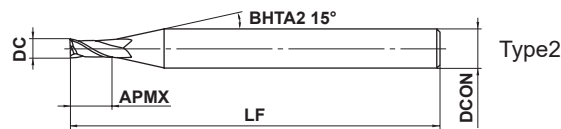
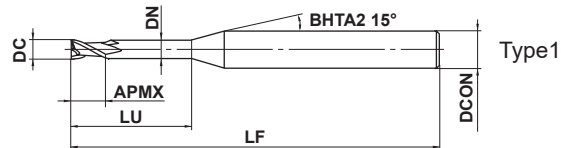
## MS2XL6

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



TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	



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

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

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

● : Inventory maintained in Japan.

(mm)

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

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ROUGHING

↩

SOLID END MILLS



# SOLID END MILLS

## MS2XL6

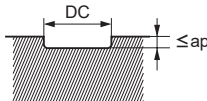
End mill, Short cut length, 2 flute, 6mm shank

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel (–30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
0.3	—	40000	500–1000	0.01	30000	300–800	0.01
	1.5			0.007			0.007
0.4	1	40000	500–1000	0.015	30000	300–800	0.015
	2			0.01			0.01
0.5	1.3	40000	500–1000	0.02	30000	300–800	0.02
	2.5			0.013			0.013
0.6	1.5	33000	500–1000	0.03	25000	300–800	0.03
	3			0.018			0.018
0.7	1.8	29000	500–1000	0.04	22000	300–800	0.04
	3.5			0.025			0.025
0.8	2	25000	500–1000	0.06	20000	300–800	0.06
	4			0.03			0.03
0.9	2.3	22000	500–1000	0.08	18000	300–800	0.08
	4.5			0.05			0.05
1	2.5	20000	500–1000	0.1	16000	300–800	0.1
	5			0.07			0.07
1.1	2.8	18000	500–1000	0.12	14000	300–800	0.12
	5.5			0.08			0.08
1.2	3	16000	500–1000	0.12	13000	300–800	0.12
	6			0.08			0.08
1.3	3.3	15000	500–1000	0.12	12000	300–800	0.12
	6.5			0.08			0.08
1.4	3.5	14000	500–1000	0.12	11000	300–800	0.12
	7			0.08			0.08
1.5	3.8	13000	500–1000	0.15	10000	300–800	0.15
	7.5			0.1			0.1

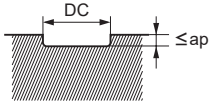
Depth of cut



DC: Dia.

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

Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

Work Material		Carbon steel, Cast iron, Alloy steel (–30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>1.6</b>	<b>4</b>	12000	500–1000	0.15	10000	300–800	0.15
	<b>8</b>			0.1			0.1
<b>1.7</b>	<b>4.3</b>	12000	500–1000	0.17	9500	300–800	0.17
	<b>8.5</b>			0.12			0.12
<b>1.8</b>	<b>4.5</b>	11000	500–1000	0.17	9000	300–800	0.17
	<b>9</b>			0.12			0.12
<b>1.9</b>	<b>4.8</b>	10000	500–1000	0.17	9000	300–800	0.17
	<b>9.5</b>			0.12			0.12
<b>2</b>	<b>5</b>	10000	500–1000	0.2	9000	300–800	0.2
	<b>10</b>			0.15			0.15
<b>2.1</b>	<b>5.3</b>	9800	500–1000	0.2	9000	300–800	0.2
	<b>10.5</b>			0.15			0.15
<b>2.2</b>	<b>5.5</b>	9600	500–1000	0.2	9000	300–800	0.2
	<b>11</b>			0.15			0.15
<b>2.3</b>	<b>5.8</b>	9400	500–1000	0.2	8800	300–800	0.2
	<b>11.5</b>			0.15			0.15
<b>2.4</b>	<b>6</b>	9200	500–1000	0.25	8700	300–800	0.25
	<b>12</b>			0.2			0.2
<b>2.5</b>	<b>6.3</b>	9000	500–1000	0.25	8500	300–800	0.25
	<b>12.5</b>			0.2			0.2
Depth of cut							

DC: Dia.

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

Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

# SOLID END MILLS

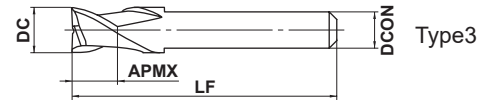
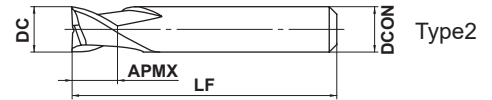
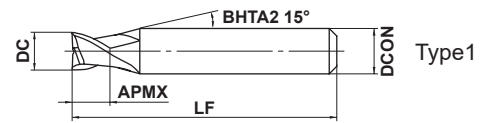
## MS2ES

End mill, 2 flute, For small automatic lathes



TOOL NEWS

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	Aluminium Alloy
○	○	○	○	○	○	○	○



$3 \leq DC \leq 12$				
0				
- 0.020				



$4 \leq DCON \leq 6$	$7 \leq DCON \leq 10$			
0	0			
- 0.008	- 0.009			

● 2 flute end mill.

Overall length 35mm

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

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

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	10000	600	7000	400	6000	300	5000	120
<b>4</b>	7500	600	5200	400	4500	300	4000	120
<b>5</b>	6000	600	4200	400	3600	300	3200	120
<b>6</b>	5000	600	3500	400	3000	300	2700	120
<b>7</b>	4500	560	3000	360	2700	280	2300	110
<b>8</b>	4000	520	2800	350	2400	260	2000	110
<b>10</b>	3200	450	2200	300	1900	230	1600	100
<b>12</b>	2700	410	1900	270	1600	210	1300	100

Depth of cut	Carbon steel, Cast iron, Alloy steel (-30HRC)		Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Hardened steel (45-55HRC)	

DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

# SOLID END MILLS

## VF2MD

End mill, Medium cut length, 2 flute, For hardened materials

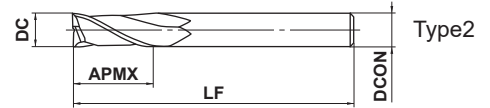
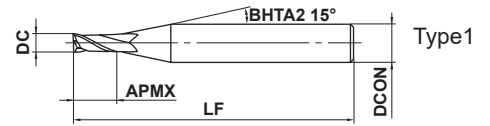


TOOL NEWS

DC < 3

DC ≥ 3

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	Aluminium Alloy
	○	◎	◎				



	0.5 ≤ DC ≤ 6				
	0 - 0.020				
	4 ≤ DCON ≤ 6				
	0 - 0.008				

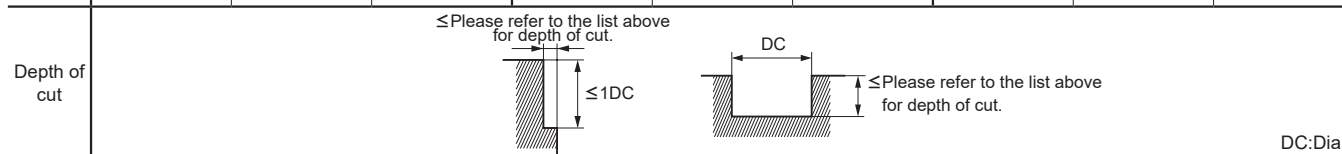
● 2 flute end mill suitable for high-speed machining of hardened steel.

								(mm)
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type	
VF2MDD0050	0.5	1.3	40	4	2	●	1	
VF2MDD0100	1	2.5	40	4	2	●	1	
VF2MDD0150	1.5	3.8	40	4	2	●	1	
VF2MDD0200	2	5	40	4	2	●	1	
VF2MDD0250	2.5	6.3	40	4	2	●	1	
VF2MDD0300	3	7.5	50	6	2	●	1	
VF2MDD0400	4	10	50	6	2	●	1	
VF2MDD0500	5	12.5	50	6	2	●	1	
VF2MDD0600	6	15	50	6	2	●	2	

● : Inventory maintained in Japan.

## 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			AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>0.5</b>	40000	1000	0.015	40000	960	0.015	30000	600	0.01
<b>1</b>	40000	2000	0.06	32000	1600	0.06	16000	550	0.05
<b>1.5</b>	40000	3000	0.12	32000	1900	0.08	10600	500	0.08
<b>2</b>	30000	3000	0.18	24000	1900	0.10	8100	400	0.1
<b>2.5</b>	24000	2600	0.25	19000	1600	0.13	6400	350	0.13
<b>3</b>	20000	2300	0.30	16000	1400	0.15	5400	300	0.15
<b>4</b>	15000	2000	0.40	12000	1200	0.20	4000	240	0.2
<b>5</b>	12000	1600	0.50	9000	900	0.25	3200	190	0.2
<b>6</b>	10000	1400	0.60	7000	700	0.30	2700	160	0.2



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

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

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

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SOLID END MILLS

# SOLID END MILLS

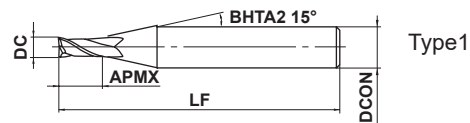
## VF2MV

End mill, Medium cut length, 2 flute, Irregular helix flutes



TOOL NEWS

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	Aluminium 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	

● : Inventory maintained in Japan.

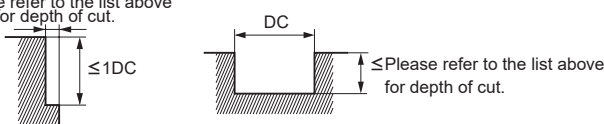


## RECOMMENDED CUTTING CONDITIONS

Work Material	Alloy steel, Tool steel, Pre-hardened steel			Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
	AISI H13, AISI W1-10, AISI P21			AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ae (mm)
<b>0.5</b>	40000	1000	0.015	40000	960	0.015	30000	600	0.01
<b>1</b>	40000	2000	0.06	32000	1600	0.06	16000	550	0.05
<b>1.5</b>	40000	3000	0.12	32000	1900	0.08	10600	500	0.08
<b>2</b>	30000	3000	0.18	24000	1900	0.10	8100	400	0.1
<b>2.5</b>	24000	2600	0.25	19000	1600	0.13	6400	350	0.13
<b>3</b>	20000	2300	0.30	16000	1400	0.15	5400	300	0.15
<b>4</b>	15000	2000	0.40	12000	1200	0.20	4000	240	0.2
<b>5</b>	12000	1600	0.50	9000	900	0.25	3200	190	0.2
<b>6</b>	10000	1400	0.60	7000	700	0.30	2700	160	0.2

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 steels, titanium and heat-resistant alloys, the VFMHV is recommended.

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 workpiece 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

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TAPER

BARREL

ROUGHING

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SOLID END MILLS

# SOLID END MILLS

## VF2XL

End mill, 2 flute, Long neck

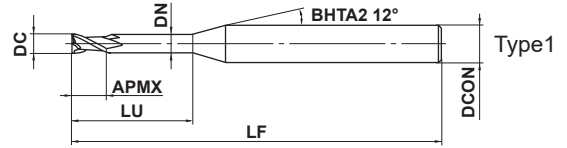


TOOL NEWS

DC<3

DC=3

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	Aluminium Alloy
○	◎	◎	◎				



Type 1

	0.1 ≤ DC ≤ 3				
	0 - 0.020				
	4 ≤ DCON ≤ 6				
	0 - 0.008				

● 2 flute long neck end mill for high-speed machining of hardened steels.

(mm)

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
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

● : Inventory maintained in Japan.

(mm)

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

# SOLID END MILLS

## VF2XL

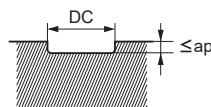
End mill, 2 flute, Long neck

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45—55HRC)			Hardened steel (55—62HRC)			
		AISI H13			AISI D2			
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	
0.1	0.5	40000	100	0.002	40000	80	0.001	
	0.2	0.6	40000	400	0.004	40000	360	0.004
		1	40000	300	0.003	40000	250	0.002
0.2	1.5	40000	200	0.002	40000	150	0.001	
	0.3	1	40000	500	0.006	40000	450	0.004
		2	40000	400	0.003	38000	350	0.002
0.3	3	38000	250	0.002	36000	200	0.001	
	0.4	1	40000	800	0.008	36000	500	0.006
		2	40000	500	0.007	30000	350	0.005
0.4	4	36000	300	0.004	27000	200	0.003	
	0.5	2	40000	800	0.01	30000	600	0.009
		4	36000	600	0.008	27000	450	0.007
0.5	6	30000	400	0.005	22000	300	0.004	
	0.6	2	40000	1000	0.015	30000	700	0.012
		4	36000	800	0.01	27000	500	0.01
0.6	6	30000	600	0.006	22000	350	0.006	
	0.8	4	36000	1200	0.03	27000	900	0.02
		6	30000	900	0.02	22000	650	0.015
0.8	8	24000	600	0.01	18000	450	0.008	
	10	20000	400	0.008	15000	300	0.005	
	1	4	32000	1600	0.05	24000	1100	0.04
6		32000	1400	0.04	24000	1000	0.03	
1	8	28000	1000	0.03	21000	750	0.02	
	10	28000	800	0.02	21000	600	0.015	
	12	24000	500	0.02	18000	370	0.01	
1.5	6	22000	1200	0.08	16000	900	0.06	
	8	22000	1100	0.07	16000	800	0.05	
	10	22000	1000	0.06	16000	750	0.04	
1.5	12	20000	800	0.05	15000	600	0.03	
	16	18000	500	0.03	13000	350	0.02	
	2	6	16000	1000	0.15	12000	750	0.15
8		16000	1000	0.15	12000	750	0.1	
10		16000	800	0.1	12000	600	0.08	
2	12	16000	800	0.08	12000	600	0.06	
	16	15000	600	0.06	11000	450	0.05	
	20	14000	500	0.05	10000	350	0.04	
3	12	11000	800	0.2	8200	600	0.15	
	16	11000	600	0.15	8200	450	0.15	
	20	11000	500	0.1	8200	350	0.1	

Depth of cut



DC: Dia.

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

Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

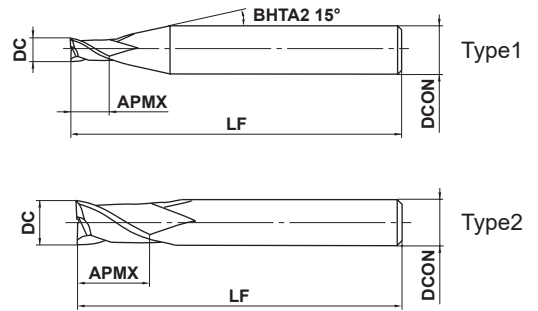
# VC2SS

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	Aluminium Alloy
○	◎	○		○	○		



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

● 2 flute end mill for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC2SSD0030	0.3	0.6	50	6	2	●	1
VC2SSD0040	0.4	0.8	50	6	2	●	1
VC2SSD0050	0.5	0.8	50	6	2	●	1
VC2SSD0060	0.6	1	50	6	2	●	1
VC2SSD0070	0.7	1	50	6	2	●	1
VC2SSD0080	0.8	1.3	50	6	2	●	1
VC2SSD0090	0.9	1.3	50	6	2	●	1
VC2SSD0100	1	1.5	50	6	2	●	1
VC2SSD0110	1.1	1.5	50	6	2	●	1
VC2SSD0120	1.2	2	50	6	2	●	1
VC2SSD0130	1.3	2	50	6	2	●	1
VC2SSD0140	1.4	2	50	6	2	●	1
VC2SSD0150	1.5	2.5	50	6	2	●	1
VC2SSD0160	1.6	2.5	50	6	2	●	1
VC2SSD0170	1.7	2.5	50	6	2	●	1
VC2SSD0180	1.8	3	50	6	2	●	1
VC2SSD0190	1.9	3	50	6	2	●	1
VC2SSD0200	2	3	50	6	2	●	1
VC2SSD0210	2.1	3	50	6	2	●	1
VC2SSD0220	2.2	3.5	50	6	2	●	1
VC2SSD0230	2.3	3.5	50	6	2	●	1
VC2SSD0240	2.4	3.5	50	6	2	●	1
VC2SSD0250	2.5	4	50	6	2	●	1
VC2SSD0260	2.6	4	50	6	2	●	1
VC2SSD0270	2.7	4	50	6	2	●	1
VC2SSD0280	2.8	4	50	6	2	●	1
VC2SSD0290	2.9	4.5	50	6	2	●	1
VC2SSD0300	3	4.5	50	6	2	●	1
VC2SSD0350	3.5	5.5	50	6	2	●	1
VC2SSD0400	4	6	50	6	2	●	1
VC2SSD0450	4.5	7	50	6	2	●	1
VC2SSD0500	5	7.5	50	6	2	●	1
VC2SSD0550	5.5	8.5	50	6	2	●	1
VC2SSD0600	6	9	50	6	2	●	2

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VC2SS

End mill, Short cut length, 2 flute

(mm)

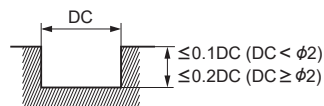
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC2SSD0800	8	12	60	8	2	●	2
VC2SSD1000	10	15	70	10	2	●	2
VC2SSD1200	12	18	75	12	2	●	2
VC2SSD1400	14	21	75	16	2	●	1
VC2SSD1500	15	23	80	16	2	●	1
VC2SSD1600	16	24	90	16	2	●	2

## RECOMMENDED CUTTING CONDITIONS

### ■ Slotting

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel (–30HRC) AISI 1050, AISI No 35 B, AISI P20		Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		Hardened steel (45–55HRC) AISI H13	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>0.3</b>	40000	190	40000	190	40000	100
<b>0.5</b>	40000	380	40000	380	30000	140
<b>1</b>	30000	720	20000	480	15000	180
<b>1.5</b>	20000	960	14000	670	10000	190
<b>2</b>	15000	1100	10000	720	8000	200
<b>3</b>	10000	1150	7000	800	5000	210
<b>4</b>	7500	900	5200	620	4000	200
<b>5</b>	6000	720	4200	500	3200	160
<b>6</b>	5000	600	3500	420	2700	140
<b>8</b>	4000	520	2800	350	2000	120
<b>10</b>	3200	450	2200	290	1600	110
<b>12</b>	2700	410	1900	260	1300	100
<b>16</b>	2000	340	1400	210	1000	90

Depth of cut



DC: Dia.

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

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

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.

● : Inventory maintained in Japan.

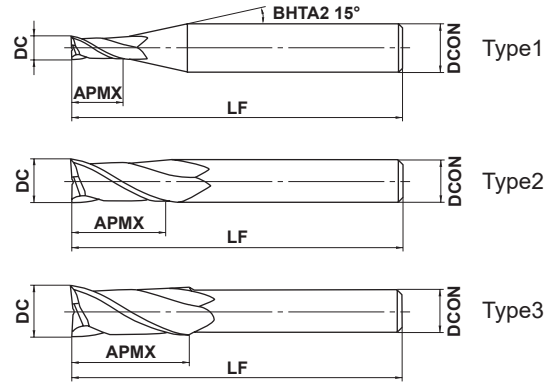
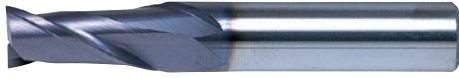
# VC2MS

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	Aluminium Alloy
○	◎	○		○	○		



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	DCON = 3	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25
	$\begin{matrix} 0 \\ -0.006 \end{matrix}$	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$

● 2 flute end mill for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC2MSD0030	0.3	0.6	38	3	2	●	1
VC2MSD0040	0.4	0.8	38	3	2	●	1
VC2MSD0050	0.5	1	38	3	2	●	1
VC2MSD0060	0.6	1.2	38	3	2	●	1
VC2MSD0070	0.7	1.4	38	3	2	●	1
VC2MSD0080	0.8	1.6	38	3	2	●	1
VC2MSD0090	0.9	2	38	3	2	●	1
VC2MSD0100	1	2.5	40	4	2	●	1
VC2MSD0110	1.1	2.5	40	4	2	●	1
VC2MSD0120	1.2	3	40	4	2	●	1
VC2MSD0130	1.3	3	40	4	2	●	1
VC2MSD0140	1.4	3	40	4	2	●	1
VC2MSD0150	1.5	4	40	4	2	●	1
VC2MSD0160	1.6	4	40	4	2	●	1
VC2MSD0170	1.7	4	40	4	2	●	1
VC2MSD0180	1.8	5	40	4	2	●	1
VC2MSD0190	1.9	5	40	4	2	●	1
VC2MSD0200	2	6	40	4	2	●	1
VC2MSD0210	2.1	6	40	4	2	●	1
VC2MSD0220	2.2	6	40	4	2	●	1
VC2MSD0230	2.3	6	40	4	2	●	1
VC2MSD0240	2.4	8	40	4	2	●	1
VC2MSD0250	2.5	8	40	4	2	●	1
VC2MSD0260	2.6	8	40	4	2	●	1
VC2MSD0270	2.7	8	40	4	2	●	1
VC2MSD0280	2.8	8	40	4	2	●	1
VC2MSD0290	2.9	8	40	4	2	●	1
VC2MSD0300	3	8	45	6	2	●	1
VC2MSD0350	3.5	10	45	6	2	●	1
VC2MSD0400	4	11	45	6	2	●	1
VC2MSD0450	4.5	11	45	6	2	●	1
VC2MSD0500	5	13	50	6	2	●	1
VC2MSD0550	5.5	13	50	6	2	●	1
VC2MSD0600	6	13	50	6	2	●	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



# SOLID END MILLS

## VC2MS

End mill, Medium cut length, 2 flute

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC2MSD0650	6.5	16	60	8	2	●	1
VC2MSD0700	7	16	60	8	2	●	1
VC2MSD0750	7.5	16	60	8	2	●	1
VC2MSD0800	8	19	60	8	2	●	2
VC2MSD0850	8.5	19	70	10	2	●	1
VC2MSD0900	9	19	70	10	2	●	1
VC2MSD0950	9.5	19	70	10	2	●	1
VC2MSD1000	10	22	70	10	2	●	2
VC2MSD1050	10.5	22	75	12	2	●	1
VC2MSD1100	11	22	75	12	2	●	1
VC2MSD1150	11.5	22	75	12	2	●	1
VC2MSD1200	12	26	75	12	2	●	2
VC2MSD1250	12.5	26	75	12	2	●	3
VC2MSD1300	13	26	75	12	2	●	3
VC2MSD1400	14	26	75	12	2	●	3
VC2MSD1500	15	30	80	16	2	●	1
VC2MSD1600	16	32	90	16	2	●	2
VC2MSD1700	17	32	90	16	2	●	3
VC2MSD1800	18	32	90	16	2	●	3
VC2MSD1900	19	32	100	20	2	●	1
VC2MSD2000	20	38	100	20	2	●	2
VC2MSD2200	22	38	100	20	2	●	3
VC2MSD2400	24	45	120	25	2	●	1
VC2MSD2500	25	45	120	25	2	●	2

● : Inventory maintained in Japan.

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

## 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			AISI H13		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>0.3</b>	40000	200	0.005	40000	200	0.005
<b>0.5</b>	40000	950	0.015	40000	950	0.015
<b>1</b>	40000	2000	0.06	32000	1600	0.06
<b>1.5</b>	40000	3000	0.12	32000	1900	0.08
<b>2</b>	30000	3000	0.18	24000	1900	0.10
<b>2.5</b>	24000	2600	0.25	19000	1600	0.13
<b>3</b>	20000	2300	0.30	16000	1400	0.15
<b>4</b>	15000	2000	0.40	12000	1200	0.20
<b>5</b>	12000	1600	0.50	9000	900	0.25
<b>6</b>	10000	1400	0.60	7000	700	0.30
<b>8</b>	8000	1000	0.80	5600	550	0.40
<b>10</b>	6400	900	1.00	4500	500	0.50
<b>12</b>	5400	820	1.00	3800	450	0.50
<b>16</b>	2400	380	3.00	1200	100	0.80
<b>20</b>	1900	320	4.00	1000	80	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 shallow, the revolution and feed rate can be increased.

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SQUARE

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BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VC2JS

End mill, Semi long cut length, 2 flute



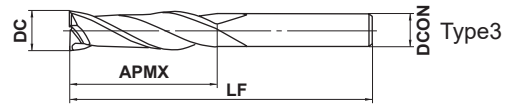
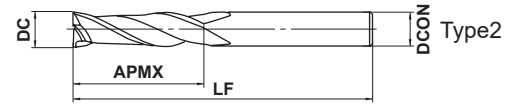
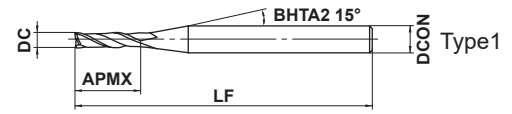
DC<3

DC≥3

DC<3

DC≥3

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	Aluminium 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

● 2 flute end mill with longer cut length than standard.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC2JSD0100	1	3.5	40	4	2	●	1
VC2JSD0150	1.5	5	40	4	2	●	1
VC2JSD0200	2	8	40	4	2	●	1
VC2JSD0250	2.5	10	40	4	2	●	1
VC2JSD0300	3	12	50	6	2	●	1
VC2JSD0350	3.5	15	50	6	2	●	1
VC2JSD0400	4	15	50	6	2	●	1
VC2JSD0450	4.5	15	50	6	2	●	1
VC2JSD0500	5	20	60	6	2	●	1
VC2JSD0550	5.5	20	60	6	2	●	1
VC2JSD0600	6	20	60	6	2	●	2
VC2JSD0650	6.5	25	70	8	2	●	1
VC2JSD0700	7	25	70	8	2	●	1
VC2JSD0750	7.5	25	70	8	2	●	1
VC2JSD0800	8	25	70	8	2	●	2
VC2JSD0850	8.5	25	90	10	2	●	1
VC2JSD0900	9	25	90	10	2	●	1
VC2JSD0950	9.5	25	90	10	2	●	1
VC2JSD1000	10	30	90	10	2	●	2
VC2JSD1050	10.5	30	90	12	2	●	1
VC2JSD1100	11	30	90	12	2	●	1
VC2JSD1150	11.5	30	90	12	2	●	1
VC2JSD1200	12	30	90	12	2	●	2
VC2JSD1300	13	35	90	12	2	●	3
VC2JSD1400	14	40	110	16	2	●	1
VC2JSD1500	15	40	110	16	2	●	1
VC2JSD1600	16	50	110	16	2	●	2
VC2JSD1700	17	50	110	20	2	●	1
VC2JSD1800	18	50	110	20	2	●	1
VC2JSD1900	19	55	110	20	2	●	1
VC2JSD2000	20	55	110	20	2	●	2
VC2JSD2200	22	65	140	25	2	●	1
VC2JSD2400	24	75	140	25	2	●	1
VC2JSD2500	25	75	140	25	2	●	2

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>	13000	60 (60)	9000	35 (35)	6500 (6500)	20 (20)	5700	20 (15)
<b>2</b>	6400	60 (60)	4800	45 (45)	3500 (3500)	30 (30)	3000	25 (15)
<b>3</b>	4200	65 (60)	3400	55 (55)	2600 (2600)	40 (40)	2100	30 (20)
<b>4</b>	3400	80 (60)	2700	65 (30)	2100 (1600)	50 (20)	1700	35 (20)
<b>5</b>	2900	100 (60)	2300	80 (40)	1800 (1350)	60 (25)	1500	40 (20)
<b>6</b>	2500	120 (60)	2000	100 (50)	1500 (1100)	75 (30)	1300	50 (25)
<b>8</b>	1900	130 (60)	1500	100 (50)	1200 (900)	85 (35)	1000	50 (25)
<b>10</b>	1600	130 (60)	1300	100 (50)	950 (710)	75 (30)	800	50 (25)
<b>12</b>	1300	120 (60)	1100	90 (45)	800 (600)	60 (25)	670	40 (20)
<b>16</b>	1000	80 (40)	820	65 (30)	600 (450)	45 (20)	500	30 (15)
<b>20</b>	800	65 (30)	650	50 (25)	480 (360)	40 (15)	400	25 (13)
<b>25</b>	650	50 (25)	520	40 (20)	380 (280)	30 (12)	320	20 (10)

Depth of cut		

( ) : Indicates standard revolution and feed rates for slotting.

DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

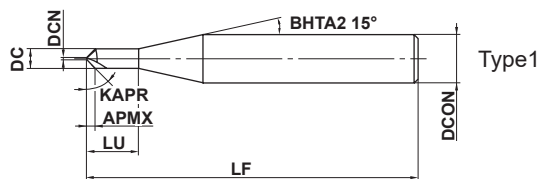
## VC2C

Chamfer cutter, 2 flute



TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	○



	DCN				
	±0.02				
	DCON=6	8≤DCON≤10	DCON=12		
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>		

● 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

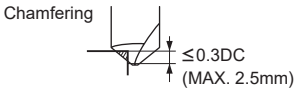
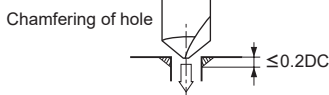
● : Inventory maintained in Japan.

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		Austenitic stainless steel, Titanium alloy		Hardened steel (45-55HRC)	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>2</b>	16000	960	11000	590	9500	460	8000	320
<b>4</b>	8000	480	5600	300	4800	230	4000	160
<b>6</b>	5300	320	3700	200	3200	150	2700	110
<b>8</b>	4000	240	2800	150	2400	120	2000	80
<b>10</b>	3200	190	2200	120	1900	90	1600	60
<b>12</b>	2700	160	1900	100	1600	80	1300	50

Depth of cut		
	DC: Dia.	

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

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## CRN2MS

End mill, Medium cut length, 2 flute, For copper electrodes

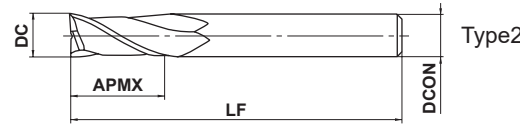
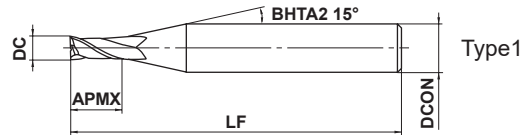


TOOL NEWS

DC < 3

DC ≥ 3

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	Aluminium Alloy
						○	○



0.2 ≤ DC ≤ 12				
0				
- 0.02				



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

● 2 flute end mill with CRN coating for copper electrode machining.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
CRN2MSD0020S04	0.2	0.4	40	4	2	●	1
CRN2MSD0020S06	0.2	0.4	45	6	2	●	1
CRN2MSD0030S04	0.3	0.6	40	4	2	●	1
CRN2MSD0030S06	0.3	0.6	45	6	2	●	1
CRN2MSD0040S04	0.4	0.8	40	4	2	●	1
CRN2MSD0040S06	0.4	0.8	45	6	2	●	1
CRN2MSD0050S04	0.5	1	40	4	2	●	1
CRN2MSD0050S06	0.5	1	45	6	2	●	1
CRN2MSD0060S04	0.6	1.2	40	4	2	●	1
CRN2MSD0070S04	0.7	1.4	40	4	2	●	1
CRN2MSD0080S04	0.8	1.6	40	4	2	●	1
CRN2MSD0080S06	0.8	1.6	45	6	2	●	1
CRN2MSD0090S04	0.9	2	40	4	2	●	1
CRN2MSD0100S04	1	2.5	40	4	2	●	1
CRN2MSD0100S06	1	2.5	45	6	2	●	1
CRN2MSD0110S04	1.1	2.5	40	4	2	●	1
CRN2MSD0120S04	1.2	3	40	4	2	●	1
CRN2MSD0120S06	1.2	3	45	6	2	●	1
CRN2MSD0130S04	1.3	3	40	4	2	●	1
CRN2MSD0140S04	1.4	3	40	4	2	●	1
CRN2MSD0150S04	1.5	4	40	4	2	●	1
CRN2MSD0150S06	1.5	4	45	6	2	●	1
CRN2MSD0160S04	1.6	4	40	4	2	●	1
CRN2MSD0170S04	1.7	4	40	4	2	●	1
CRN2MSD0180S04	1.8	5	40	4	2	●	1
CRN2MSD0190S04	1.9	5	40	4	2	●	1
CRN2MSD0200S06	2	6	45	6	2	●	1
CRN2MSD0250S06	2.5	8	45	6	2	●	1
CRN2MSD0300S06	3	8	45	6	2	●	1
CRN2MSD0400S06	4	11	45	6	2	●	1
CRN2MSD0500S06	5	13	50	6	2	●	1
CRN2MSD0600S06	6	13	50	6	2	●	2
CRN2MSD0800S08	8	19	60	8	2	●	2
CRN2MSD1000S10	10	22	70	10	2	●	2
CRN2MSD1200S12	12	26	75	12	2	●	2

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material	Copper, Copper alloys		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>0.2</b>	40000	600	0.01
<b>0.3</b>	40000	600	0.01
<b>0.4</b>	40000	800	0.01
<b>0.5</b>	40000	960	0.015
<b>0.6</b>	40000	1200	0.02
<b>0.7</b>	40000	1400	0.02
<b>0.8</b>	40000	1600	0.03
<b>0.9</b>	40000	1800	0.04
<b>1</b>	40000	2000	0.06
<b>1.5</b>	40000	3000	0.12
<b>2</b>	30000	3000	0.18
<b>2.5</b>	24000	2600	0.25
<b>3</b>	20000	2300	0.30
<b>4</b>	15000	2000	0.40
<b>5</b>	12000	1600	0.50
<b>6</b>	10000	1400	0.60
<b>8</b>	8000	1000	0.80
<b>10</b>	6400	900	1.00
<b>12</b>	5400	820	1.00

Depth of cut	<p>≤Please refer to the list above for depth of cut.</p> <p>≤DC</p>	<p>DC</p> <p>≤Please refer to the list above for depth of cut.</p>
	DC: Dia.	

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

Note 2) Water-soluble cutting fluid is recommended.

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

Note 4) 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.



# SOLID END MILLS

## CRN2XL

End mill, Medium cut length, 2 flute, Long neck, For copper electrodes

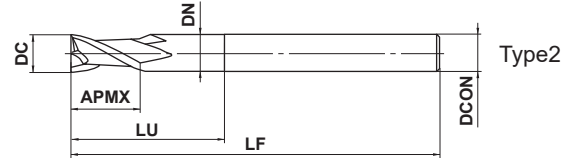
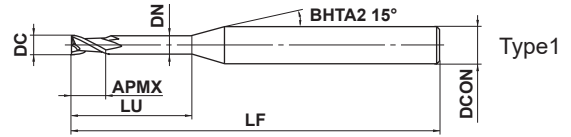


TOOL NEWS

DC<3

DC≥3

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	Aluminium Alloy
						○	○



	0.2 ≤ DC ≤ 6			
	0 - 0.02			
	4 ≤ DCON ≤ 6			
	0 - 0.008			

● 2 flute long neck end mill with CRN coating for copper electrode machining.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CRN2XLD0020N005S04	0.2	0.3	0.5	0.17	50	4	2	●	1
CRN2XLD0020N005S06	0.2	0.3	0.5	0.17	50	6	2	●	1
CRN2XLD0020N010S04	0.2	0.3	1	0.17	50	4	2	●	1
CRN2XLD0020N010S06	0.2	0.3	1	0.17	50	6	2	●	1
CRN2XLD0020N015S04	0.2	0.3	1.5	0.17	50	4	2	●	1
CRN2XLD0020N015S06	0.2	0.3	1.5	0.17	50	6	2	●	1
CRN2XLD0030N010S04	0.3	0.5	1	0.27	50	4	2	●	1
CRN2XLD0030N010S06	0.3	0.5	1	0.27	50	6	2	●	1
CRN2XLD0030N030S04	0.3	0.5	3	0.27	50	4	2	●	1
CRN2XLD0030N030S06	0.3	0.5	3	0.27	50	6	2	●	1
CRN2XLD0040N020S04	0.4	0.6	2	0.36	50	4	2	●	1
CRN2XLD0040N020S06	0.4	0.6	2	0.36	50	6	2	●	1
CRN2XLD0040N040S04	0.4	0.6	4	0.36	50	4	2	●	1
CRN2XLD0040N040S06	0.4	0.6	4	0.36	50	6	2	●	1
CRN2XLD0040N060S04	0.4	0.6	6	0.36	50	4	2	●	1
CRN2XLD0040N060S06	0.4	0.6	6	0.36	50	6	2	●	1
CRN2XLD0050N020S04	0.5	0.8	2	0.46	50	4	2	●	1
CRN2XLD0050N020S06	0.5	0.8	2	0.46	50	6	2	●	1
CRN2XLD0050N040S04	0.5	0.8	4	0.46	50	4	2	●	1
CRN2XLD0050N040S06	0.5	0.8	4	0.46	50	6	2	●	1
CRN2XLD0050N060S04	0.5	0.8	6	0.46	50	4	2	●	1
CRN2XLD0050N060S06	0.5	0.8	6	0.46	50	6	2	●	1
CRN2XLD0050N080S04	0.5	0.8	8	0.46	50	4	2	●	1
CRN2XLD0050N080S06	0.5	0.8	8	0.46	50	6	2	●	1
CRN2XLD0080N040S04	0.8	1.2	4	0.76	50	4	2	●	1
CRN2XLD0080N040S06	0.8	1.2	4	0.76	50	6	2	●	1
CRN2XLD0080N060S04	0.8	1.2	6	0.76	50	4	2	●	1
CRN2XLD0080N060S06	0.8	1.2	6	0.76	50	6	2	●	1
CRN2XLD0080N080S04	0.8	1.2	8	0.76	50	4	2	●	1
CRN2XLD0080N080S06	0.8	1.2	8	0.76	50	6	2	●	1
CRN2XLD0080N100S04	0.8	1.2	10	0.76	50	4	2	●	1
CRN2XLD0080N100S06	0.8	1.2	10	0.76	50	6	2	●	1
CRN2XLD0100N060S04	1	1.5	6	0.94	50	4	2	●	1
CRN2XLD0100N060S06	1	1.5	6	0.94	50	6	2	●	1

● : Inventory maintained in Japan.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CRN2XLD0100N080S04	1	1.5	8	0.94	50	4	2	●	1
CRN2XLD0100N080S06	1	1.5	8	0.94	50	6	2	●	1
CRN2XLD0100N100S04	1	1.5	10	0.94	50	4	2	●	1
CRN2XLD0100N100S06	1	1.5	10	0.94	50	6	2	●	1
CRN2XLD0100N120S04	1	1.5	12	0.94	50	4	2	●	1
CRN2XLD0100N120S06	1	1.5	12	0.94	50	6	2	●	1
CRN2XLD0100N160S04	1	1.5	16	0.94	55	4	2	●	1
CRN2XLD0100N160S06	1	1.5	16	0.94	55	6	2	●	1
CRN2XLD0150N060S04	1.5	2.3	6	1.44	50	4	2	●	1
CRN2XLD0150N060S06	1.5	2.3	6	1.44	50	6	2	●	1
CRN2XLD0150N080S04	1.5	2.3	8	1.44	50	4	2	●	1
CRN2XLD0150N080S06	1.5	2.3	8	1.44	50	6	2	●	1
CRN2XLD0150N100S04	1.5	2.3	10	1.44	50	4	2	●	1
CRN2XLD0150N100S06	1.5	2.3	10	1.44	50	6	2	●	1
CRN2XLD0150N120S04	1.5	2.3	12	1.44	50	4	2	●	1
CRN2XLD0150N120S06	1.5	2.3	12	1.44	50	6	2	●	1
CRN2XLD0150N160S04	1.5	2.3	16	1.44	55	4	2	●	1
CRN2XLD0150N160S06	1.5	2.3	16	1.44	55	6	2	●	1
CRN2XLD0150N200S04	1.5	2.3	20	1.44	60	4	2	●	1
CRN2XLD0150N200S06	1.5	2.3	20	1.44	60	6	2	●	1
CRN2XLD0200N060S06	2	3.0	6	1.90	50	6	2	●	1
CRN2XLD0200N080S06	2	3.0	8	1.90	50	6	2	●	1
CRN2XLD0200N100S06	2	3.0	10	1.90	50	6	2	●	1
CRN2XLD0200N120S06	2	3.0	12	1.90	50	6	2	●	1
CRN2XLD0200N160S06	2	3.0	16	1.90	55	6	2	●	1
CRN2XLD0200N200S06	2	3.0	20	1.90	60	6	2	●	1
CRN2XLD0250N080S06	2.5	3.8	8	2.40	50	6	2	●	1
CRN2XLD0250N120S06	2.5	3.8	12	2.40	55	6	2	●	1
CRN2XLD0250N160S06	2.5	3.8	16	2.40	60	6	2	●	1
CRN2XLD0250N200S06	2.5	3.8	20	2.40	65	6	2	●	1
CRN2XLD0300N200S06	3	4.5	20	2.90	65	6	2	●	1
CRN2XLD0400N200S06	4	6.0	20	3.90	65	6	2	●	1
CRN2XLD0500N250S06	5	7.5	25	4.90	70	6	2	●	1
CRN2XLD0600N300S06	6	9.0	30	5.85	70	6	2	●	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## CRN2XL

End mill, Medium cut length, 2 flute, Long neck, For copper electrodes

CARBIDE

SQUARE

BALL

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TAPER

BARREL

ROUGHING

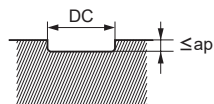
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SOLID END MILLS

### RECOMMENDED CUTTING CONDITIONS

Work Material		Copper, Copper alloys		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
0.2	0.5	40000	800	0.004
	1.0	40000	700	0.003
	1.5	40000	600	0.002
0.3	1	40000	800	0.007
	3	40000	600	0.002
0.4	2	40000	950	0.007
	4	40000	800	0.003
	6	40000	600	0.001
0.5	2	40000	950	0.01
	4	40000	800	0.005
	6	40000	700	0.002
0.8	4	40000	1200	0.02
	6	40000	1200	0.015
	8	40000	1000	0.01
1	6	40000	2000	0.04
	8	40000	2000	0.03
	10	30000	1200	0.02
	12	30000	1000	0.015
1.5	6	40000	2400	0.10
	8	40000	2200	0.09
	10	40000	2000	0.08
	12	30000	1800	0.05
	16	20000	1200	0.03
2	20	15000	800	0.02
	6	40000	2400	0.18
	8	40000	2200	0.15
	10	40000	2000	0.12
	12	30000	1500	0.10
2.5	16	30000	1000	0.06
	20	15000	600	0.03
	8	40000	3000	0.20
	12	40000	2800	0.15
3	16	30000	2100	0.10
	20	20000	1000	0.08
	20	20000	2000	0.12
	20	15000	2000	0.30
4	20	15000	2000	0.30
5	25	12000	1500	0.35
6	30	10000	1200	0.40

Depth of cut



DC: Dia.

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

Note 2) Water-soluble cutting fluid is recommended.

Note 3) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

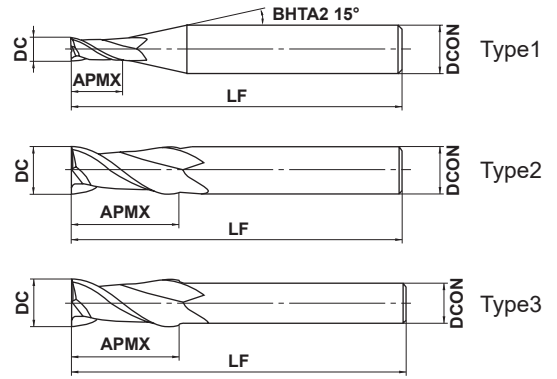
# DLC2MA

Medium cut length, 2 flute



CARBIDE

Copper Alloy	Aluminium Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎		○	



DC ≤ 12	DC > 12			
$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
$4 \leq \text{DCON} \leq 6$	$8 \leq \text{DCON} \leq 10$	$12 \leq \text{DCON} \leq 16$	DCON = 20	
$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	



● 2 flute end mill with new high welding resistance DLC coating, ideal for machining non-ferrous materials.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DLC2MAD0100	1	2.5	40	4	2	●	1
DLC2MAD0150	1.5	4	40	4	2	●	1
DLC2MAD0200	2	6	40	4	2	●	1
DLC2MAD0250	2.5	8	40	4	2	●	1
DLC2MAD0300	3	8	45	6	2	●	1
DLC2MAD0350	3.5	10	45	6	2	●	1
DLC2MAD0400	4	11	45	6	2	●	1
DLC2MAD0450	4.5	11	45	6	2	●	1
DLC2MAD0500	5	13	50	6	2	●	1
DLC2MAD0600	6	13	50	6	2	●	2
DLC2MAD0800	8	19	60	8	2	●	2
DLC2MAD1000	10	22	70	10	2	●	2
DLC2MAD1200	12	26	75	12	2	●	2
DLC2MAD1400	14	26	75	12	2	●	3
DLC2MAD1500	15	30	80	16	2	●	1
DLC2MAD1600	16	32	90	16	2	●	2
DLC2MAD1800	18	32	90	16	2	●	3
DLC2MAD2000	20	38	100	20	2	●	2

SQUARE

BALL

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TAPER

BARREL

ROUGHING



SOLID END MILLS

● : Inventory maintained in Japan.

## DLC2MA

Medium cut length, 2 flute

CARBIDE

SQUARE

BALL

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TAPER

BARREL

ROUGHING

SOLID END MILLS

### RECOMMENDED CUTTING CONDITIONS

#### Side milling

Work Material	Aluminium alloy		Aluminium alloy casting, Copper, Copper alloys		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>		40000	600	40000	460
<b>2</b>		40000	1100	38000	850
<b>3</b>		32000	1400	25000	950
<b>4</b>		24000	1500	19000	1000
<b>5</b>		19000	1600	15000	1000
<b>6</b>		16000	1900	13000	1100
<b>8</b>		12000	1900	9500	1200
<b>10</b>		9500	1900	7600	1200
<b>12</b>		8000	1900	6400	1200
<b>16</b>		6000	1900	4800	1200
<b>20</b>		4800	1500	3800	1000

Depth of cut	$\leq 0.2DC$ ( $DC < \phi 3$ ) $\leq 0.5DC$ ( $DC \geq \phi 3$ )		DC:Dia.
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#### Slotting

Work Material	Aluminium alloy		Aluminium alloy casting, Copper, Copper alloys		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>		40000	460	40000	350
<b>2</b>		38000	850	32000	550
<b>3</b>		25000	950	21000	600
<b>4</b>		19000	1000	16000	650
<b>5</b>		15000	1000	13000	700
<b>6</b>		13000	1100	11000	750
<b>8</b>		9500	1200	8000	800
<b>10</b>		7600	1200	6400	800
<b>12</b>		6400	1200	5300	800
<b>16</b>		4800	1000	4000	720
<b>20</b>		3800	970	3200	660

Depth of cut		DC:Dia.
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Note 1) When cutting a very hard workpiece, reduce the feed rate.

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.

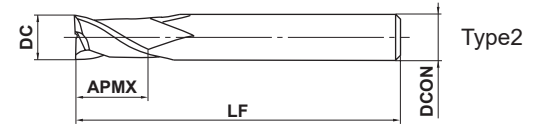
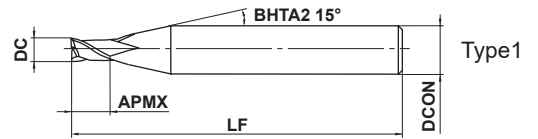
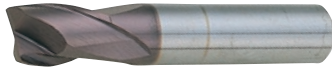
# SED2KMG

End mill, Medium cut length, 2 flute, - Tolerance



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	Aluminium Alloy
○	○			○	○		



	2 ≤ DC ≤ 16			
	0 - 0.02			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	
	0 - 0.008	0 - 0.009	0 - 0.011	

● 2 flute end mill for key way slotting with minus tolerance cutting diameter.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
SED2020KMG	2	3	45	4	2	●	1
SED2030KMG	3	5	45	6	2	●	1
SED2040KMG	4	6	45	6	2	●	1
SED2050KMG	5	8	50	6	2	●	1
SED2060KMG	6	9	50	6	2	●	2
SED2070KMG	7	10	60	8	2	●	1
SED2080KMG	8	12	60	8	2	●	2
SED2100KMG	10	15	65	10	2	●	2
SED2120KMG	12	15	65	12	2	●	2
SED2140KMG	14	15	70	16	2	●	1
SED2150KMG	15	15	70	16	2	●	1
SED2160KMG	16	15	70	16	2	●	2

SQUARE

BALL

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TAPER

BARREL

ROUGHING



SOLID END MILLS

● : Inventory maintained in Japan.

# SOLID END MILLS

## SED2KPG

End mill, Medium cut length, 2 flute, + Tolerance



DC ≤ 10

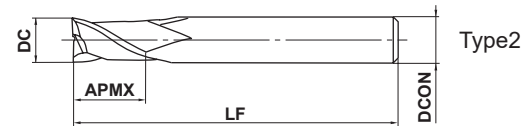
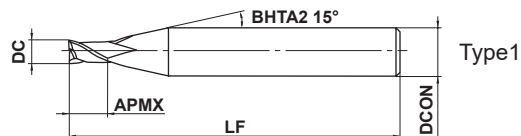
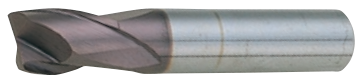
DC > 10

DC < 3

3 ≤ DC ≤ 10

DC ≥ 11

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	Aluminium Alloy
○	○			○	○		



	2 ≤ DC ≤ 16				
	0 + 0.02				
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16		
	0 - 0.008	0 - 0.009	0 - 0.011		

● 2 flute end mill for key way slotting with plus tolerance cutting diameter.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
SED2020KPG	2	3	45	4	2	●	1
SED2030KPG	3	5	45	6	2	●	1
SED2040KPG	4	6	45	6	2	●	1
SED2050KPG	5	8	50	6	2	●	1
SED2060KPG	6	9	50	6	2	●	2
SED2070KPG	7	10	60	8	2	●	1
SED2080KPG	8	12	60	8	2	●	2
SED2100KPG	10	15	65	10	2	●	2
SED2120KPG	12	15	65	12	2	●	2
SED2140KPG	14	15	70	16	2	●	1
SED2150KPG	15	15	70	16	2	●	1
SED2160KPG	16	15	70	16	2	●	2

● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

# SED2KMG

End mill, Short cut length, 2 flute, For key ways

# SED2KPG

End mill, Short cut length, 2 flute, For key ways

CARBIDE

## RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Alloy steel (180—280HB)		Carbon steel, Alloy steel (280—380HB)		Pre-hardened steel (35—45HRC)		Stainless steel (270HB≥)		Cast iron (Tensile Strength 350MPa≥)	
	AISI 1045, AISI P20		AISI 1045, AISI P20				AISI 420		AISI No 35 B	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>2</b>	13000	260 (260)	10300	200 (200)	8800	110 (110)	9800	170 (170)	21500	830 (830)
<b>3</b>	8500	340 (340)	6900	200 (200)	6400	110 (110)	6400	170 (170)	14300	850 (850)
<b>4</b>	6500	380 (380)	5200	250 (200)	4400	140 (110)	4800	200 (160)	10700	860 (860)
<b>5</b>	5100	400 (400)	4100	290 (230)	3500	140 (110)	3800	190 (150)	8600	850 (850)
<b>6</b>	4300	410 (410)	3400	290 (230)	2900	150 (120)	3200	180 (140)	7200	870 (870)
<b>8</b>	3200	410 (410)	2600	250 (200)	2200	140 (110)	2400	150 (120)	5400	880 (880)
<b>10</b>	2600	400 (400)	2070	240 (190)	1800	140 (110)	1900	140 (110)	4300	860 (860)
<b>12</b>	2200	360 (360)	1700	210 (170)	1500	130 (100)	1600	130 (105)	3600	860 (860)
<b>14</b>	1900	340 (340)	1500	200 (160)	1250	130 (100)	1400	130 (100)	3100	860 (860)
<b>16</b>	1600	320 (320)	1300	200 (160)	1100	130 (100)	1200	120 (95)	2700	870 (870)

Depth of cut			DC: Dia.
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( ) : Indicates standard feed rate for slotting.

Note 1) The cutting conditions above are a guide only to milling within the standard depth of cut.

Note 2) Ductile cast iron milling has the same cutting conditions as carbon steel and alloy steel. (180—280HB)

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

Note 4) 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

↩

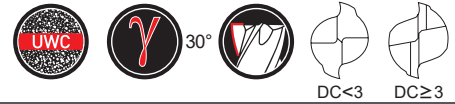
SOLID END MILLS



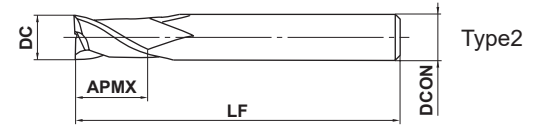
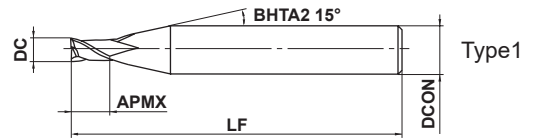
# SOLID END MILLS

## C2SS

End mill, 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	Aluminium Alloy
○	○			○	○	○	○



	0.4 ≤ DC ≤ 6				
	0 - 0.020				
	4 ≤ DCON ≤ 6				
	0 - 0.008				

● 2 flute end mill with short rigid geometry.

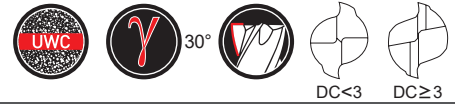
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2SSD0040	0.4	0.8	40	4	2	▲	1
C2SSD0050	0.5	0.8	40	4	2	▲	1
C2SSD0060	0.6	1	40	4	2	▲	1
C2SSD0070	0.7	1	40	4	2	▲	1
C2SSD0080	0.8	1.3	40	4	2	▲	1
C2SSD0090	0.9	1.3	40	4	2	▲	1
C2SSD0100	1	1.5	40	4	2	▲	1
C2SSD0110	1.1	1.5	40	4	2	▲	1
C2SSD0120	1.2	2	40	4	2	▲	1
C2SSD0130	1.3	2	40	4	2	▲	1
C2SSD0140	1.4	2	40	4	2	▲	1
C2SSD0150	1.5	2.5	40	4	2	▲	1
C2SSD0160	1.6	2.5	40	4	2	▲	1
C2SSD0170	1.7	2.5	40	4	2	▲	1
C2SSD0180	1.8	3	40	4	2	▲	1
C2SSD0190	1.9	3	40	4	2	▲	1
C2SSD0200	2	3	40	4	2	▲	1
C2SSD0210	2.1	3	40	4	2	▲	1
C2SSD0220	2.2	3.5	40	4	2	▲	1
C2SSD0230	2.3	3.5	40	4	2	▲	1
C2SSD0240	2.4	3.5	40	4	2	▲	1
C2SSD0250	2.5	4	40	4	2	▲	1
C2SSD0260	2.6	4	40	4	2	▲	1
C2SSD0270	2.7	4	40	4	2	▲	1
C2SSD0280	2.8	4	40	4	2	▲	1
C2SSD0290	2.9	4.5	40	4	2	▲	1
C2SSD0300	3	4.5	45	6	2	▲	1
C2SSD0350	3.5	5.5	45	6	2	▲	1
C2SSD0400	4	6	45	6	2	▲	1
C2SSD0450	4.5	7	45	6	2	▲	1
C2SSD0500	5	7.5	50	6	2	▲	1
C2SSD0550	5.5	8.5	50	6	2	▲	1
C2SSD0600	6	9	50	6	2	▲	2

▲ : Product scheduled to be discontinued at the end of March 2020

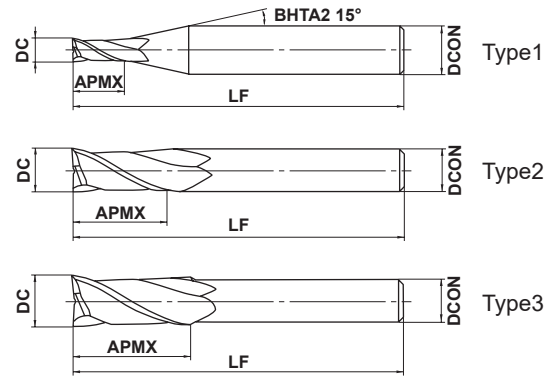
C2SA (J102) and C2MA (J104) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MS2SS (J048) is alternative for processing of other cutting materials.

# C2MS

End mill, 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	Aluminium Alloy
○	○			○	○	○	○



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● 2 flute end mill for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2MSD0100	1	2.5	40	4	2	▲	1
C2MSD0110	1.1	2.5	40	4	2	▲	1
C2MSD0120	1.2	3	40	4	2	▲	1
C2MSD0130	1.3	3	40	4	2	▲	1
C2MSD0140	1.4	3	40	4	2	▲	1
C2MSD0150	1.5	4	40	4	2	▲	1
C2MSD0160	1.6	4	40	4	2	▲	1
C2MSD0170	1.7	4	40	4	2	▲	1
C2MSD0180	1.8	5	40	4	2	▲	1
C2MSD0190	1.9	5	40	4	2	▲	1
C2MSD0200	2	6	40	4	2	▲	1
C2MSD0210	2.1	6	40	4	2	▲	1
C2MSD0220	2.2	6	40	4	2	▲	1
C2MSD0230	2.3	6	40	4	2	▲	1
C2MSD0240	2.4	8	40	4	2	▲	1
C2MSD0250	2.5	8	40	4	2	▲	1
C2MSD0260	2.6	8	40	4	2	▲	1
C2MSD0270	2.7	8	40	4	2	▲	1
C2MSD0280	2.8	8	40	4	2	▲	1
C2MSD0290	2.9	8	40	4	2	▲	1
C2MSD0300	3	8	45	6	2	▲	1
C2MSD0310	3.1	8	45	6	2	▲	1
C2MSD0320	3.2	8	45	6	2	▲	1
C2MSD0330	3.3	8	45	6	2	▲	1
C2MSD0340	3.4	10	45	6	2	▲	1
C2MSD0350	3.5	10	45	6	2	▲	1
C2MSD0360	3.6	10	45	6	2	▲	1
C2MSD0370	3.7	10	45	6	2	▲	1
C2MSD0380	3.8	11	45	6	2	▲	1
C2MSD0390	3.9	11	45	6	2	▲	1
C2MSD0400	4	11	45	6	2	▲	1
C2MSD0410	4.1	11	45	6	2	▲	1
C2MSD0420	4.2	11	45	6	2	▲	1
C2MSD0430	4.3	11	45	6	2	▲	1

▲ : Product scheduled to be discontinued at the end of March 2020

C2MA(J104) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MS2MS(J049) is alternative for processing of other cutting materials.

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## C2MS

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
C2MSD0440	4.4	11	45	6	2	▲	1
C2MSD0450	4.5	11	45	6	2	▲	1
C2MSD0460	4.6	11	45	6	2	▲	1
C2MSD0470	4.7	11	45	6	2	▲	1
C2MSD0480	4.8	13	50	6	2	▲	1
C2MSD0490	4.9	13	50	6	2	▲	1
C2MSD0500	5	13	50	6	2	▲	1
C2MSD0510	5.1	13	50	6	2	▲	1
C2MSD0520	5.2	13	50	6	2	▲	1
C2MSD0530	5.3	13	50	6	2	▲	1
C2MSD0540	5.4	13	50	6	2	▲	1
C2MSD0550	5.5	13	50	6	2	▲	1
C2MSD0560	5.6	13	50	6	2	▲	1
C2MSD0570	5.7	13	50	6	2	▲	1
C2MSD0580	5.8	13	50	6	2	▲	1
C2MSD0590	5.9	13	50	6	2	▲	1
C2MSD0600	6	13	50	6	2	▲	2
C2MSD0610	6.1	16	60	8	2	▲	1
C2MSD0620	6.2	16	60	8	2	▲	1
C2MSD0630	6.3	16	60	8	2	▲	1
C2MSD0640	6.4	16	60	8	2	▲	1
C2MSD0650	6.5	16	60	8	2	▲	1
C2MSD0660	6.6	16	60	8	2	▲	1
C2MSD0670	6.7	16	60	8	2	▲	1
C2MSD0680	6.8	16	60	8	2	▲	1
C2MSD0690	6.9	16	60	8	2	▲	1
C2MSD0700	7	16	60	8	2	▲	1
C2MSD0710	7.1	16	60	8	2	▲	1
C2MSD0720	7.2	16	60	8	2	▲	1
C2MSD0730	7.3	16	60	8	2	▲	1
C2MSD0740	7.4	16	60	8	2	▲	1
C2MSD0750	7.5	16	60	8	2	▲	1
C2MSD0760	7.6	19	60	8	2	▲	1
C2MSD0770	7.7	19	60	8	2	▲	1
C2MSD0780	7.8	19	60	8	2	▲	1
C2MSD0790	7.9	19	60	8	2	▲	1
C2MSD0800	8	19	60	8	2	▲	2
C2MSD0810	8.1	19	70	10	2	▲	1
C2MSD0820	8.2	19	70	10	2	▲	1
C2MSD0830	8.3	19	70	10	2	▲	1
C2MSD0840	8.4	19	70	10	2	▲	1
C2MSD0850	8.5	19	70	10	2	▲	1
C2MSD0860	8.6	19	70	10	2	▲	1
C2MSD0870	8.7	19	70	10	2	▲	1
C2MSD0880	8.8	19	70	10	2	▲	1
C2MSD0890	8.9	19	70	10	2	▲	1
C2MSD0900	9	19	70	10	2	▲	1
C2MSD0910	9.1	19	70	10	2	▲	1
C2MSD0920	9.2	19	70	10	2	▲	1
C2MSD0930	9.3	19	70	10	2	▲	1
C2MSD0940	9.4	19	70	10	2	▲	1
C2MSD0950	9.5	19	70	10	2	▲	1

▲ : Product scheduled to be discontinued at the end of March 2020

C2MA(J104) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MS2MS(J049) is alternative for processing of other cutting materials.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2MSD0960	9.6	22	70	10	2	▲	1
C2MSD0970	9.7	22	70	10	2	▲	1
C2MSD0980	9.8	22	70	10	2	▲	1
C2MSD0990	9.9	22	70	10	2	▲	1
C2MSD1000	10	22	70	10	2	▲	2
C2MSD1100	11	22	75	12	2	▲	1
C2MSD1200	12	26	75	12	2	▲	2
C2MSD1300	13	26	75	12	2	▲	3
C2MSD1400	14	26	75	12	2	▲	3
C2MSD1500	15	30	80	16	2	▲	1
C2MSD1600	16	32	90	16	2	▲	2
C2MSD1700	17	32	90	16	2	▲	3
C2MSD1800	18	32	90	16	2	▲	3
C2MSD1900	19	32	100	20	2	▲	1
C2MSD2000	20	38	100	20	2	▲	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## C2SS

End mill, Short cut length, 2 flute

## C2MS

End mill, Medium cut length, 2 flute

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

### RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20—30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30—45HRC)		Austenitic stainless steel, Titanium alloy	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>0.5</b>	17000	50 (50)	14000	45 (45)	11000	30 (30)	9000	30 (30)
<b>1</b>	10000	65 (65)	8500	55 (55)	6400	40 (40)	5200	35 (35)
<b>2</b>	5500	90 (90)	4800	80 (80)	3800	55 (55)	3100	50 (50)
<b>3</b>	4100	100 (100)	3500	85 (85)	2800	65 (65)	2300	60 (60)
<b>4</b>	3400	170 (135)	2900	140 (110)	2200	90 (70)	1900	80 (60)
<b>5</b>	2900	190 (150)	2400	150 (120)	1800	100 (80)	1500	90 (60)
<b>6</b>	2500	200 (160)	2100	170 (135)	1600	110 (90)	1300	95 (65)
<b>8</b>	1900	200 (160)	1600	170 (135)	1200	105 (85)	1000	100 (70)
<b>10</b>	1500	180 (145)	1250	150 (120)	950	95 (75)	800	90 (65)
<b>12</b>	1250	150 (120)	1050	130 (100)	800	80 (65)	660	75 (50)
<b>16</b>	940	110 (90)	800	95 (75)	600	60 (50)	500	55 (40)
<b>20</b>	750	90 (70)	640	80 (65)	480	50 (40)	400	45 (30)

Depth of cut			DC: Dia.
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( ) : Indicates standard feed rate for slotting.

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.

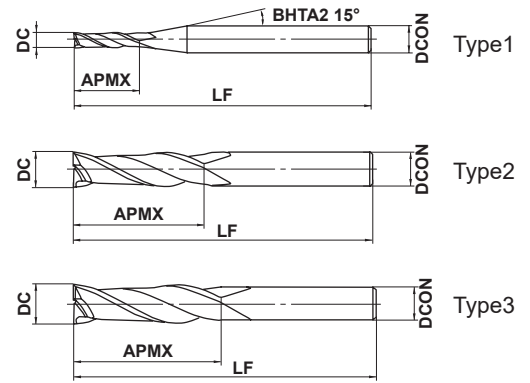
# C2JS

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	Aluminium Alloy
○	○			○	○	○	○



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● 2 flute uncoated end mill for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2JSD0100	1	3.5	40	4	2	▲	1
C2JSD0150	1.5	5	40	4	2	▲	1
C2JSD0200	2	8	40	4	2	▲	1
C2JSD0250	2.5	10	40	4	2	▲	1
C2JSD0300	3	12	50	6	2	▲	1
C2JSD0350	3.5	15	50	6	2	▲	1
C2JSD0400	4	15	50	6	2	▲	1
C2JSD0450	4.5	15	50	6	2	▲	1
C2JSD0500	5	20	60	6	2	▲	1
C2JSD0550	5.5	20	60	6	2	▲	1
C2JSD0600	6	20	60	6	2	▲	2
C2JSD0650	6.5	25	70	8	2	▲	1
C2JSD0700	7	25	70	8	2	▲	1
C2JSD0750	7.5	25	70	8	2	▲	1
C2JSD0800	8	25	70	8	2	▲	2
C2JSD0850	8.5	25	90	10	2	▲	1
C2JSD0900	9	25	90	10	2	▲	1
C2JSD0950	9.5	25	90	10	2	▲	1
C2JSD1000	10	30	90	10	2	▲	2
C2JSD1050	10.5	30	90	12	2	▲	1
C2JSD1100	11	30	90	12	2	▲	1
C2JSD1150	11.5	30	90	12	2	▲	1
C2JSD1200	12	30	90	12	2	▲	2
C2JSD1300	13	35	90	12	2	▲	3
C2JSD1400	14	40	110	16	2	▲	1
C2JSD1500	15	40	110	16	2	▲	1
C2JSD1600	16	50	110	16	2	▲	2
C2JSD1700	17	50	110	20	2	▲	1
C2JSD1800	18	50	110	20	2	▲	1
C2JSD1900	19	55	110	20	2	▲	1
C2JSD2000	20	55	110	20	2	▲	2
C2JSD2200	22	65	140	25	2	▲	1
C2JSD2400	24	75	140	25	2	▲	1
C2JSD2500	25	75	140	25	2	▲	2

▲ : Product scheduled to be discontinued at the end of March 2020

C2LA(J106) and SEE2L(J110) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MS2JS(J054) is alternative for processing of other cutting materials.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS

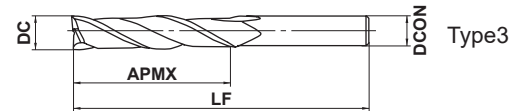
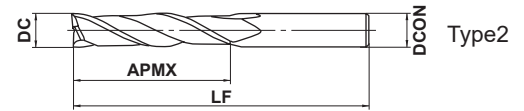
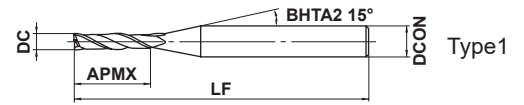
# SOLID END MILLS

## C2LS

End mill, Long 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	Aluminium 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 with longer cut length than standard.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2LSD0100	1	4	40	4	2	▲	1
C2LSD0150	1.5	6	40	4	2	▲	1
C2LSD0200	2	9	40	4	2	▲	1
C2LSD0250	2.5	12	40	4	2	▲	1
C2LSD0300	3	20	60	6	2	▲	1
C2LSD0350	3.5	22	60	6	2	▲	1
C2LSD0400	4	25	60	6	2	▲	1
C2LSD0450	4.5	25	60	6	2	▲	1
C2LSD0500	5	30	70	6	2	▲	1
C2LSD0550	5.5	30	70	6	2	▲	1
C2LSD0600	6	30	70	6	2	▲	2
C2LSD0650	6.5	30	90	8	2	▲	1
C2LSD0700	7	40	90	8	2	▲	1
C2LSD0750	7.5	40	90	8	2	▲	1
C2LSD0800	8	40	90	8	2	▲	2
C2LSD0850	8.5	40	100	10	2	▲	1
C2LSD0900	9	40	100	10	2	▲	1
C2LSD0950	9.5	40	100	10	2	▲	1
C2LSD1000	10	50	100	10	2	▲	2
C2LSD1050	10.5	50	110	12	2	▲	1
C2LSD1100	11	50	110	12	2	▲	1
C2LSD1150	11.5	50	110	12	2	▲	1
C2LSD1200	12	50	110	12	2	▲	2
C2LSD1250	12.5	50	120	12	2	▲	3
C2LSD1300	13	50	120	12	2	▲	3
C2LSD1400	14	70	130	16	2	▲	1
C2LSD1500	15	70	130	16	2	▲	1
C2LSD1600	16	70	130	16	2	▲	2
C2LSD1700	17	70	140	20	2	▲	1
C2LSD1800	18	70	140	20	2	▲	1
C2LSD1900	19	70	140	20	2	▲	1
C2LSD2000	20	70	140	20	2	▲	2

▲ : Product scheduled to be discontinued at the end of March 2020

C2LA(J1068) and SEE2L(J110) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MS2LS(J056) is alternative for processing of other cutting materials.

# C2JS

End mill, Semi long cut length, 2 flute

# C2LS

End mill, Long cut length, 2 flute

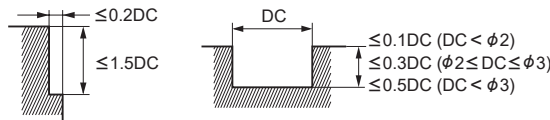
CARBIDE

## RECOMMENDED CUTTING CONDITIONS

### C2JS

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–45HRC)		Austenitic stainless steel, Titanium alloy	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1050, AISI P20		AISI H13, AISI P21		AISI 304	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>0.5</b>	17000	40 (40)	14000	35 (35)	11000	25 (25)	9000	25 (25)
<b>1</b>	10000	50 (50)	8500	40 (40)	6400	30 (30)	5200	25 (30)
<b>2</b>	5500	70 (70)	4800	60 (60)	3800	40 (40)	3100	40 (40)
<b>3</b>	4100	80 (80)	3500	65 (65)	2800	50 (50)	2300	45 (45)
<b>4</b>	3400	130 (100)	2900	100 (80)	2200	70 (50)	1900	60 (45)
<b>5</b>	2900	140 (110)	2400	110 (90)	1800	75 (60)	1500	70 (45)
<b>6</b>	2500	150 (120)	2100	130 (100)	1600	80 (70)	1300	70 (50)
<b>8</b>	1900	150 (120)	1600	130 (100)	1200	80 (65)	1000	75 (55)
<b>10</b>	1500	135 (110)	1300	110 (90)	950	70 (60)	800	70 (50)
<b>12</b>	1300	110 (90)	1100	100 (75)	800	60 (50)	660	60 (40)
<b>16</b>	940	80 (70)	800	70 (60)	600	45 (40)	500	40 (30)
<b>20</b>	750	70 (50)	640	60 (50)	480	40 (30)	400	35 (25)

Depth of cut

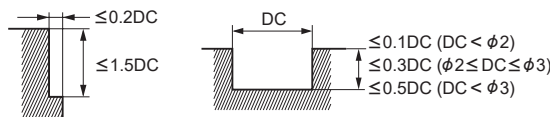


DC: Dia.

### C2LS

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–45HRC)		Austenitic stainless steel, Titanium alloy	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1050, AISI P20		AISI H13, AISI P21		AISI 304	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>0.5</b>	13000	30 (30)	11000	25 (25)	8300	16 (16)	6800	15 (15)
<b>1</b>	7500	35 (35)	6400	30 (30)	4800	20 (20)	3900	20 (20)
<b>2</b>	4100	50 (50)	3600	45 (45)	2900	30 (30)	2300	30 (30)
<b>3</b>	3100	55 (55)	2600	45 (45)	2100	35 (35)	1700	35 (35)
<b>4</b>	2600	100 (75)	2200	80 (60)	1700	50 (40)	1400	45 (35)
<b>5</b>	2200	100 (85)	1800	80 (65)	1400	55 (45)	1100	50 (35)
<b>6</b>	1900	110 (90)	1600	95 (75)	1200	60 (50)	980	55 (35)
<b>8</b>	1400	110 (90)	1200	95 (75)	900	60 (45)	750	55 (40)
<b>10</b>	1100	100 (80)	940	85 (65)	710	50 (40)	600	50 (35)
<b>12</b>	940	85 (65)	790	70 (55)	600	45 (35)	500	40 (30)
<b>16</b>	710	60 (50)	600	55 (40)	450	30 (30)	380	30 (20)
<b>20</b>	560	50 (40)	480	45 (35)	360	30 (20)	300	25 (16)

Depth of cut



DC: Dia.

( ) : Indicates standard feed rate for slotting.

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



# SOLID END MILLS

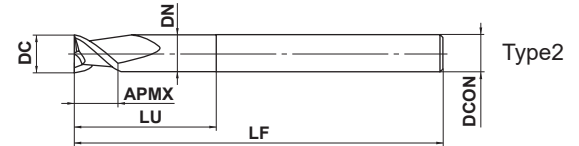
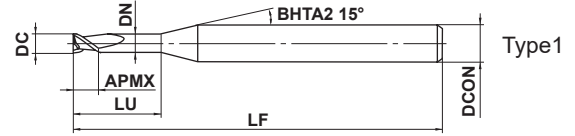
## C2SA

End mill, Short cut length, 2 flute, For aluminium alloy



TOOL NEWS

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	Aluminium Alloy
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	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	DCON=6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON=20	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● High efficiency machining for aluminium alloys.

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type	(mm)
C2SAD0300N120	3	6	12	2.7	60	6	2	●	1	
C2SAD0400N120	4	6	12	3.7	60	6	2	●	1	
C2SAD0500N150	5	8	15	4.7	60	6	2	●	1	
C2SAD0600N160	6	8	16	5.7	75	6	2	●	2	
C2SAD0800N200	8	10	20	7.4	75	8	2	●	2	
C2SAD1000N300	10	12	30	9.4	75	10	2	●	2	
C2SAD1000N350	10	12	35	9.4	100	10	2	●	2	
C2SAD1200N300	12	15	30	11.4	75	12	2	●	2	
C2SAD1200N350	12	15	35	11.4	100	12	2	●	2	
C2SAD1200N400	12	15	40	11.4	125	12	2	●	2	
C2SAD1600N300	16	15	30	15.4	75	16	2	●	2	
C2SAD1600N400	16	15	40	15.4	100	16	2	●	2	
C2SAD1600N450	16	15	45	15.4	125	16	2	●	2	
C2SAD2000N400	20	20	40	18	100	20	2	●	2	
C2SAD2000N500	20	20	50	18	125	20	2	●	2	

● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	40000	1800
4	36000	2400
5	30000	3000
6	27000	3200
8	20000	3400
10	16000	3600
12	13000	3600
16	10000	3600
20	8000	3300

Depth of cut	
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### ■ Slotting

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	40000	1600
4	36000	2100
5	30000	2700
6	27000	2800
8	20000	3000
10	16000	3200
12	13000	3200
16	10000	3200
20	8000	3000

Depth of cut	
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Note 1) Water-soluble cutting fluid is recommended.

Note 2) Climb cutting is recommended for side milling.

Note 3) If tool clamping is poor, the tool can be pulled out of the holder. Ensure that the tool is sufficiently clamped.

Note 4) This table shows the cutting condition with less than 4D overhang length. If more than 4D, spindle speed, feed rate and depth of cut should be reduced.

Note 5) 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

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SOLID END MILLS

# SOLID END MILLS

## C2MA

End mill, Medium cut length, 2 flute, For aluminium alloy



TOOL NEWS



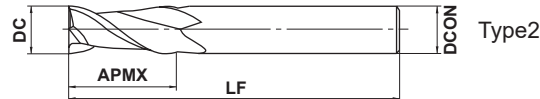
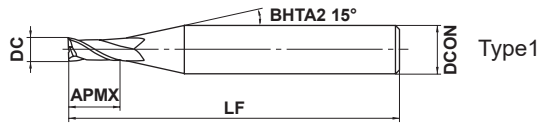
DC<3

DC≥3

DC<3

DC≥3

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	Aluminium Alloy
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	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 uncoated end mill designed especially for aluminium alloys.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2MAD0100	1	2.5	40	4	2	●	1
C2MAD0150	1.5	4	40	4	2	●	1
C2MAD0200	2	6	40	4	2	●	1
C2MAD0250	2.5	8	40	4	2	●	1
C2MAD0300	3	8	45	6	2	●	1
C2MAD0400	4	11	45	6	2	●	1
C2MAD0500	5	13	50	6	2	●	1
C2MAD0600	6	13	50	6	2	●	2
C2MAD0800	8	19	60	8	2	●	2
C2MAD1000	10	22	70	10	2	●	2
C2MAD1200	12	26	75	12	2	●	2
C2MAD1400	14	26	75	12	2	●	3
C2MAD1500	15	30	80	16	2	●	1
C2MAD1600	16	32	90	16	2	●	2
C2MAD1800	18	32	90	16	2	●	3
C2MAD2000	20	38	100	20	2	●	2

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>		40000	600	40000	460
<b>2</b>		40000	1100	38000	850
<b>3</b>		32000	1400	25000	950
<b>4</b>		24000	1500	19000	1000
<b>5</b>		19000	1600	15000	1000
<b>6</b>		16000	1900	13000	1100
<b>8</b>		12000	1900	9500	1200
<b>10</b>		9500	1900	7600	1200
<b>12</b>		8000	1900	6400	1200
<b>16</b>		6000	1900	4800	1200
<b>20</b>		4800	1500	3800	1000

Depth of cut	$\leq 0.2DC$ ( $DC < \phi 3$ ) $\leq 0.5DC$ ( $DC \geq \phi 3$ )		DC: Dia.

### ■ Slotting

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>		40000	460	40000	350
<b>2</b>		38000	850	32000	550
<b>3</b>		25000	950	21000	600
<b>4</b>		19000	1000	16000	650
<b>5</b>		15000	1000	13000	700
<b>6</b>		13000	1100	11000	750
<b>8</b>		9500	1200	8000	800
<b>10</b>		7600	1200	6400	800
<b>12</b>		6400	1200	5300	800
<b>16</b>		4800	1000	4000	720
<b>20</b>		3800	970	3200	660

Depth of cut	$\leq 1DC$ (MAX. 12mm)		DC: Dia.

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

Note 2) Water-soluble cutting fluid is recommended.

Note 3) Climb cutting is recommended for side milling.

Note 4) 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

↩

SOLID END MILLS

# SOLID END MILLS

## C2LA

End mill, Long cut length, 2 flute, For aluminium alloy



TOOL NEWS



DC<3



DC≥3

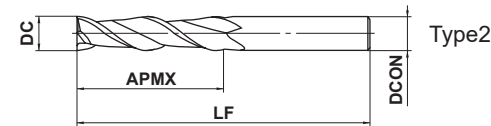
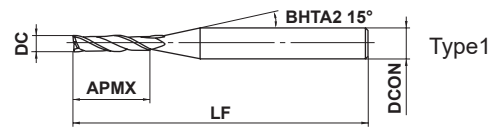


DC<3



DC≥3

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	Aluminium Alloy
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	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● 2 flute uncoated end mill designed especially for aluminium alloys.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2LAD0100	1	4	40	4	2	●	1
C2LAD0150	1.5	6	40	4	2	●	1
C2LAD0200	2	9	40	4	2	●	1
C2LAD0250	2.5	12	40	4	2	●	1
C2LAD0300	3	20	60	6	2	●	1
C2LAD0400	4	25	60	6	2	●	1
C2LAD0500	5	30	70	6	2	●	1
C2LAD0600	6	30	70	6	2	●	2
C2LAD0800	8	40	90	8	2	●	2
C2LAD1000	10	50	100	10	2	●	2
C2LAD1200	12	50	110	12	2	●	2
C2LAD1400	14	70	130	16	2	●	1
C2LAD1500	15	70	130	16	2	●	1
C2LAD1600	16	70	130	16	2	●	2
C2LAD1800	18	70	140	20	2	●	1
C2LAD2000	20	70	140	20	2	●	2

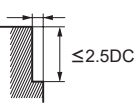
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy		Aluminium alloy casting	
Cutting speed	150m/min		120m/min	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>	40000	320	38000	240
<b>2</b>	24000	380	19000	240
<b>3</b>	16000	510	13000	330
<b>4</b>	12000	580	9500	380
<b>5</b>	9500	640	7600	400
<b>6</b>	8000	640	6400	400
<b>8</b>	6000	770	4800	480
<b>10</b>	4800	770	3800	480
<b>12</b>	4000	770	3200	480
<b>16</b>	3000	670	2400	430
<b>20</b>	2400	610	1900	390

Depth of cut	$\leq 0.05DC$ ( $DC < \phi 3$ )	
	$\leq 0.1DC$ ( $DC \geq \phi 3$ )	

DC: Dia.

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

Note 2) Water-soluble cutting fluid is recommended.

Note 3) Climb cutting is recommended for side milling.

Note 4) 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.

# SOLID END MILLS

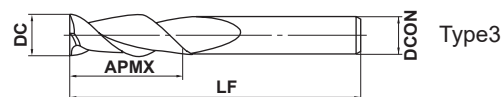
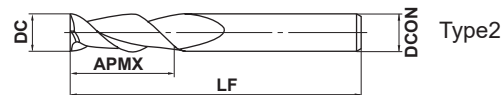
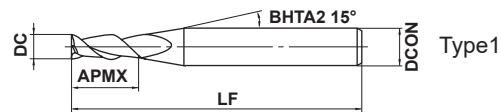
## C2MHA

End mill, Medium cut length, 2 flute, For aluminium alloy



TOOL NEWS

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



● High efficiency machining for aluminium 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

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

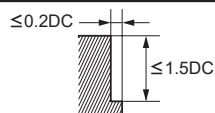
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	40000	2400
<b>4</b>	36000	2600
<b>5</b>	30000	4000
<b>6</b>	27000	4000
<b>8</b>	20000	4000
<b>10</b>	16000	4500
<b>12</b>	13000	4500
<b>16</b>	10000	4500
<b>20</b>	8000	4300
<b>25</b>	6000	3600

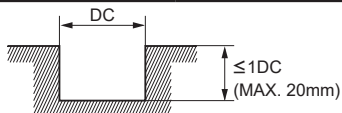
  

Depth of cut		DC:Dia.

### ■ Slotting

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	40000	1500
<b>4</b>	36000	1800
<b>5</b>	30000	2800
<b>6</b>	27000	2800
<b>8</b>	20000	2800
<b>10</b>	16000	3200
<b>12</b>	13000	3200
<b>16</b>	10000	3200
<b>20</b>	8000	3000
<b>25</b>	6000	2500

Depth of cut		DC:Dia.

Note 1) Water-soluble cutting fluid is recommended.

Note 2) Climb cutting is recommended for side milling.

Note 3) If tool clamping is poor, the tool can be pulled out of the holder. Ensure that the tool is sufficiently clamped.

Note 4) 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.



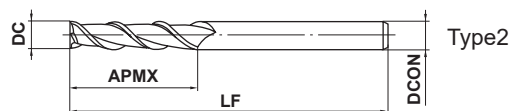
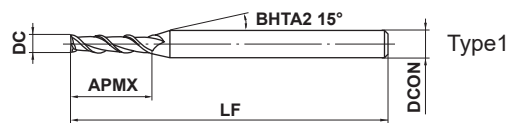
# SOLID END MILLS

## SEE2L

End mill, Long 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	Aluminium 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	

● 2 flute uncoated high helix end mill.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
SEE2030L	3	15	55	6	2	●	1
SEE2040L	4	20	60	6	2	●	1
SEE2050L	5	25	65	6	2	●	1
SEE2060L	6	25	65	6	2	●	2
SEE2070L	7	35	80	8	2	●	1
SEE2080L	8	35	80	8	2	●	2
SEE2090L	9	45	90	10	2	●	1
SEE2100L	10	45	95	10	2	●	2
SEE2110L	11	55	105	12	2	●	1
SEE2120L	12	55	105	12	2	●	2
SEE2150L	15	70	125	16	2	●	1
SEE2160L	16	70	125	16	2	●	2
SEE2200L	20	75	140	20	2	●	2

(mm)

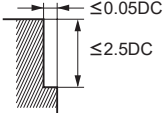
● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Alloy steel (180—280HB)		Carbon steel, Alloy steel (280—380HB)		Pre-hardened steel (35—45HRC)		Stainless steel (270HB≥)		Cast iron (Tensile Strength 350MPa≥)	
	AISI 1045, AISI P20		AISI 1045, AISI P20				AISI 420		AISI No 35 B	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	3400	100	3000	40	2100	20	2600	40	5500	160
<b>4</b>	2400	110	2200	60	1600	30	1900	50	4200	180
<b>5</b>	2000	120	1800	60	1300	40	1500	50	3300	200
<b>6</b>	1600	120	1500	60	1000	40	1300	50	2800	210
<b>8</b>	1200	110	1100	60	800	40	960	50	2100	210
<b>10</b>	1000	100	880	60	640	40	760	50	1600	210
<b>12</b>	800	100	760	70	520	40	640	60	1400	210
<b>16</b>	600	90	560	70	400	40	480	70	1000	220
<b>20</b>	480	80	440	80	320	40	400	70	840	230

Depth of cut



≤0.05DC  
≤2.5DC

DC: Dia.

Note 1) The cutting conditions above are a guide only to milling within the standard depth of cut.

Note 2) Ductile cast iron milling has the same cutting conditions as carbon steel and alloy steel. (180—280HB)

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

Note 4) 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.

# SOLID END MILLS

## MSMHZD

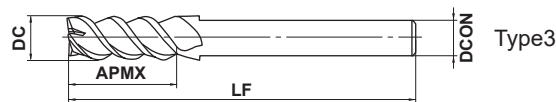
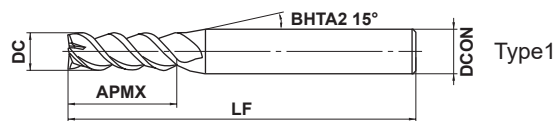
Slotting, Medium cut length, 3 flute



TOOL NEWS



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	Aluminium Alloy
○	○	○		○	○	○	



	DC ≤ 12	DC > 12			
	0 - 0.020	0 - 0.030			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
h6	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

● : Inventory maintained in Japan.

## 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		Heat resistant alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
1	19000	600	13000	310	10000	200	9500	65
1.5	14000	600	9000	310	7500	210	6400	75
2	11000	600	7200	310	6000	210	4800	75
3	8500	770	5300	380	4400	220	3200	100
4	7200	850	4400	480	3700	250	2400	130
6	5300	940	3200	490	2700	270	1600	130
8	4000	1010	2400	560	2000	280	1200	120
10	3200	1000	1900	480	1600	300	950	110
12	2700	950	1600	440	1300	300	800	90
16	2000	720	1200	350	1000	260	600	70
20	1600	600	1000	290	800	240	480	60

Depth of cut	$\leq 0.2DC$ ( $DC > \phi 3$ ) $\leq 0.1DC$ ( $DC \leq \phi 3$ )		

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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
1	13000	80	10000	50	6000	10
1.5	12000	120	8000	80	6000	20
2	11000	200	7200	140	6000	30
3	8500	250	5300	180	4200	50
4	7200	300	4400	210	3300	60
6	5300	300	3200	210	2200	70
8	4000	320	2400	220	1600	80
10	3200	340	1900	240	1300	70
12	2700	320	1600	220	1100	70
16	2000	250	1200	180	800	55
20	1600	200	1000	140	640	55

Depth of cut	$\leq 1DC$ ( $DC \geq \phi 2$ ) $\leq 0.5DC$ ( $DC < \phi 2$ )		

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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
1	13000	130	10000	80	6000	30	5700	25
1.5	12000	250	8000	150	6000	60	3800	30
2	11000	500	7200	260	6000	130	2800	35
3	8500	640	5300	320	4200	130	1900	50
4	7200	650	4400	370	3300	140	1400	70
6	5300	720	3200	380	2200	140	950	70
8	4000	780	2400	430	1600	140	720	60
10	3200	770	1900	370	1300	150	570	50
12	2700	730	1600	340	1100	150	480	40
16	2000	600	1200	290	800	130	360	30
20	1600	500	1000	240	640	120	290	25

Depth of cut	$\leq 1DC$ ( $DC \geq \phi 2$ ) $\leq 0.5DC$ ( $DC < \phi 2$ )		

DC:Dia.

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

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↵

SOLID END MILLS

# SOLID END MILLS

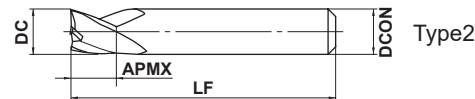
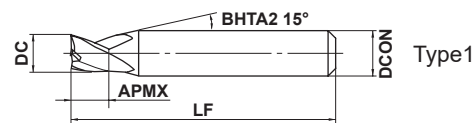
## MS3ES

End mill, 3 flute, For small automatic lathes



TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	



$3 \leq DC \leq 12$				
0				
- 0.020				



$4 \leq DCON \leq 6$	$7 \leq DCON \leq 10$			
0	0			
- 0.008	- 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)

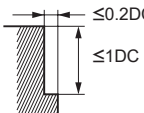
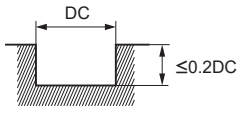
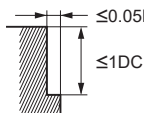
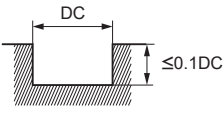
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS3ESD0300L45S04	3	3	45	4	3	●	1
MS3ESD0350L45S04	3.5	3.5	45	4	3	●	1
MS3ESD0400L45S04	4	4	45	4	3	●	2
MS3ESD0500L45S06	5	5	45	6	3	●	1
MS3ESD0600L45S06	6	6	45	6	3	●	2
MS3ESD0700L45S07	7	7	45	7	3	●	2
MS3ESD0800L45S07	8	8	45	7	3	●	3
MS3ESD0800L45S08	8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

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	10000	600	7000	400	6000	300	5000	120
<b>4</b>	7500	600	5200	400	4500	300	4000	120
<b>5</b>	6000	600	4200	400	3600	300	3200	120
<b>6</b>	5000	600	3500	400	3000	300	2700	120
<b>7</b>	4500	560	3000	360	2700	280	2300	110
<b>8</b>	4000	520	2800	350	2400	260	2000	110
<b>10</b>	3200	450	2200	300	1900	230	1600	100
<b>12</b>	2700	410	1900	270	1600	210	1300	100

Depth of cut	Carbon steel, Cast iron, Alloy steel (-30HRC)		Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Hardened steel (45-55HRC)	
								

DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

# SOLID END MILLS

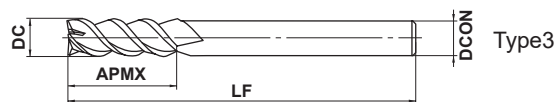
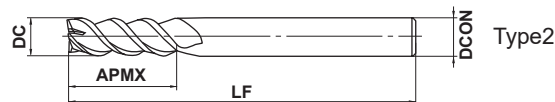
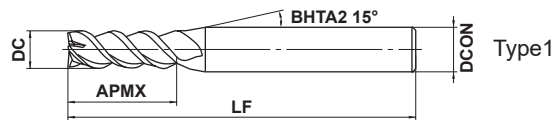
## VQMHZV

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



TOOL NEWS

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	Aluminium 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
VQMHZVD0400	4	8	50	6	3	●	1
VQMHZVD0450	4.5	10	50	6	3	●	1

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.

● : Inventory maintained in Japan.

(mm)

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS



# SOLID END MILLS

## VQMHZV

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

CARBIDE

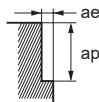
### RECOMMENDED CUTTING CONDITIONS

#### Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

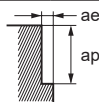
#### High efficiency conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340, SKD, SKT					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys AISI 304, AISI 316, Ti-6Al-4V					Hardened stainless steels, Cobalt chromium alloy AISI 630, AISI 631 15-5PH, 17-4PH				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



#### General-purpose conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340, SKD, SKT					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys AISI 304, AISI 316, Ti-6Al-4V					Hardened stainless steels, Cobalt chromium alloy AISI 630, AISI 631 15-5PH, 17-4PH				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



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 alloys and heat-resistant alloys 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.

## Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.


### High efficiency cutting conditions

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

Depth of cut 

### General-purpose conditions

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

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 alloys and heat-resistant alloys 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.

# SOLID END MILLS

## VQMHSZV

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

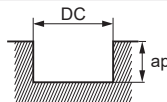
### RECOMMENDED CUTTING CONDITIONS

#### Slotting

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

#### High efficiency conditions

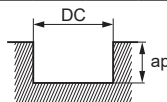
Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



DC: Dia.

#### General-purpose conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



DC: Dia.

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 alloys and heat-resistant alloys 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.

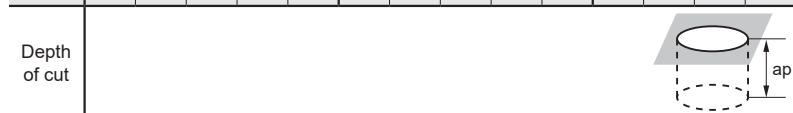
Note 4) When the depth of cut is smaller than shown the feed rate can be increased.

## Plunging

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

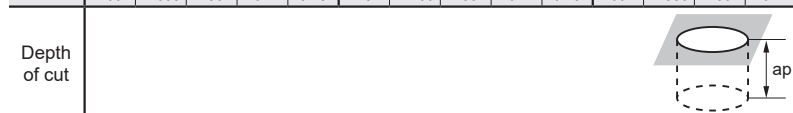
### High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, 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									
Dia. DC (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (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	0.2	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



### 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 steels, Titanium alloys					Hardened stainless steels, 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									
Dia. DC (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



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 alloys and heat-resistant alloys etc. can be achieved with the use of emulsion.

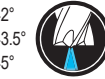
Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient.

In these cases the feed and speed should be reduced proportionately.

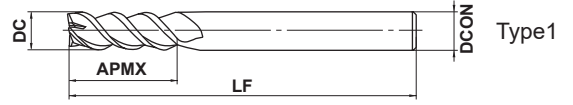
# SOLID END MILLS

## VQMZHVOH

End mill, Medium cutting length, 3 flute for drilling and slotting with internal through coolant holes



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	Aluminium Alloy
○	○			○	○	○	



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

	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.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMZHVOHD0600	6	13	60	6	3	●	1
VQMZHVOHD0800	8	19	70	8	3	●	1
VQMZHVOHD1000	10	22	80	10	3	●	1
VQMZHVOHD1200	12	26	90	12	3	●	1
VQMZHVOHD1600	16	30	110	16	3	●	1

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.

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### Slotting

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece 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 steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	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			
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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

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 steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	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			
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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

DC: Dia.

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 alloys and heat-resistant alloys 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.

# SOLID END MILLS

## VQMHZVOH

End mill, Medium cutting length, 3 flute for drilling and slotting with internal through coolant holes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

### RECOMMENDED CUTTING CONDITIONS

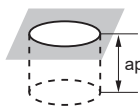
#### ■ Plunging

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

#### High efficiency conditions

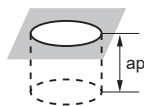
Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
<b>6</b>	100	5300	950	9	3	70	3700	440	9	1.2	60	3200	100	6	0.6	40	2100	60	6	0.6
<b>8</b>	100	4000	720	12	4	70	2800	340	12	1.6	60	2400	70	8	0.6	40	1600	50	8	0.6
<b>10</b>	100	3200	580	15	5	70	2200	260	15	2.5	60	1900	60	10	0.6	40	1300	40	10	0.6
<b>12</b>	100	2700	490	18	5	70	1900	230	18	3	60	1600	50	12	0.6	40	1100	30	12	0.6
<b>16</b>	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					
Dia. DC (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
<b>6</b>	120	6400	1200	9	3
<b>8</b>	120	4800	860	12	4
<b>10</b>	120	3800	680	15	5
<b>12</b>	120	3200	580	18	5
<b>16</b>	120	2400	430	24	5

Depth of cut



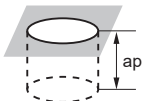
Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.

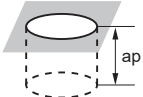
Note 2) Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion.

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

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)
<b>6</b>	100	5300	950	9	0.6	70	3700	440	9	0.6	60	3200	100	6	0.3	40	2100	60	6	0.3
<b>8</b>	100	4000	720	12	0.7	70	2800	340	12	0.7	60	2400	70	8	0.3	40	1600	50	8	0.3
<b>10</b>	100	3200	580	15	0.75	70	2200	260	15	0.75	60	1900	60	10	0.3	40	1300	40	10	0.3
<b>12</b>	100	2700	490	18	0.75	70	1900	230	18	0.75	60	1600	50	12	0.3	40	1100	30	12	0.3
<b>16</b>	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 (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Step (mm)	
<b>6</b>	120	6400	1200	9	0.6	
<b>8</b>	120	4800	860	12	0.7	
<b>10</b>	120	3800	680	15	0.75	
<b>12</b>	120	3200	580	18	0.75	
<b>16</b>	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 alloys and heat-resistant alloys 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.



# SOLID END MILLS

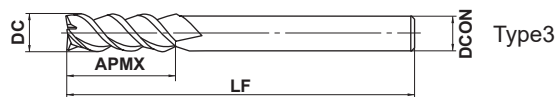
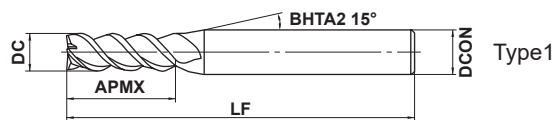
## VCMH

End mill, Medium cut length, 3–4 flute, High helix angle



DC ≤ 18 DC ≥ 20

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	Aluminium Alloy
○	○	○		◎	◎		



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● 3–4 flute end mill for milling difficult-to-cut and soft materials.

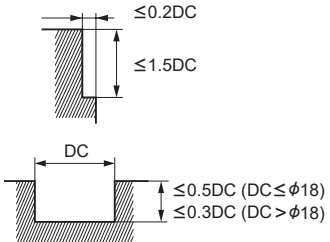
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
							Type	
VCMHD0300	3	8	45	6	3	●	1	
VCMHD0400	4	11	45	6	3	●	1	
VCMHD0500	5	13	50	6	3	●	1	
VCMHD0600	6	13	50	6	3	●	2	
VCMHD0700	7	16	60	8	3	●	1	
VCMHD0800	8	19	60	8	3	●	2	
VCMHD0900	9	19	70	10	3	●	1	
VCMHD1000	10	22	70	10	3	●	2	
VCMHD1100	11	22	75	12	3	●	1	
VCMHD1200	12	26	75	12	3	●	2	
VCMHD1300	13	26	75	12	3	●	3	
VCMHD1400	14	26	75	12	3	●	3	
VCMHD1500	15	30	80	16	3	●	1	
VCMHD1600	16	32	90	16	3	●	2	
VCMHD1800	18	32	90	16	3	●	3	
VCMHD2000	20	38	100	20	4	●	2	
VCMHD2500	25	45	120	25	4	●	2	

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Hardened steel (45–55HRC)		Heat resistant alloys	
	AISI 1050, AISI No 35 B, AISI P20, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	5300	130	4400	100	2400	50	1500	25
<b>4</b>	4400	220	3700	160	2000	80	1300	40
<b>5</b>	3600	260	3000	190	1700	100	1100	50
<b>6</b>	3200	280	2700	200	1500	100	1000	50
<b>8</b>	2400	300	2000	210	1200	110	800	45
<b>10</b>	1900	290	1600	210	960	115	640	45
<b>12</b>	1600	250	1300	170	800	95	530	40
<b>16</b>	1200	180	1000	130	600	70	400	30
<b>18</b>	1100	170	900	120	530	65	350	25
<b>20</b>	960	190	800	140	480	75	320	25
<b>25</b>	760	150	640	110	380	60	260	20

Depth of cut	Side Milling		Slotting	
		$\leq 0.2DC$	$\leq 1.5DC$	$\leq 0.05DC$

DC: Dia.

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

Note 2) The above table shows cutting conditions for side milling. For slotting, please set the revolution at 80–100% and the feed rate at 60–80% of the table figure. Please set the revolution rate at 60% and the feed rate at 40% when slotting austenitic stainless steels.

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



SOLID END MILLS

# SOLID END MILLS

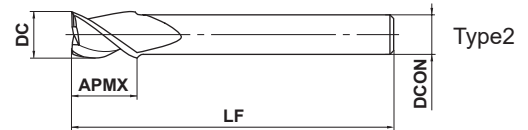
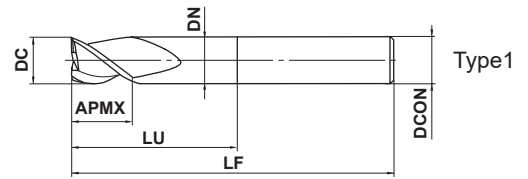
## C3SA

End mill, Short cut length, 3 flute, For aluminium alloy



Non-center Cutting Center Cutting

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	Aluminium Alloy
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	DC ≤ 12	DC > 12			
	0 - 0.020	0 - 0.030			
	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25		
	0 - 0.009	0 - 0.011	0 - 0.013		

● High efficiency machining for aluminium alloys.

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type	(mm)	
										Center	cutting edge
C3SAD1000A100S08	10	12	—	—	100	8	3	●	2	○	
C3SAD1000N300	10	12	30	9.4	75	10	3	●	1	—	
C3SAD1000N350	10	12	35	9.4	100	10	3	●	1	—	
C3SAD1200A150S10	12	15	—	—	150	10	3	●	2	○	
C3SAD1200N300	12	15	30	11.4	75	12	3	●	1	—	
C3SAD1200N350	12	15	35	11.4	100	12	3	●	1	—	
C3SAD1200N400	12	15	40	11.4	125	12	3	●	1	—	
C3SAD1600A200S14	16	15	—	—	200	14	3	●	2	○	
C3SAD1600N300	16	15	30	15.4	75	16	3	●	1	—	
C3SAD1600N400	16	15	40	15.4	100	16	3	●	1	—	
C3SAD1600N450	16	15	45	15.4	125	16	3	●	1	—	
C3SAD1700A150S16	17	18	—	—	150	16	3	●	2	○	
C3SAD1800A200S16	18	18	—	—	200	16	3	●	2	○	
C3SAD2000A200S18	20	20	—	—	200	18	3	●	2	○	
C3SAD2000N400	20	20	40	18	100	20	3	●	1	—	
C3SAD2000N600	20	20	60	18	125	20	3	●	1	—	
C3SAD2000N850	20	20	85	18	150	20	3	●	1	—	
C3SAD2500N500	25	20	50	23	100	25	3	●	1	—	
C3SAD2500N650	25	20	65	23	125	25	3	●	1	—	
C3SAD2500N900	25	20	90	23	150	25	3	●	1	—	
C3SAD2600A200S25	26	20	—	—	200	25	3	●	2	○	

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>12</b>	13000	5400
<b>16</b>	10000	5400
<b>18</b>	9000	5000
<b>20</b>	8000	5000
<b>25</b>	6000	4500

Depth of cut		
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### ■ Slotting

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>12</b>	13000	3200
<b>16</b>	10000	3200
<b>18</b>	9000	3000
<b>20</b>	8000	3000
<b>25</b>	6000	2800

Depth of cut		
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Note 1) Water-soluble cutting fluid is recommended.

Note 2) Climb cutting is recommended for side milling.

Note 3) This table shows the cutting condition with less than 4D overhang length. If more than 4D, spindle speed, feed rate and depth of cut should be reduced.

Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↵

SOLID END MILLS

# SOLID END MILLS

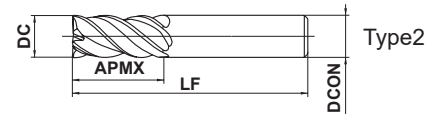
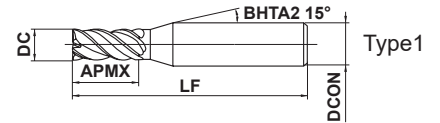
## MPMHV

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



TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	

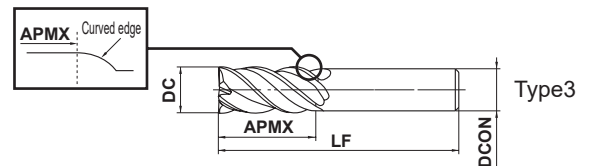


	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.02 \end{matrix}$	$\begin{matrix} 0 \\ -0.03 \end{matrix}$			
	DCON=4	DCON=6	DCON=8		
	$\begin{matrix} 0 \\ -0.005 \end{matrix}$	$\begin{matrix} 0 \\ -0.005 \end{matrix}$	$\begin{matrix} 0 \\ -0.006 \end{matrix}$		
	DCON=6(DC=8)	DCON=8(DC=10)	DCON=10	12 ≤ DCON ≤ 16	DCON=20
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$

● flute irregular helix end mill for reduced vibration when machining stainless steels and carbon steels.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MPMHVD0100	1	2.5	45	4	4	●	1
MPMHVD0150	1.5	3.8	45	4	4	●	1
MPMHVD0200	2	5	45	4	4	●	1
MPMHVD0250	2.5	6.3	45	4	4	●	1
MPMHVD0300	3	7.5	45	6	4	●	1
MPMHVD0400	4	10	45	6	4	●	1
MPMHVD0500	5	12.5	50	6	4	●	1
MPMHVD0600	6	15	60	6	4	●	2
MPMHVD0700	7	17.5	70	8	4	●	2
MPMHVD0800	8	20	70	8	4	●	2
MPMHVD1000	10	25	80	10	4	●	2
MPMHVD1200	12	30	100	12	4	●	2
MPMHVD1600	16	40	110	16	4	●	2
MPMHVD2000	20	50	125	20	4	●	2



### ■ Slim Shank

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
NEW MPMHVD0700S06	7	17.5	80	6	4	●	3
MPMHVD0800S06	8	20	90	6	4	●	3
NEW MPMHVD0900S08	9	22.5	90	8	4	●	3
MPMHVD1000S08	10	25	100	8	4	●	3
MPMHVD1100S10	11	28	100	10	4	●	3
MPMHVD1200S10	12	30	110	10	4	●	3
MPMHVD1300S12	13	32	110	12	4	●	3
NEW MPMHVD1400S12	14	35	130	12	4	●	3
NEW MPMHVD1800S16	18	45	150	16	4	●	3
NEW MPMHVD2200S20	22	55	160	20	4	●	3

CUTTING CONDITIONS > J132

● : Inventory maintained in Japan.

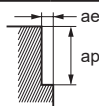
## RECOMMENDED CUTTING CONDITIONS

### Side milling

\*Please refer to page J132 for cutting conditions of slim shank.

Work Material	Carbon steel, Alloy steel (180—280HB) Ductile cast iron				Carbon steel, Alloy steel (280—350HB) Pre-hardened steel, Alloy tool steel				Austenitic stainless steel (≤200HB) Titanium alloy				Hardened steel (45—55HRC)			
	AISI 1045, AISI 4140, FCD450				AISI 4340, AISI P21, AISI P20, SKD, SKT				AISI 304, AISI 306, Ti-6Al-4V				AISI H13, AISI L6			
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>1</b>	38000	910	1.7	0.2	31000	500	1.7	0.2	25000	500	1.7	0.2	18000	290	1.7	0.05
<b>1.5</b>	27000	970	2.5	0.3	22000	530	2.5	0.3	18000	500	2.5	0.3	13000	310	2.5	0.08
<b>2</b>	21000	1500	3.5	0.4	17000	820	3.5	0.4	14000	640	3.5	0.4	10000	320	3.5	0.1
<b>2.5</b>	18000	1700	4.2	0.5	15000	900	4.2	0.5	12000	820	4.2	0.5	8500	360	4.2	0.13
<b>3</b>	16000	1800	5	0.6	13000	940	5	0.6	11000	880	5	0.6	7400	380	5	0.15
<b>4</b>	12000	1700	7	0.8	9500	950	7	0.8	8000	900	7	0.8	5600	400	7	0.2
<b>5</b>	9500	1800	8.5	1	7600	1100	8.5	1	6400	900	8.5	1	4500	430	8.5	0.25
<b>6</b>	8000	2100	10	1.2	6400	1300	10	1.2	5300	1100	10	1.2	3700	440	10	0.3
<b>7</b>	6800	2000	12	1.4	5500	1400	12	1.4	4500	1200	12	1.4	3200	450	12	0.35
<b>8</b>	6000	2000	13.5	1.6	4800	1400	13.5	1.6	4000	1200	13.5	1.6	2800	450	13.5	0.4
<b>10</b>	4800	2100	17	2	3800	1500	17	2	3200	1100	17	2	2200	440	17	0.5
<b>12</b>	4000	1900	20.5	2.4	3200	1400	20.5	2.4	2700	1100	20.5	2.4	1900	380	20.5	0.6
<b>16</b>	3000	1400	27.2	3.2	2400	1100	27.2	3.2	2000	840	27.2	3.2	1400	340	27.2	0.8
<b>20</b>	2400	1200	34	4	1900	840	34	4	1600	670	34	4	1100	260	34	1

Depth of cut



Note 1) Wet cutting mode is recommended for cutting stainless steels and titanium alloys, and air blow is recommended for carbon steels.

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 workpiece 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.

# SOLID END MILLS

## MPMHV

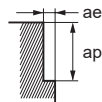
End mill, Medium cut length, 4 flute, Irregular helix flutes

### RECOMMENDED CUTTING CONDITIONS

#### ■ Side milling (Slim Shank)

Dia. DC (mm)	Carbon steel, Alloy steel (180—280HB) Ductile cast iron				Carbon steel, Alloy steel (280—350HB) Pre-hardened steel, Alloy tool steel				Austenitic stainless steel (≤200HB) Titanium alloy				Hardened steel (45—55HRC)			
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>7</b>	4100	1200	12	0.7	3300	860	12	0.7	2700	700	12	0.7	1900	270	12	0.35
<b>8</b>	3600	1200	13.5	0.8	2900	870	13.5	0.8	2400	720	13.5	0.8	1700	270	13.5	0.4
<b>9</b>	3200	1200	15	0.9	2500	900	15	0.9	2100	660	15	0.9	1500	270	15	0.45
<b>10</b>	2900	1300	17	1	2300	920	17	1	1900	670	17	1	1300	260	17	0.5
<b>11</b>	2600	1200	18.5	1.1	2100	880	18.5	1.1	1700	520	18.5	1.1	1200	190	18.5	0.55
<b>12</b>	2400	1200	20.5	1.2	1900	840	20.5	1.2	1600	650	20.5	1.2	1100	220	20.5	0.6
<b>13</b>	2200	1100	22	1.3	1800	790	22	1.3	1500	490	22	1.3	1000	160	22	0.65
<b>14</b>	2000	960	24	1.4	1600	700	24	1.4	1400	460	24	1.4	950	150	24	0.7
<b>18</b>	1600	770	31	1.8	1300	570	31	1.8	1100	360	31	1.8	740	120	31	0.9
<b>22</b>	1300	620	37.5	2.2	1000	440	37.5	2.2	870	280	37.5	2.2	610	98	37.5	1.2

Depth of cut



Note 1) Wet cutting mode is recommended for cutting stainless steels and titanium alloys, and air blow is recommended for carbon steels.

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 workpiece 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

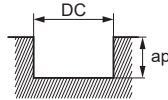


SOLID END MILLS

## Slotting

Work Material	Carbon steel, Alloy steel (180–280HB) Ductile cast iron			Carbon steel, Alloy steel (280–350HB) Pre-hardened steel, Alloy tool steel			Austenitic stainless steel ( $\leq 200\text{HB}$ ) Titanium alloy			Hardened steel (45–55HRC)		
	AISI 1045, AISI 4140, FCD450			AISI 4340, AISI P21, AISI P20, SKD, SKT			AISI 304, AISI 306, Ti-6Al-4V			AISI H13, AISI L6		
Dia. DC (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>1</b>	31000	620	0.5	24000	380	0.5	20000	320	0.5	9500	110	0.2
<b>1.5</b>	22000	630	0.8	17000	410	0.8	14000	340	0.8	6400	130	0.3
<b>2</b>	17000	650	2	14000	450	2	11000	350	2	4800	130	0.4
<b>2.5</b>	15000	830	2.5	12000	580	2.5	9700	470	2.5	3800	130	0.5
<b>3</b>	13000	940	3	10000	660	3	8500	510	3	3200	140	0.6
<b>4</b>	9500	820	4	7600	600	4	6400	460	4	2400	150	0.8
<b>5</b>	7600	910	5	6100	670	5	5100	510	5	1900	170	1
<b>6</b>	6400	860	6	5100	630	6	4200	470	6	1600	190	1.2
<b>7</b>	5500	960	7	4400	710	7	3600	530	7	1400	190	1.4
<b>8</b>	4800	1000	8	3800	750	8	3200	580	8	1200	190	1.6
<b>10</b>	3800	910	10	3100	680	10	2500	500	10	950	150	2
<b>12</b>	3200	920	12	2500	660	12	2100	500	12	800	160	2.4
<b>16</b>	2400	690	16	1900	500	16	1600	380	16	600	120	3.2
<b>20</b>	1900	550	20	1500	400	20	1300	310	20	480	96	4

Depth of cut



DC: Dia.

Note 3) Slim shank type is not recommended for grooving.



# SOLID END MILLS

## MPJHV

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

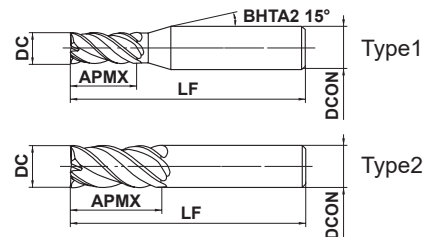


TOOL NEWS

APMX=DCx3.3

APMX=DCx4

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	Aluminium Alloy
○	○	○		○	○	○	



DC ≤ 12	DC > 12			
0 - 0.02	0 - 0.03			
DCON=4	DCON=6	DCON=8		
0 - 0.005	0 - 0.005	0 - 0.006		
DCON=10	DCON=12	DCON=16	DCON=20	
0 - 0.009	0 - 0.011	0 - 0.011	0 - 0.013	



- Irregular helix flutes end mill for reduced vibration when machining stainless steels and carbon steels.
- Semi long flute length suitable for vertical wall finishing.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MPJHVD0100AP04	1	4	45	4	4	●	1
MPJHVD0150AP06	1.5	6	45	4	4	●	1
MPJHVD0200AP06	2	6.5	60	6	4	●	1
MPJHVD0200AP08	2	8	60	6	4	●	1
MPJHVD0250AP10	2.5	10	60	6	4	●	1
MPJHVD0300AP10	3	10	60	6	4	●	1
MPJHVD0300AP12	3	12	60	6	4	●	1
MPJHVD0400AP13	4	13	60	6	4	●	1
MPJHVD0400AP16	4	16	60	6	4	●	1
MPJHVD0500AP17	5	17	60	6	4	●	1
MPJHVD0500AP20	5	20	60	6	4	●	1
MPJHVD0600AP20	6	20	60	6	4	●	2
MPJHVD0600AP24	6	24	60	6	4	●	2
MPJHVD0800AP26	8	26	80	8	4	●	2
MPJHVD0800AP32	8	32	80	8	4	●	2
MPJHVD1000AP33	10	33	100	10	4	●	2
MPJHVD1000AP40	10	40	100	10	4	●	2
MPJHVD1200AP40	12	40	110	12	4	●	2
MPJHVD1200AP48	12	48	110	12	4	●	2
MPJHVD1600AP53	16	53	125	16	4	●	2
MPJHVD1600AP64	16	64	125	16	4	●	2
MPJHVD2000AP66	20	66	140	20	4	●	2
MPJHVD2000AP80	20	80	140	20	4	●	2

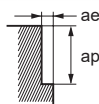
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material		Carbon steel, Alloy steel (180—280HB) Ductile cast iron AISI 1045, AISI 4140, FCD450				Carbon steel, Alloy steel (280—350HB) Pre-hardened steel, Alloy tool steel AISI 4340, AISI P21, AISI P20, SKD, SKT				Austenitic stainless steel (≤200HB) Titanium alloy AISI 304, AISI 306, Ti-6Al-4V				Hardened steel (45—55HRC) AISI H13, AISI L6			
Dia. DC (mm)	Length of cut APMX (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>1</b>	<b>4</b>	19000	300	3	0.03	15000	240	3	0.03	13000	210	3	0.03	13000	160	3	0.02
<b>1.5</b>	<b>6</b>	16000	320	4.5	0.05	13000	260	4.5	0.05	11000	220	4.5	0.05	8500	170	4.5	0.03
<b>2</b>	<b>6.5</b>	15000	500	5	0.1	12000	380	5	0.1	10000	320	5	0.1	7700	220	5	0.06
	<b>8</b>	14000	470	6	0.06	11000	350	6	0.06	9500	300	6	0.06	7300	200	6	0.04
<b>2.5</b>	<b>10</b>	13000	660	7.5	0.08	11000	520	7.5	0.08	8900	390	7.5	0.08	6300	250	7.5	0.05
<b>3</b>	<b>10</b>	13000	890	7.4	0.15	10000	620	7.4	0.15	8400	470	7.4	0.15	5900	300	7.4	0.09
	<b>12</b>	12000	820	9	0.09	9500	590	9	0.09	8000	450	9	0.09	5600	280	9	0.06
<b>4</b>	<b>13</b>	9400	940	9.9	0.2	7500	650	9.9	0.2	6300	530	9.9	0.2	4700	320	9.9	0.12
	<b>16</b>	9000	900	12	0.12	7200	620	12	0.12	6000	500	12	0.12	4500	310	12	0.08
<b>5</b>	<b>17</b>	7500	990	12.4	0.25	6000	680	12.4	0.25	5000	560	12.4	0.25	3800	350	12.4	0.15
	<b>20</b>	7200	950	15	0.15	5700	650	15	0.15	4800	540	15	0.15	3600	330	15	0.1
<b>6</b>	<b>20</b>	6300	1100	14.9	0.3	5000	760	14.9	0.3	4200	640	14.9	0.3	3200	350	14.9	0.18
	<b>24</b>	6000	1000	18	0.18	4800	730	18	0.18	4000	610	18	0.18	3000	330	18	0.12
<b>8</b>	<b>26</b>	4700	1100	19.8	0.4	3800	800	19.8	0.4	3100	620	19.8	0.4	2400	360	19.8	0.24
	<b>32</b>	4500	1000	24	0.24	3600	760	24	0.24	3000	600	24	0.24	2300	350	24	0.16
<b>10</b>	<b>33</b>	3800	1000	24.8	0.5	3000	760	24.8	0.5	2500	590	24.8	0.5	1900	330	24.8	0.3
	<b>40</b>	3600	970	30	0.3	2900	730	30	0.3	2400	570	30	0.3	1800	310	30	0.2
<b>12</b>	<b>40</b>	3100	1000	29.7	0.6	2500	720	29.7	0.6	2100	550	29.7	0.6	1600	300	29.7	0.36
	<b>48</b>	3000	970	36	0.36	2400	690	36	0.36	2000	520	36	0.36	1500	280	36	0.24
<b>16</b>	<b>53</b>	2400	780	27.2	0.48	1900	550	39.6	0.8	1600	420	39.6	0.8	1200	240	39.6	0.48
	<b>64</b>	2200	710	48	0.48	1800	520	48	0.48	1500	390	48	0.48	1100	220	48	0.32
<b>20</b>	<b>66</b>	1900	620	34	0.6	1500	430	49.5	1	1300	340	49.5	1	950	190	49.5	0.6
	<b>80</b>	1800	580	60	0.6	1400	400	60	0.6	1200	310	60	0.6	900	180	60	0.4

Depth of cut



Note 1) Wet cutting mode is recommended for cutting stainless steels and titanium alloys, and air blow is recommended for carbon steels.

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 workpiece 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

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RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

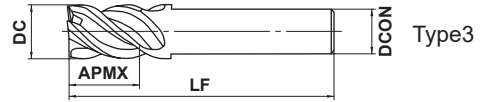
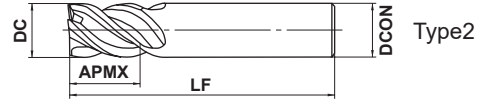
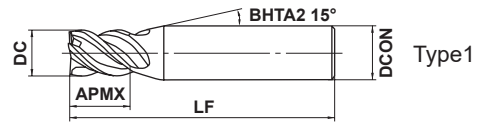
## MSSHDD

High power, Short cut length, 4 flute



TOOL NEWS

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	Aluminium 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.

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

● : Inventory maintained in Japan.

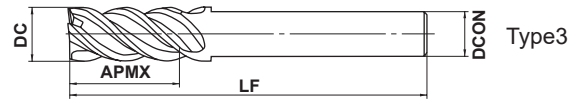
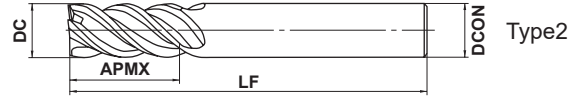
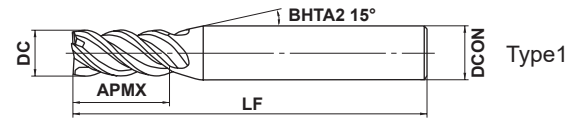
# MSMHD

High power, 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	Aluminium 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
MSMHDD0510	5.1	13	50	6	4	●	1
MSMHDD0520	5.2	13	50	6	4	●	1
MSMHDD0530	5.3	13	50	6	4	●	1

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## MSMHD

High power, Medium cut length, 4 flute

(mm)

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

● : Inventory maintained in Japan.



BARREL

TAPER

RADIUS

BALL

SQUARE

CARBIDE

# MSSHD

High power, Short cut length, 4 flute

# MSMHD

High power, Medium cut length, 4 flute

CARBIDE

## 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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
2	15000	550	10000	340	10000	320	6400	160	4800	100
3	11000	800	7400	500	7400	480	4800	250	4000	170
4	8000	900	5600	540	5600	520	3600	270	3200	240
5	6400	1000	4500	600	4500	580	2900	300	2600	240
6	5800	1100	3700	640	3700	600	2400	320	2100	230
8	4400	1100	2800	660	2800	600	1800	330	1600	220
10	3500	1000	2200	640	2200	560	1400	320	1300	200
12	2900	1000	1900	640	1900	530	1200	320	1100	170
16	2200	800	1400	500	1400	450	900	250	800	130
20	1800	750	1100	460	1100	440	720	230	640	100
25	1400	600	900	400	900	380	570	200	510	80

Depth of cut	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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	

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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
2	12000	400	7000	200	7000	100	4200	80	2300	40
3	9000	600	5300	300	5300	150	3200	130	1900	70
4	7200	720	4000	360	4000	180	2400	140	1400	95
5	5800	720	3200	360	3200	180	1900	150	1100	95
6	5000	800	2700	400	2700	200	1600	160	950	95
8	3700	800	2000	400	2000	200	1200	170	720	90
10	3000	720	1600	360	1600	180	960	160	570	80
12	2500	720	1300	360	1300	180	800	160	480	70
16	2000	600	1000	280	1000	150	600	130	360	50
20	1600	540	800	250	800	130	480	120	290	40
25	1300	480	640	220	640	120	380	100	230	35

Depth of cut	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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	

DC: Dia.

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

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.

SQUARE

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ROUGHING

SOLID END MILLS

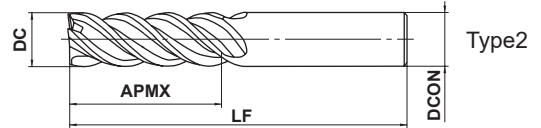
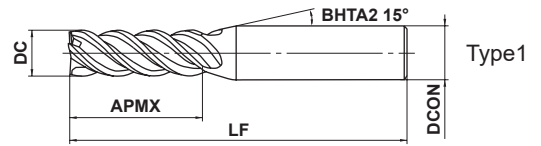
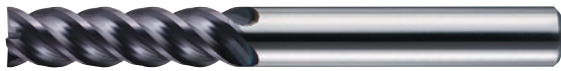
# SOLID END MILLS

## MSJHD

High power, Semi long 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	Aluminium 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.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
							Type	
MSJHDD0200	2	8	60	6	4	▲	1	
MSJHDD0250	2.5	10	60	6	4	▲	1	
MSJHDD0300	3	12	60	6	4	▲	1	
MSJHDD0350	3.5	14	60	6	4	▲	1	
MSJHDD0400	4	16	60	6	4	▲	1	
MSJHDD0450	4.5	18	60	6	4	▲	1	
MSJHDD0500	5	20	60	6	4	▲	1	
MSJHDD0600	6	24	60	6	4	▲	2	
MSJHDD0700	7	25	80	8	4	▲	1	
MSJHDD0800	8	28	80	8	4	▲	2	
MSJHDD0900	9	32	90	10	4	▲	1	
MSJHDD1000	10	35	90	10	4	▲	2	
MSJHDD1100	11	35	100	12	4	▲	1	
MSJHDD1200	12	36	100	12	4	▲	2	
MSJHDD1400	14	42	110	16	4	▲	1	
MSJHDD1500	15	45	110	16	4	▲	1	
MSJHDD1600	16	48	125	16	4	▲	2	
MSJHDD2000	20	55	140	20	4	▲	2	

▲ : Product scheduled to be discontinued at the end of March 2020

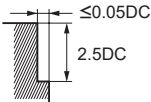
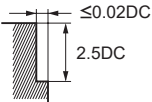
MPJHV (J134) is alternative product.

## 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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>2</b>	11000	370	7000	230	7000	210	5000	100	3800	55
<b>3</b>	8000	550	5100	320	5100	300	3800	190	2500	80
<b>4</b>	6200	620	4000	350	4000	340	3000	210	1900	110
<b>5</b>	5000	670	3200	370	3200	360	2400	220	1500	110
<b>6</b>	4200	750	2600	400	2600	390	2000	220	1300	110
<b>8</b>	3200	780	2000	420	2000	400	1500	230	960	100
<b>10</b>	2500	690	1600	410	1600	380	1200	210	760	100
<b>12</b>	2100	670	1300	380	1300	340	1000	190	640	80
<b>16</b>	1600	570	1000	320	1000	280	750	170	480	65
<b>20</b>	1200	470	800	290	800	260	600	150	380	50

Depth of cut		

DC: Dia.

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

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.

SQUARE

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ROUGHING

↩

SOLID END MILLS



# SOLID END MILLS

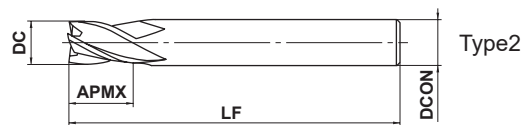
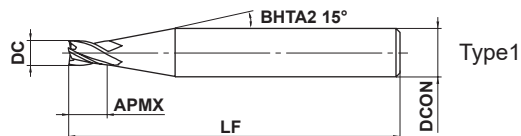
## MS4SC

End mill, Short cut length, 4 flute



TOOL NEWS

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	Aluminium Alloy
○	○	○	○	○	○	○	○



$1 \leq DC \leq 12$				
$0$				
$-0.020$				



$4 \leq DCON \leq 6$	$8 \leq DCON \leq 10$	$DCON = 12$		
$0$	$0$	$0$		
$-0.008$	$-0.009$	$-0.011$		

● 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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21			Hardened steel (45—55HRC) AISI H13		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	3000	0.06	32000	2400	0.06
<b>1.5</b>	40000	4500	0.12	32000	3600	0.08
<b>2</b>	30000	4500	0.18	24000	3600	0.10
<b>2.5</b>	24000	3900	0.25	19000	3000	0.13
<b>3</b>	20000	3500	0.30	16000	2700	0.15
<b>4</b>	15000	3000	0.40	12000	2400	0.20
<b>5</b>	12000	2400	0.50	9000	1800	0.25
<b>6</b>	10000	2100	0.60	7000	1500	0.30
<b>8</b>	8000	1500	0.80	5600	1100	0.40
<b>10</b>	6400	1400	1.00	4500	950	0.50
<b>12</b>	5400	1200	1.00	3800	860	0.50
<b>16</b>	2400	550	3.00	1200	120	0.80
<b>20</b>	1900	480	4.00	1000	100	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 shallow, the revolution and feed rate can be increased.

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

# SOLID END MILLS

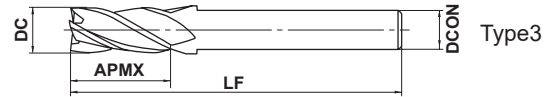
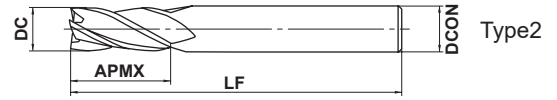
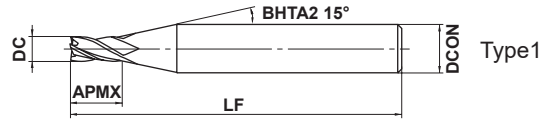
## MS4MC

End mill, Medium cut length, 4 flute



TOOL NEWS

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	Aluminium 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.

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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21			Hardened steel (45—55HRC) AISI H13		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	3000	0.06	32000	2400	0.06
<b>1.5</b>	40000	4500	0.12	32000	3600	0.08
<b>2</b>	30000	4500	0.18	24000	3600	0.10
<b>2.5</b>	24000	3900	0.25	19000	3000	0.13
<b>3</b>	20000	3500	0.30	16000	2700	0.15
<b>4</b>	15000	3000	0.40	12000	2400	0.20
<b>5</b>	12000	2400	0.50	9000	1800	0.25
<b>6</b>	10000	2100	0.60	7000	1500	0.30
<b>8</b>	8000	1500	0.80	5600	1100	0.40
<b>10</b>	6400	1400	1.00	4500	950	0.50
<b>12</b>	5400	1200	1.00	3800	860	0.50
<b>16</b>	2400	550	3.00	1200	120	0.80
<b>20</b>	1900	480	4.00	1000	100	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 shallow, the revolution and feed rate can be increased.

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

# SOLID END MILLS

## MS4JC

End mill, Semi long cut length, 4 flute



TOOL NEWS



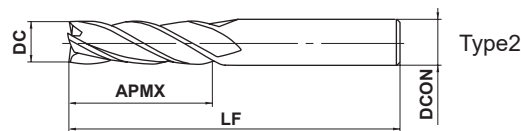
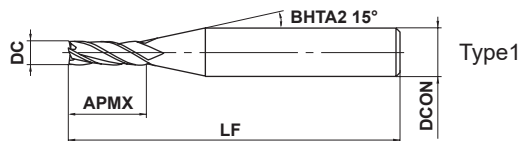
DC<3

DC≥3

DC<3

DC≥3

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	Aluminium 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.

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

(mm)

● : Inventory maintained in Japan.

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		Austenitic stainless steel, Titanium alloy		Hardened steel (45-55HRC)	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>1</b>	11100	85	9500	65	8000	50	6400	35
<b>1.5</b>	7400	85	6400	90	5300	50	4200	35
<b>2</b>	5600	85	4800	90	4000	50	3200	35
<b>2.5</b>	4500	85	3800	90	3200	55	2500	35
<b>3</b>	3700	90	3400	90	2600	60	2100	35
<b>4</b>	3000	110	2700	90	2100	70	1700	50
<b>5</b>	2600	140	2300	110	1800	85	1500	55
<b>6</b>	2300	170	2000	140	1500	110	1300	70
<b>8</b>	1700	180	1500	140	1200	110	1000	70
<b>10</b>	1400	180	1300	140	950	110	800	70
<b>12</b>	1200	170	1100	140	800	110	670	70

Depth of cut	Left Column		Right Column	
	Diagram 1	Diagram 2	Diagram 3	Diagram 4

DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

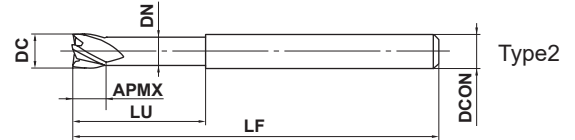
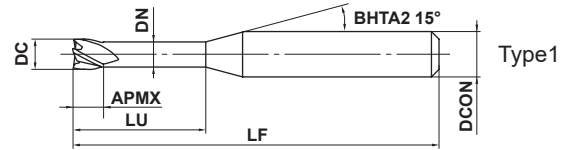
# SOLID END MILLS

## MS4XL

End mill, Short cut length, 4 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	Aluminium 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.

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
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

● : Inventory maintained in Japan.

(mm)

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS





# SOLID END MILLS

## MS4XL

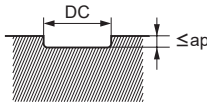
End mill, Short cut length, 4 flute, Long neck

(mm)

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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21			Work Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>1</b>	<b>4</b>	40000	3000	0.04	<b>3.5</b>	<b>15</b>	20000	3000	0.6
	<b>8</b>	36000	2400	0.03		<b>25</b>	11000	1600	0.15
	<b>12</b>	20000	1000	0.02		<b>35</b>	5500	800	0.06
	<b>16</b>	10000	500	0.005	<b>4</b>	<b>12</b>	18000	3000	1
<b>1.2</b>	<b>6</b>	40000	3000	0.05		<b>20</b>	12000	2000	0.5
	<b>10</b>	36000	2400	0.04		<b>30</b>	8000	1300	0.2
	<b>12</b>	20000	1200	0.03		<b>40</b>	4200	700	0.08
	<b>16</b>	12000	600	0.01		<b>50</b>	2400	400	0.03
<b>1.5</b>	<b>6</b>	40000	3200	0.06	<b>5</b>	<b>16</b>	14000	2700	1
	<b>12</b>	32000	2400	0.05		<b>25</b>	9500	1800	0.5
	<b>16</b>	16000	1100	0.03		<b>35</b>	6400	1200	0.2
	<b>20</b>	10000	600	0.01		<b>50</b>	3200	600	0.05
<b>1.8</b>	<b>6</b>	40000	3600	0.08	<b>6</b>	<b>20</b>	11000	2200	1.2
	<b>12</b>	32000	2800	0.06		<b>30</b>	8000	1600	0.6
	<b>20</b>	12000	1000	0.02		<b>40</b>	5400	1100	0.25
	<b>25</b>	7000	600	0.01		<b>50</b>	3200	640	0.15
<b>2</b>	<b>6</b>	40000	4000	0.1	<b>8</b>	<b>30</b>	8000	1600	1.6
	<b>12</b>	32000	3200	0.07		<b>50</b>	4000	800	0.5
	<b>16</b>	24000	2400	0.05		<b>70</b>	2000	400	0.2
	<b>20</b>	12000	1200	0.03	<b>10</b>	<b>40</b>	6400	1300	2
	<b>30</b>	5000	500	0.01		<b>60</b>	3200	640	0.6
<b>2.5</b>	<b>8</b>	32000	4000	0.2	<b>80</b>	1600	320	0.3	
	<b>25</b>	9000	1100	0.04	Depth of cut				
	<b>50</b>	2500	300	0.005					
<b>3</b>	<b>8</b>	25000	3600	0.4					
	<b>16</b>	18000	2500	0.2					
	<b>25</b>	12000	1700	0.1					
	<b>30</b>	7000	800	0.05					

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

Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

DC: Dia.  
ap: Depth of Cut in the Axial Direction

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

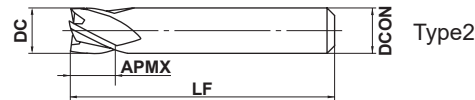
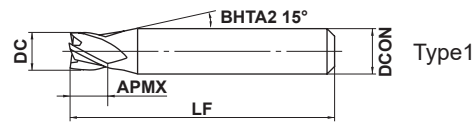
## MS4EC

End mill, 4 flute, For small automatic lathes



TOOL NEWS

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	Aluminium Alloy
○	○	○	○	○	○	○	○



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

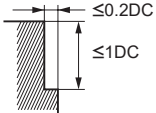
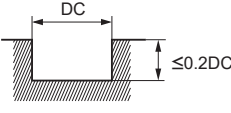
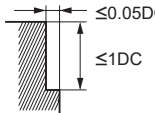
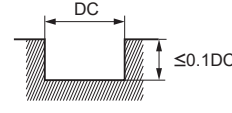
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4ECD0300L45S04	3	3	45	4	4	●	1
MS4ECD0350L45S04	3.5	3.5	45	4	4	●	1
MS4ECD0400L45S04	4	4	45	4	4	●	2
MS4ECD0500L45S06	5	5	45	6	4	●	1
MS4ECD0600L45S06	6	6	45	6	4	●	2
MS4ECD0700L45S07	7	7	45	7	4	●	2
MS4ECD0800L45S07	8	8	45	7	4	●	3
MS4ECD0800L45S08	8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

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	10000	900	7000	600	6000	450	5000	180
<b>4</b>	7500	900	5200	600	4500	450	4000	180
<b>5</b>	6000	900	4200	600	3600	450	3200	180
<b>6</b>	5000	900	3500	600	3000	450	2700	180
<b>7</b>	4500	840	3000	540	2700	420	2300	160
<b>8</b>	4000	780	2800	520	2400	390	2000	160
<b>10</b>	3200	680	2200	450	1900	340	1600	140
<b>12</b>	2700	620	1900	410	1600	310	1300	120
<b>14</b>	2300	550	1600	350	1400	280	1200	120

Depth of cut	Carbon steel, Cast iron, Alloy steel (–30HRC)		Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Hardened steel (45–55HRC)	
								

DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

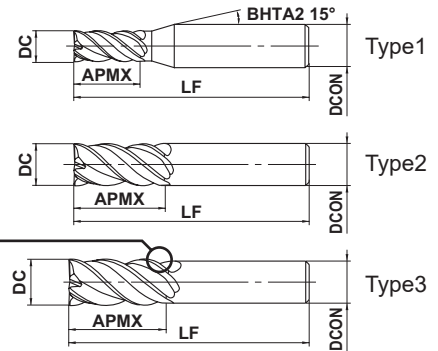
# SOLID END MILLS

## 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	Aluminium 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

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

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 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.

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

#### High efficiency conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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

#### General-purpose conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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

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 alloys and heat-resistant alloys 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.

# SOLID END MILLS

## VQMHV

End mill, Medium length of cut, 4 flute, Irregular helix flutes

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

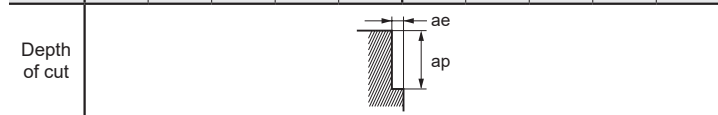
### RECOMMENDED CUTTING CONDITIONS

#### ■ Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

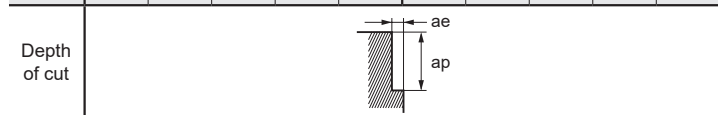
#### High efficiency conditions

Dia. DC (mm)	Copper, Copper alloy					Heat resistant alloys				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



#### General-purpose conditions

Dia. DC (mm)	Copper, Copper alloy					Heat resistant alloys				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



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 alloys and heat-resistant alloys 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.

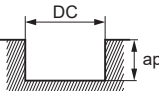
### Slotting

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece 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 steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	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			
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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

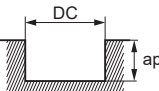


DC: Dia.

#### 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 steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	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			
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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 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 alloys and heat-resistant alloys 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.



# SOLID END MILLS

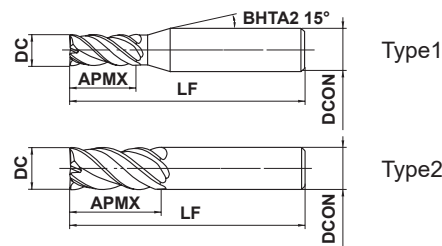
## VQJHV

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



TOOL NEWS

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	Aluminium 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	

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

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
<b>NEW</b> VQJHVD0100	1	4	45	4	4	●	1
<b>NEW</b> 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 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.


● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

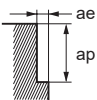
Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	AISI 1045, AISI 4140, ASTM A36, AISI 1010					AISI P21, AISI P20, AISI 4340					AISI 304, AISI 306, Ti-6Al-4V					SUS630, SUS631, 15-5PH, 17-4PH				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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 alloys				
	Inconel718									
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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 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 alloys and heat-resistant alloys 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

↵

SOLID END MILLS

# SOLID END MILLS

## VQXL

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

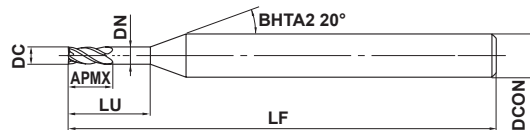


TOOL NEWS

DC≤0.3

DC≥0.4

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	Aluminium Alloy
○	○			○	○	○	



Type1

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ROUGHING

SOLID END MILLS

	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 φ1 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	0.47	40	4	4	●	1
VQXLD0050N025	0.5	0.7	2.5	0.47	40	4	4	●	1
VQXLD0050N030	0.5	0.7	3	0.47	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 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.

### Torque chart

Order Number	ISO 10664
	Torque type
VQXLD0020N006	T4
VQXLD0030N009	T6
VQXLD0030N015	T6
VQXLD0040N010	T8
VQXLD0040N018	T8
VQXLD0050N015	T15
VQXLD0050N025	T15
VQXLD0050N030	T15
VQXLD0080N024	TS25
VQXLD0080N040	TS25
VQXLD0100N050	T40

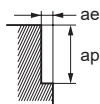
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material		Carbon steel, Alloy steel, Austenitic stainless steels, Titanium alloys Cobalt chromium alloy, Copper, Copper alloy					Heat resistant alloys, Pre-hardened steel, Hardened steel				
Work Material		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				
Dia. DC (mm)	Neck Length LU (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.2</b>	<b>0.6</b>	25	40000	360	0.03	0.01	20	32000	290	0.03	0.01
<b>0.3</b>	<b>0.9</b>	40	40000	480	0.045	0.015	20	21000	250	0.045	0.015
<b>0.3</b>	<b>1.5</b>	40	40000	360	0.045	0.015	20	21000	190	0.045	0.015
<b>0.4</b>	<b>1</b>	50	40000	800	0.06	0.02	20	16000	320	0.06	0.02
<b>0.4</b>	<b>1.8</b>	50	40000	560	0.06	0.02	20	16000	220	0.06	0.025
<b>0.5</b>	<b>1.5</b>	60	38000	910	0.075	0.025	20	13000	310	0.075	0.025
<b>0.5</b>	<b>2.5</b>	60	38000	610	0.075	0.025	20	13000	210	0.075	0.025
<b>0.5</b>	<b>3</b>	60	38000	550	0.075	0.025	20	13000	180	0.075	0.025
<b>0.6</b>	<b>3</b>	60	32000	640	0.09	0.03	20	10500	210	0.09	0.03
<b>0.7</b>	<b>3.5</b>	60	27000	650	0.11	0.035	20	9100	200	0.11	0.035
<b>0.8</b>	<b>2.4</b>	60	24000	960	0.12	0.04	20	8000	260	0.12	0.04
<b>0.8</b>	<b>3</b>	60	24000	860	0.12	0.04	20	8000	230	0.12	0.04
<b>0.8</b>	<b>4</b>	60	24000	670	0.12	0.04	20	8000	190	0.12	0.04
<b>1</b>	<b>5</b>	60	20000	800	0.15	0.05	20	6500	210	0.15	0.05

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 alloys and heat-resistant alloys 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

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SOLID END MILLS

# SOLID END MILLS

## VQXL

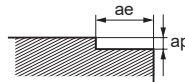
End mill, Short cut length, 4 flute, Long neck

### RECOMMENDED CUTTING CONDITIONS

#### Bottom face milling

Work Material		Carbon steel, Alloy steel, Austenitic stainless steels, Titanium alloys Cobalt chromium alloy, Copper, Copper alloy					Heat resistant alloys, Pre-hardened steel, Hardened steel				
Work Material		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				
Dia. DC (mm)	Neck Length LU (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.2</b>	<b>0.6</b>	25	40000	360	0.015	≤0.2	20	32000	290	0.015	≤0.1
<b>0.3</b>	<b>0.9</b>	40	40000	480	0.025	≤0.3	20	21000	250	0.025	≤0.15
<b>0.3</b>	<b>1.5</b>	40	40000	360	0.02	≤0.3	20	21000	190	0.02	≤0.15
<b>0.4</b>	<b>1</b>	50	40000	800	0.03	≤0.4	20	16000	320	0.03	≤0.2
<b>0.4</b>	<b>1.8</b>	50	40000	560	0.02	≤0.4	20	16000	220	0.02	≤0.2
<b>0.5</b>	<b>1.5</b>	60	38000	910	0.04	≤0.5	20	13000	310	0.04	≤0.25
<b>0.5</b>	<b>2.5</b>	60	38000	610	0.03	≤0.5	20	13000	210	0.03	≤0.25
<b>0.5</b>	<b>3</b>	60	38000	550	0.03	≤0.5	20	13000	180	0.03	≤0.25
<b>0.6</b>	<b>3</b>	60	32000	640	0.035	≤0.6	20	10500	210	0.035	≤0.3
<b>0.7</b>	<b>3.5</b>	60	27000	640	0.035	≤0.7	20	9100	190	0.035	≤0.35
<b>0.8</b>	<b>2.4</b>	60	24000	960	0.06	≤0.8	20	8000	260	0.06	≤0.4
<b>0.8</b>	<b>3</b>	60	24000	840	0.05	≤0.8	20	8000	230	0.05	≤0.4
<b>0.8</b>	<b>4</b>	60	24000	670	0.04	≤0.8	20	8000	190	0.04	≤0.4
<b>1</b>	<b>5</b>	60	20000	800	0.05	≤1	20	6500	210	0.05	≤0.5

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.

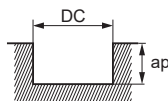
Note 2) Effective cutting of stainless steel, titanium alloys and heat-resistant alloys etc. can be achieved with the use of emulsion.

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

## Slotting

Work Material		Carbon steel, Alloy steel, Austenitic stainless steels, Titanium alloys Cobalt chromium alloy, Copper, Copper alloy				Heat resistant alloys, Pre-hardened steel, Hardened steel			
Work Material		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			
Dia. DC (mm)	Neck Length LU (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>0.2</b>	<b>0.6</b>	20	30000	270	0.03	15	24000	220	0.03
<b>0.3</b>	<b>0.9</b>	30	30000	360	0.045	14	15000	180	0.045
<b>0.3</b>	<b>1.5</b>	30	30000	270	0.045	14	15000	140	0.045
<b>0.4</b>	<b>1</b>	40	30000	600	0.06	15	12000	240	0.06
<b>0.4</b>	<b>1.8</b>	40	30000	420	0.06	15	12000	170	0.06
<b>0.5</b>	<b>1.5</b>	45	28000	670	0.075	15	9500	230	0.075
<b>0.5</b>	<b>2.5</b>	45	28000	450	0.075	15	9500	150	0.075
<b>0.5</b>	<b>3</b>	45	28000	390	0.075	15	9500	130	0.075
<b>0.6</b>	<b>3</b>	45	24000	480	0.09	15	7800	160	0.09
<b>0.7</b>	<b>3.5</b>	45	20000	480	0.11	15	6800	140	0.11
<b>0.8</b>	<b>2.4</b>	45	18000	720	0.12	15	6000	190	0.12
<b>0.8</b>	<b>3</b>	45	18000	650	0.12	15	6000	170	0.12
<b>0.8</b>	<b>4</b>	45	18000	500	0.12	15	6000	140	0.12
<b>1</b>	<b>5</b>	45	15000	600	0.15	15	4800	150	0.15

Depth of cut



DC: Dia.

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 alloys and heat-resistant alloys etc. can be achieved with the use of emulsion.

Note 3) When the depth of cut is small, the feed rate can be increased.

# SOLID END MILLS

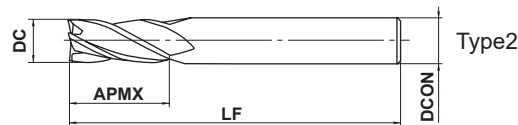
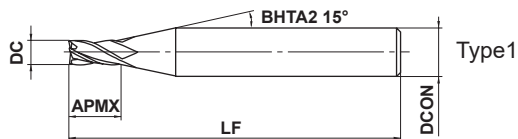
## VF4MD

End mill, Medium cut length, 4 flute, For hardened materials



TOOL NEWS

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	Aluminium Alloy
	○	◎	◎				



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



● 4 flute end mill suitable for high-speed machining of hardened steel.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF4MDD0100	1	2.5	40	4	4	●	1
VF4MDD0150	1.5	3.8	40	4	4	●	1
VF4MDD0200	2	5	40	4	4	●	1
VF4MDD0250	2.5	6.3	40	4	4	●	1
VF4MDD0300	3	7.5	50	6	4	●	1
VF4MDD0400	4	10	50	6	4	●	1
VF4MDD0500	5	12.5	50	6	4	●	1
VF4MDD0600	6	15	50	6	4	●	2
VF4MDD0800	8	20	60	8	4	●	2
VF4MDD1000	10	25	70	10	4	●	2
VF4MDD1200	12	30	90	12	4	●	2
VF4MDD1600	16	40	100	16	4	●	2
VF4MDD2000	20	50	110	20	4	●	2

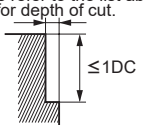
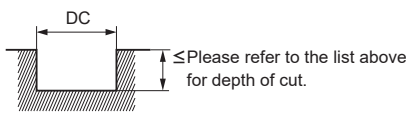
● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## 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			AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	3000	0.06	32000	2400	0.06	16000	710	0.05
<b>1.5</b>	40000	4500	0.12	32000	3600	0.08	10600	650	0.08
<b>2</b>	30000	4500	0.18	24000	3600	0.10	8100	520	0.10
<b>2.5</b>	24000	3900	0.25	19000	3000	0.13	6400	450	0.13
<b>3</b>	20000	3500	0.30	16000	2700	0.15	5400	390	0.15
<b>4</b>	15000	3000	0.40	12000	2400	0.20	4000	450	0.20
<b>5</b>	12000	2400	0.50	9000	1800	0.25	3200	380	0.20
<b>6</b>	10000	2100	0.60	7000	1400	0.30	2700	320	0.20
<b>8</b>	8000	1500	0.80	5600	1100	0.40	2000	240	0.20
<b>10</b>	6400	1400	1.00	4500	950	0.50	1600	210	0.30
<b>12</b>	5400	1200	1.00	3800	860	0.50	1300	160	0.30
<b>16</b>	2400	550	3.00	1200	280	0.80	1000	130	0.30
<b>20</b>	1900	480	4.00	1000	240	1.00	800	100	0.30

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

DC: Dia.

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

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

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



SOLID END MILLS



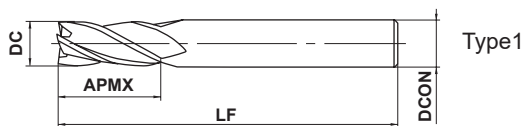
# SOLID END MILLS

## VF4MV

End mill, Medium cut length, 4 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	Aluminium Alloy
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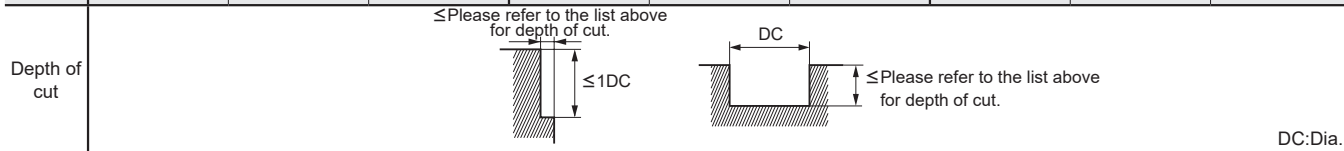
	DC ≤ 12	DC > 12			
	$0$ - 0.020	$0$ - 0.030			
	DCON=6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON=20	
	$0$ - 0.008	$0$ - 0.009	$0$ - 0.011	$0$ - 0.013	

● An irregular helix 4 flute square end mill suitable for high-speed machining of hardened steel.

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			AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
6	10000	2100	0.60	7000	1400	0.30	2700	320	0.20
8	8000	1500	0.80	5600	1100	0.40	2000	240	0.20
10	6400	1400	1.00	4500	950	0.50	1600	210	0.30
12	5400	1200	1.00	3800	860	0.50	1300	160	0.30
16	2400	550	3.00	1200	280	0.80	1000	130	0.30
20	1900	480	4.00	1000	240	1.00	800	100	0.30



- Note 1) When slotting, reduce the revolutions by 50—70% and the feed rate by 40—60%.
- Note 2) For austenitic stainless steels, titanium and heat-resistant alloys, the VFMHV is recommended.
- 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 workpiece 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.

● : Inventory maintained in Japan.

# VFMHVCH

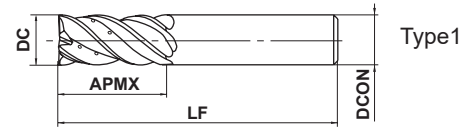
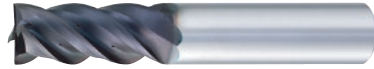
End mill, Medium cut length, 4 flute, Irregular helix flutes, with multiple internal through coolant holes



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	Aluminium Alloy
○	○			◎	◎		

**CoolStar**  
END MILLS



	16 ≤ DC ≤ 20				
	$\begin{matrix} 0 \\ -0.03 \end{matrix}$				
	DCON = 16	DCON = 20			
	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$			

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

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMHVCHD1600	16	35	90	16	4	●	1
VFMHVCHD2000	20	45	110	20	4	●	1

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel (−45HRC)		Austenitic stainless steel, Titanium alloy		Heat resistant alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	3000	1140	2000	560	800	110
20	2400	860	1600	510	600	100

Depth of cut	Alloy steel, Tool steel, Pre-hardened steel (−45HRC)		Austenitic stainless steel, Titanium alloy	
	$\begin{matrix} \leq 0.1DC \\ 0.5DC - 1.5DC \end{matrix}$		$\begin{matrix} \leq 0.05DC \\ 0.5DC - 1.5DC \end{matrix}$	

DC: Dia.

### ■ Slotting

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	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	2400	670	1400	380	1400	170
20	1900	610	1100	350	1100	130

Depth of cut	Alloy steel, Tool steel, Pre-hardened steel (−45HRC)	
	$\begin{matrix} DC \\ 0.5DC - 1.5DC \end{matrix}$	

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 workpiece 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



SOLID END MILLS

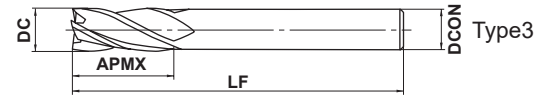
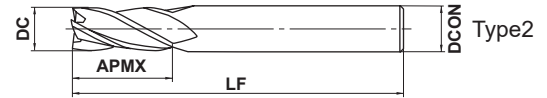
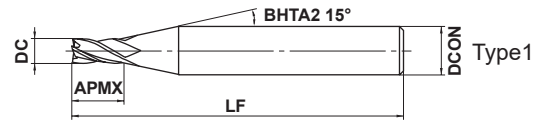
# SOLID END MILLS

## VC4MC

End mill, 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	Aluminium Alloy
○	◎	○		○	○		



h6	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 end mill for general use.

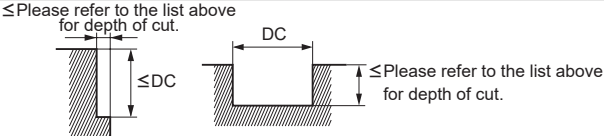
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC4MCD0200	2	6	40	4	4	●	1
VC4MCD0250	2.5	8	40	4	4	●	1
VC4MCD0300	3	8	45	6	4	●	1
VC4MCD0350	3.5	10	45	6	4	●	1
VC4MCD0400	4	11	45	6	4	●	1
VC4MCD0450	4.5	11	45	6	4	●	1
VC4MCD0500	5	13	50	6	4	●	1
VC4MCD0550	5.5	13	50	6	4	●	1
VC4MCD0600	6	13	50	6	4	●	2
VC4MCD0650	6.5	16	60	8	4	●	1
VC4MCD0700	7	16	60	8	4	●	1
VC4MCD0750	7.5	16	60	8	4	●	1
VC4MCD0800	8	19	60	8	4	●	2
VC4MCD0850	8.5	19	70	10	4	●	1
VC4MCD0900	9	19	70	10	4	●	1
VC4MCD0950	9.5	19	70	10	4	●	1
VC4MCD1000	10	22	70	10	4	●	2
VC4MCD1050	10.5	22	75	12	4	●	1
VC4MCD1100	11	22	75	12	4	●	1
VC4MCD1150	11.5	22	75	12	4	●	1
VC4MCD1200	12	26	75	12	4	●	2
VC4MCD1250	12.5	26	75	12	4	●	3
VC4MCD1300	13	26	75	12	4	●	3
VC4MCD1400	14	26	75	12	4	●	3
VC4MCD1500	15	30	80	16	4	●	1
VC4MCD1600	16	32	90	16	4	●	2
VC4MCD1700	17	32	90	16	4	●	3
VC4MCD1800	18	32	90	16	4	●	3
VC4MCD1900	19	32	100	20	4	●	1
VC4MCD2000	20	38	100	20	4	●	2
VC4MCD2200	22	38	100	20	4	●	3
VC4MCD2400	24	45	120	25	4	●	1
VC4MCD2500	25	45	120	25	4	●	2

● : Inventory maintained in Japan.

## 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			AISI H13		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>2</b>	30000	4500	0.18	24000	3600	0.10
<b>2.5</b>	24000	3900	0.25	19000	3000	0.13
<b>3</b>	20000	3500	0.30	16000	2700	0.15
<b>4</b>	15000	3000	0.40	12000	2400	0.20
<b>5</b>	12000	2400	0.50	9000	1800	0.25
<b>6</b>	10000	2100	0.60	7000	1470	0.30
<b>8</b>	8000	1500	0.80	5600	1050	0.40
<b>10</b>	6400	1400	1.00	4500	950	0.50
<b>12</b>	5400	1200	1.00	3800	860	0.50
<b>16</b>	2400	550	2.00	1200	120	0.80
<b>20</b>	1900	480	3.00	1000	100	1.00

Depth of cut



DC: Dia.

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

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

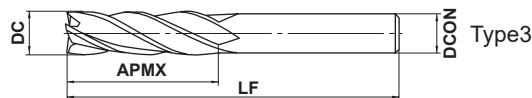
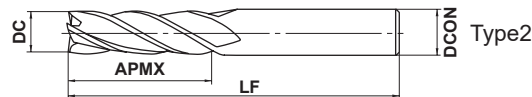
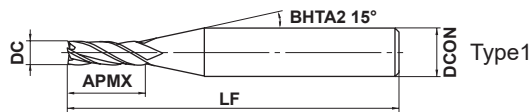
# SOLID END MILLS

## VC4JC

End mill, Semi long 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	Aluminium 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

● 4 flute end mill for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VC4JCD0300	3	12	50	6	4	●	1
VC4JCD0350	3.5	15	50	6	4	●	1
VC4JCD0400	4	15	50	6	4	●	1
VC4JCD0450	4.5	15	50	6	4	●	1
VC4JCD0500	5	20	60	6	4	●	1
VC4JCD0550	5.5	20	60	6	4	●	1
VC4JCD0600	6	20	60	6	4	●	2
VC4JCD0650	6.5	25	70	8	4	●	1
VC4JCD0700	7	25	70	8	4	●	1
VC4JCD0750	7.5	25	70	8	4	●	1
VC4JCD0800	8	25	70	8	4	●	2
VC4JCD0850	8.5	25	90	10	4	●	1
VC4JCD0900	9	25	90	10	4	●	1
VC4JCD0950	9.5	25	90	10	4	●	1
VC4JCD1000	10	30	90	10	4	●	2
VC4JCD1050	10.5	30	90	12	4	●	1
VC4JCD1100	11	30	90	12	4	●	1
VC4JCD1150	11.5	30	90	12	4	●	1
VC4JCD1200	12	30	90	12	4	●	2
VC4JCD1300	13	35	90	12	4	●	3
VC4JCD1400	14	40	110	16	4	●	1
VC4JCD1500	15	40	110	16	4	●	1
VC4JCD1600	16	50	110	16	4	●	2
VC4JCD1700	17	50	110	20	4	●	1
VC4JCD1800	18	50	110	20	4	●	1
VC4JCD1900	19	55	110	20	4	●	1
VC4JCD2000	20	55	110	20	4	●	2
VC4JCD2200	22	65	140	25	4	●	1
VC4JCD2400	24	75	140	25	4	●	1
VC4JCD2500	25	75	140	25	4	●	2

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	4200	110	3400	95	2600	70	2100	50
<b>4</b>	3400	140	2700	110	2100	85	1700	60
<b>5</b>	2900	170	2300	140	1800	100	1500	70
<b>6</b>	2500	200	2000	170	1500	130	1300	85
<b>8</b>	1900	220	1500	170	1200	150	1000	85
<b>10</b>	1600	220	1300	170	950	130	800	85
<b>12</b>	1300	170	1100	150	800	100	670	70
<b>16</b>	1000	140	820	110	600	80	500	50
<b>20</b>	800	110	650	85	480	70	400	40
<b>25</b>	650	85	520	70	380	50	320	35

Depth of cut	Standard side milling		Slotting	
		$\leq 0.05DC$ (MAX. 0.5mm)	$\leq 2.5DC$	$\leq 0.02DC$ (MAX. 0.3mm)
		$\leq 0.3DC$ (MAX. 3mm)		$\leq 0.05DC$ (MAX. 0.5mm)

DC: Dia.

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

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

Note 3) The above table shows cutting conditions for standard side 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 steels.

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

Note 5) 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.

# SOLID END MILLS

## VCMDSC

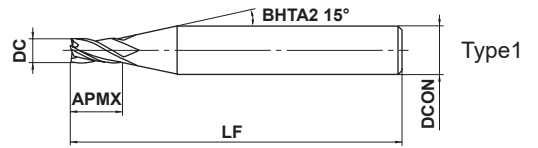
End mill, Medium cut length, 4–6 flute



DC<3

DC=3

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	Aluminium Alloy
	○	◎	◎				



	0.5 ≤ DC ≤ 3				
	0 - 0.020				
	DCON=6				
	0 - 0.008				

● Recommended for shape nose cutting hardened steels.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
							Type	
VCMDSCD0050	0.5	1	45	6	4	●	1	
VCMDSCD0100	1	2.5	45	6	4	●	1	
VCMDSCD0150	1.5	4	45	6	4	●	1	
VCMDSCD0200	2	6	45	6	4	●	1	
VCMDSCD0250	2.5	8	45	6	4	●	1	
VCMDSCD0300	3	8	45	6	6	●	1	

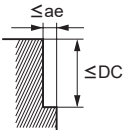
● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

Work Material	Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
	AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ae (mm)
<b>0.5</b>	40000	2000	0.03	30000	600	0.02
<b>1</b>	40000	3000	0.05	20000	900	0.03
<b>1.5</b>	40000	5000	0.08	18000	1100	0.05
<b>2</b>	40000	5600	0.10	16000	1300	0.06
<b>3</b>	34000	5600	0.15	13000	1600	0.09

Depth of cut				DC: Dia.		
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Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.

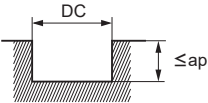
Note 2) The above condition are for shoulder milling. For slotting  $\phi 3$  or larger diameters, set the revolution, feed rate and depth of cut at 20—40% of the table figures.

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.

### Slot milling with small diameter tools

Work Material	Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
	AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>0.5</b>	20000	200	0.05	15000	90	0.03
<b>1</b>	15000	300	0.1	11000	110	0.05
<b>1.5</b>	10000	280	0.15	7500	150	0.07
<b>2</b>	8000	320	0.2	6000	190	0.1

Depth of cut				DC: Dia.		
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Note 1) Air blow or oil mist is recommended for good chip evacuation.



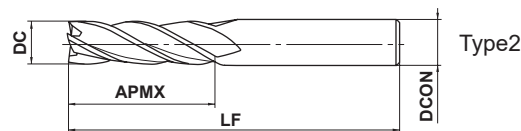
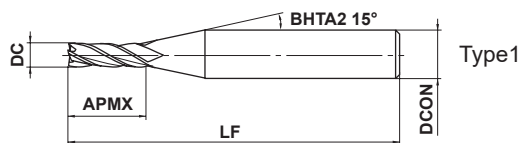
# SOLID END MILLS

## CRN4JC

End mill, Semi long cut length, 4 flute, For copper electrodes



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	Aluminium Alloy
						○	○



3 ≤ DC ≤ 12				
0				
- 0.02				



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

● 4 flute end mill with CRN coating for copper electrode machining.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
							Type	
CRN4JCD0300	3	12	50	6	4	●	1	
CRN4JCD0400	4	15	50	6	4	●	1	
CRN4JCD0500	5	20	60	6	4	●	1	
CRN4JCD0600	6	20	60	6	4	●	2	
CRN4JCD0800	8	25	70	8	4	●	2	
CRN4JCD1000	10	30	90	10	4	●	2	
CRN4JCD1200	12	30	90	12	4	●	2	

● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

Work Material	Copper, Copper alloys	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	10600	280
<b>4</b>	8000	330
<b>5</b>	6400	380
<b>6</b>	5300	420
<b>8</b>	4000	460
<b>10</b>	3200	460
<b>12</b>	2700	460

Depth of cut	<p style="text-align: right;">DC: Dia.</p>
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Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 2) Water-soluble cutting fluid is recommended.

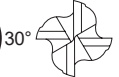
Note 3) When drilling, please set the feed rate at 1/3 or below of the table value.

Note 4) 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.

# SOLID END MILLS

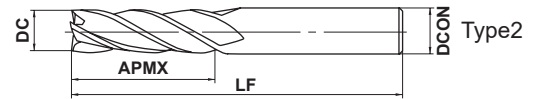
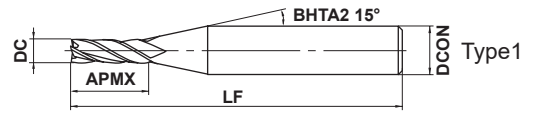
## DF4JC

End mill, Semi long cut length, 4 flute, For graphite



TOOL NEWS

Aluminium Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



	$3 \leq DC \leq 12$				
	$0$ - 0.02				
	DCON=6	$8 \leq DCON \leq 10$	DCON=12		
	$0$ - 0.008	$0$ - 0.009	$0$ - 0.011		

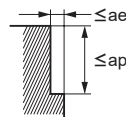
● 4 flute end mill with original diamond coating for graphite machining.

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

## RECOMMENDED CUTTING CONDITIONS

Work Material	Graphite				Copper, Copper alloys			
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of Cut ap (mm)	Cutting Width ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of Cut ap (mm)
3	22000	2500	6	0.15	10600	280	6	0.15
4	18000	2900	8	0.2	8000	330	8	0.2
6	14000	3200	12	0.3	6400	380	12	0.3
8	10500	2900	16	0.4	4000	420	16	0.4
10	8700	2600	20	0.5	3200	460	20	0.5
12	7200	2200	24	0.6	2700	460	24	0.6

Depth of cut



DC: Dia.

Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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.

● : Inventory maintained in Japan.

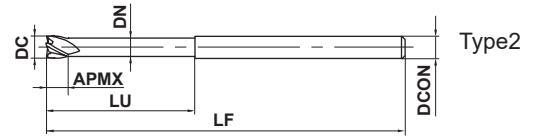
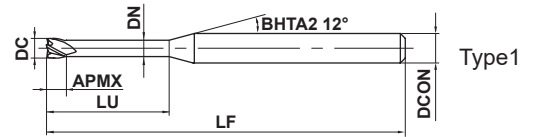
# DF4XL

End mill, Long neck, 4 flute, For graphite



CARBIDE

Aluminium Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



	1 ≤ DC ≤ 12				
	$\begin{matrix} 0 \\ -0.02 \end{matrix}$				
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$		

● 4 flute long neck end mill with original diamond coating for graphite machining.

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## DF4XL

End mill, Long neck, 4 flute, For graphite

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

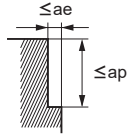
ROUGHING

↳

SOLID END MILLS

### RECOMMENDED CUTTING CONDITIONS

#### ■ Side milling

Work Material		Graphite				Copper, Copper alloys			
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of Cut ap (mm)	Cutting Width ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of Cut ap (mm)	Cutting Width ae (mm)
1	6	30000	1300	1	0.05	30000	1300	1	0.05
	8	25000	1000	1	0.05	25000	1000	1	0.05
	10	22000	700	1	0.05	22000	700	1	0.05
1.5	10	25000	1200	1.5	0.075	21000	1000	1.5	0.075
	16	18000	800	1.5	0.075	18000	800	1.5	0.075
2	10	22000	1500	2	0.1	16000	1100	2	0.1
	16	19000	1100	2	0.1	16000	930	2	0.1
	20	16000	800	2	0.1	16000	800	2	0.1
3	16	21000	1900	3	0.15	10600	960	3	0.15
	20	18000	1500	3	0.15	10600	890	3	0.15
	30	14000	1000	3	0.15	10600	760	3	0.15
4	20	18000	2400	4	0.4	8000	1100	4	0.4
	40	13000	1500	4	0.4	8000	920	4	0.4
6	30	14000	3200	6	0.6	5300	1200	6	0.6
8	30	10500	2900	8	0.8	4000	1100	8	0.8
10	30	8700	2600	10	1.0	3200	960	10	1.0
12	30	7200	2200	12	1.2	2650	800	12	1.2
Depth of cut									

Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

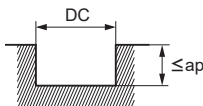
Note 2) Use a milling machine dedicated for graphite.

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.

**Slotting**

Work Material		Graphite			Copper, Copper alloys		
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of Cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of Cut ap (mm)
<b>1</b>	<b>6</b>	30000	1000	0.1	30000	980	0.1
	<b>8</b>	25000	700	0.08	25000	700	0.08
	<b>10</b>	22000	500	0.06	22000	500	0.06
<b>1.5</b>	<b>10</b>	25000	1100	0.14	21000	750	0.14
	<b>16</b>	18000	600	0.1	18000	600	0.1
<b>2</b>	<b>10</b>	22000	1200	0.2	16000	820	0.2
	<b>16</b>	19000	800	0.16	16000	700	0.16
	<b>20</b>	16000	600	0.12	16000	600	0.12
<b>3</b>	<b>16</b>	21000	1400	0.3	10600	720	0.3
	<b>20</b>	18000	1100	0.25	10600	670	0.25
	<b>30</b>	14000	700	0.2	10600	570	0.2
<b>4</b>	<b>20</b>	18000	1800	0.5	8000	820	0.5
	<b>40</b>	13000	900	0.4	8000	690	0.4
<b>6</b>	<b>30</b>	14000	2300	1.2	5300	900	1.2
<b>8</b>	<b>30</b>	10500	2000	2.0	4000	820	2.0
<b>10</b>	<b>30</b>	8700	1900	3.0	3200	720	3.0
<b>12</b>	<b>30</b>	7200	1700	4.0	2650	600	4.0

Depth of cut		DC: Dia.
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Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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.

# SOLID END MILLS

## DFC4JC

Diamond coating endmill, 4 flute



CFRP



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	$6 \leq DC \leq 12$				
	$\begin{matrix} 0 \\ -0.03 \end{matrix}$				
	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 CVD diamond coating for CFRP machining.

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

(mm)

Note 1) Please contact Mitsubishi Materials for geometries and through coolant types that are non-standard.

### RECOMMENDED CUTTING CONDITIONS

Work Material	CFRP	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
6	11000	950
8	8000	780
10	6400	700
12	5300	650

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 workpiece. 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.

● : Inventory maintained in Japan.

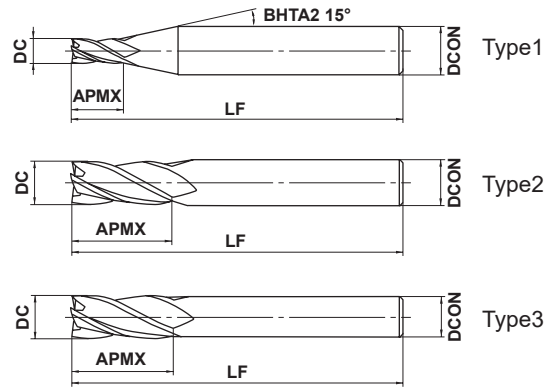
# C4MC

End mill, Medium cut length, 4 flute, Center 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	Aluminium Alloy
○	○			○	○	○	○



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

● 4 flute uncoated center cutting end mill for general use.

Order Number	DC	APMX	LF	D CON	No. of Flutes	Stock	Type
C4MCD0300	3	8	45	6	4	▲	1
C4MCD0350	3.5	10	45	6	4	▲	1
C4MCD0400	4	11	45	6	4	▲	1
C4MCD0450	4.5	11	45	6	4	▲	1
C4MCD0500	5	13	50	6	4	▲	1
C4MCD0550	5.5	13	50	6	4	▲	1
C4MCD0600	6	13	50	6	4	▲	2
C4MCD0650	6.5	16	60	8	4	▲	1
C4MCD0700	7	16	60	8	4	▲	1
C4MCD0750	7.5	16	60	8	4	▲	1
C4MCD0800	8	19	60	8	4	▲	2
C4MCD0850	8.5	19	70	10	4	▲	1
C4MCD0900	9	19	70	10	4	▲	1
C4MCD0950	9.5	19	70	10	4	▲	1
C4MCD1000	10	22	70	10	4	▲	2
C4MCD1050	10.5	22	75	12	4	▲	1
C4MCD1100	11	22	75	12	4	▲	1
C4MCD1150	11.5	22	75	12	4	▲	1
C4MCD1200	12	26	75	12	4	▲	2
C4MCD1250	12.5	26	75	12	4	▲	3
C4MCD1300	13	26	75	12	4	▲	3
C4MCD1400	14	26	75	12	4	▲	3
C4MCD1500	15	30	80	16	4	▲	1
C4MCD1600	16	32	90	16	4	▲	2
C4MCD1700	17	32	90	16	4	▲	3
C4MCD1800	18	32	90	16	4	▲	3
C4MCD1900	19	32	100	20	4	▲	1
C4MCD2000	20	38	100	20	4	▲	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

▲ : Product scheduled to be discontinued at the end of March 2020

SEG4SA(J185) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and SEG4SA(J185),VQMHV(J154) is alternative for processing of other cutting materials.



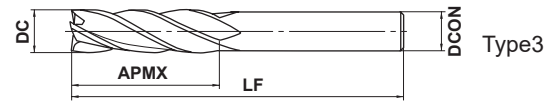
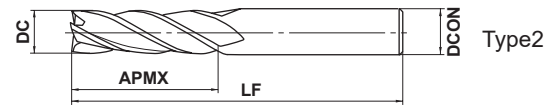
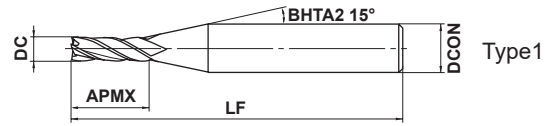
# SOLID END MILLS

## C4JC

End mill, Semi long cut length, 4 flute, Center cutting



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	Aluminium 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

● 4 flute uncoated end mill for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C4JCD0300	3	12	50	6	4	▲	1
C4JCD0350	3.5	15	50	6	4	▲	1
C4JCD0400	4	15	50	6	4	▲	1
C4JCD0450	4.5	15	50	6	4	▲	1
C4JCD0500	5	20	60	6	4	▲	1
C4JCD0550	5.5	20	60	6	4	▲	1
C4JCD0600	6	20	60	6	4	▲	2
C4JCD0650	6.5	25	70	8	4	▲	1
C4JCD0700	7	25	70	8	4	▲	1
C4JCD0750	7.5	25	70	8	4	▲	1
C4JCD0800	8	25	70	8	4	▲	2
C4JCD0850	8.5	25	90	10	4	▲	1
C4JCD0900	9	25	90	10	4	▲	1
C4JCD0950	9.5	25	90	10	4	▲	1
C4JCD1000	10	30	90	10	4	▲	2
C4JCD1050	10.5	30	90	12	4	▲	1
C4JCD1100	11	30	90	12	4	▲	1
C4JCD1150	11.5	30	90	12	4	▲	1
C4JCD1200	12	30	90	12	4	▲	2
C4JCD1300	13	35	90	12	4	▲	3
C4JCD1400	14	40	110	16	4	▲	1
C4JCD1500	15	40	110	16	4	▲	1
C4JCD1600	16	50	110	16	4	▲	2
C4JCD1700	17	50	110	20	4	▲	1
C4JCD1800	18	50	110	20	4	▲	1
C4JCD1900	19	55	110	20	4	▲	1
C4JCD2000	20	55	110	20	4	▲	2
C4JCD2200	22	65	140	25	4	▲	1
C4JCD2400	24	75	140	25	4	▲	1
C4JCD2500	25	75	140	25	4	▲	2

▲ : Product scheduled to be discontinued at the end of March 2020

SEE4L(J186) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MPJHV(J134), VQJHV(J158) is alternative for processing of other cutting materials.

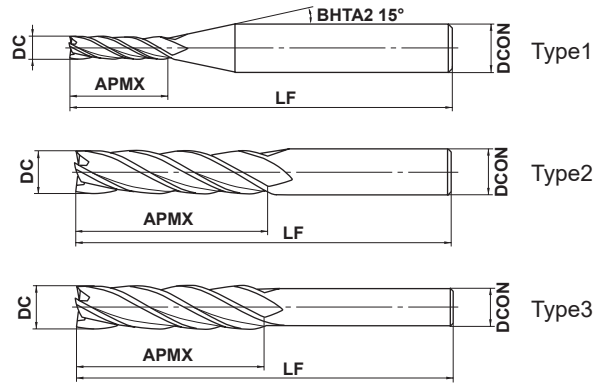
# C4LC

End mill, Long cut length, 4 flute, Center 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	Aluminium Alloy
○	○			○	○	○	○



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

● 4 flute end mill with longer cut length than standard.

Order Number	DC	APMX	LF	D CON	No. of Flutes	Stock	Type
C4LCD0300	3	20	60	6	4	▲	1
C4LCD0350	3.5	22	60	6	4	▲	1
C4LCD0400	4	25	60	6	4	▲	1
C4LCD0450	4.5	25	60	6	4	▲	1
C4LCD0500	5	30	70	6	4	▲	1
C4LCD0550	5.5	30	70	6	4	▲	1
C4LCD0600	6	30	70	6	4	▲	2
C4LCD0650	6.5	30	90	8	4	▲	1
C4LCD0700	7	40	90	8	4	▲	1
C4LCD0750	7.5	40	90	8	4	▲	1
C4LCD0800	8	40	90	8	4	▲	2
C4LCD0850	8.5	40	100	10	4	▲	1
C4LCD0900	9	40	100	10	4	▲	1
C4LCD0950	9.5	40	100	10	4	▲	1
C4LCD1000	10	50	100	10	4	▲	2
C4LCD1050	10.5	50	110	12	4	▲	1
C4LCD1100	11	50	110	12	4	▲	1
C4LCD1150	11.5	50	110	12	4	▲	1
C4LCD1200	12	50	110	12	4	▲	2
C4LCD1250	12.5	50	120	12	4	▲	3
C4LCD1300	13	50	120	12	4	▲	3
C4LCD1400	14	70	130	16	4	▲	1
C4LCD1500	15	70	130	16	4	▲	1
C4LCD1600	16	70	130	16	4	▲	2
C4LCD1700	17	70	140	20	4	▲	1
C4LCD1800	18	70	140	20	4	▲	1
C4LCD1900	19	70	140	20	4	▲	1
C4LCD2000	20	70	140	20	4	▲	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS

# SOLID END MILLS

CARBIDE

End mill, Medium cut length, 4 flute, Center cutting **C4MC**

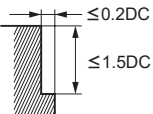
End mill, Semi long cut length, 4 flute, Center cutting **C4JC** End mill, Long cut length, 4 flute, Center cutting **C4LC**

## RECOMMENDED CUTTING CONDITIONS (C4MC)

### ■ Side milling

Dia. DC (mm)	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20—30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30—45HRC)		Austenitic stainless steel, Titanium alloy	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	4100	150	3500	130	2800	100	2300	90
<b>4</b>	3400	260	2900	210	2200	140	1900	120
<b>5</b>	2900	290	2400	230	1800	150	1500	135
<b>6</b>	2500	300	2100	260	1600	170	1300	140
<b>8</b>	1900	300	1600	260	1200	160	1000	150
<b>10</b>	1500	270	1250	230	950	140	800	135
<b>12</b>	1250	230	1050	200	800	120	660	110
<b>16</b>	940	170	800	140	600	90	500	80
<b>20</b>	750	140	640	120	480	75	400	70

Depth of cut		DC: Dia.
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Note 1) Decrease the feed rate by 20—30% for C4JC.

Note 2) Decrease the revolution by 20—30% and the feed rate by 40—50% for C4LC.

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

SOLID END MILLS

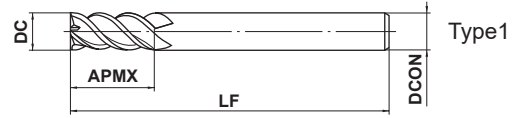
# SEG4SA

End mill, Medium cut length, 4 flute, Irregular spiral helix angle, For aluminium alloy



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	Aluminium 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	



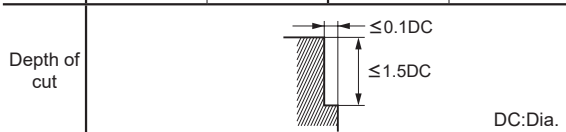
● 4 flute end mill with irregular helix angle for aluminium alloy.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
SEG4060SA	6	14	50	6	4	●	1
SEG4080SA	8	19	60	8	4	●	1
SEG4100SA	10	24	70	10	4	●	1
SEG4120SA	12	29	75	12	4	●	1
SEG4160SA	16	38	90	16	4	●	1
SEG4200SA	20	48	110	20	4	●	1
SEG4250SA	25	59	125	25	4	●	1

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy Plastics		Pure copper		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
6	9600	1700	4800	840	
8	7200	1800	3600	900	
10	5800	1800	2900	910	
12	4800	2000	2400	980	
16	3600	2000	1800	980	
20	2900	2400	1400	1100	
25	2300	2400	1100	1100	



Note 1) The cutting conditions above are a guide only to milling within the standard 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.

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

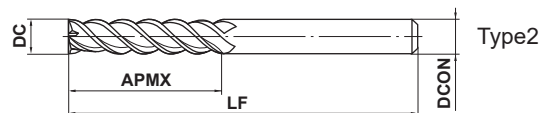
# SOLID END MILLS

## SEE4L

End mill, Long 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	Aluminium 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	

● 4 flute high helix end mill.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
SEE4030L	3	15	55	6	4	●	1
SEE4040L	4	20	60	6	4	●	1
SEE4050L	5	25	65	6	4	●	1
SEE4060L	6	25	65	6	4	●	2
SEE4070L	7	35	80	8	4	●	1
SEE4080L	8	35	80	8	4	●	2
SEE4090L	9	45	90	10	4	●	1
SEE4100L	10	45	95	10	4	●	2
SEE4110L	11	55	105	12	4	●	1
SEE4120L	12	55	105	12	4	●	2
SEE4140L	14	70	125	16	4	●	1
SEE4150L	15	70	125	16	4	●	1
SEE4160L	16	70	125	16	4	●	2
SEE4180L	18	70	125	20	4	●	1
SEE4200L	20	75	140	20	4	●	2
SEE4250L	25	85	160	25	4	●	2

(mm)

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Alloy steel (180—280HB)		Carbon steel, Alloy steel (280—380HB)		Pre-hardened steel (35—45HRC)		Stainless steel (270HB≥)		Cast iron (Tensile Strength 350MPa≥)	
	AISI 1045, AISI P20		AISI 1045, AISI P20				AISI 420		AISI No 35 B	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	3400	150	3000	60	2100	30	2600	60	5500	240
<b>4</b>	2400	170	2200	90	1600	50	1900	80	4200	270
<b>5</b>	2000	180	1800	90	1300	60	1500	80	3300	300
<b>6</b>	1600	180	1500	90	1000	60	1300	80	2800	320
<b>8</b>	1200	170	1100	90	800	60	960	80	2100	320
<b>10</b>	1000	150	880	90	640	60	760	80	1600	320
<b>12</b>	800	150	760	110	520	60	640	90	1400	320
<b>14</b>	720	150	640	110	480	60	560	110	1200	320
<b>16</b>	600	140	560	110	400	60	480	110	1000	330
<b>18</b>	560	140	480	120	360	60	440	110	960	330
<b>20</b>	480	120	440	120	320	60	400	110	840	350
<b>25</b>	400	120	360	110	240	50	320	90	680	330

Depth of cut

≤0.05DC  
≤2.5DC

DC: Dia.

Note 1) The cutting conditions above are a guide only to milling within the standard depth of cut.

Note 2) Ductile cast iron milling has the same cutting conditions as carbon steel and alloy steel. (180—280HB)

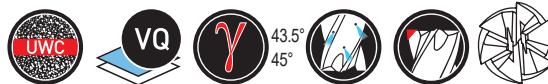
Note 3) When drilling, please set the feed rate at 1/3 or below of the values above.

Note 4) 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.

# SOLID END MILLS

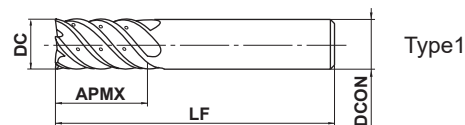
## VQ6MHVCH NEW

End mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through 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	Aluminium Alloy
○	○			◎	◎	○	

**CoolStar**  
END MILLS



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

	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	

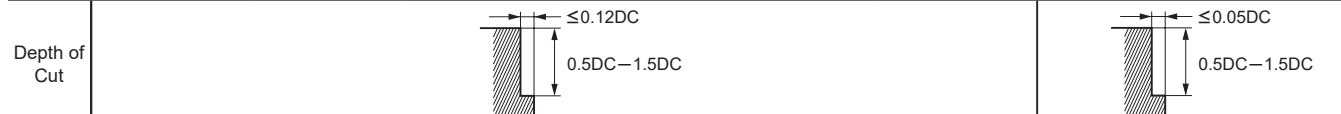
● Vibration control end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

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

### RECOMMENDED CUTTING CONDITIONS

#### Shoulder Milling

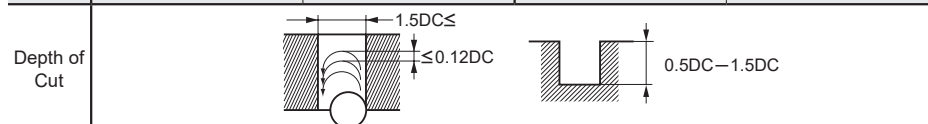
Work Material	Alloy steel, Tool steel, Pre-hardened steel		Austenitic Stainless Steel (≤200HB), Titanium Alloy		Copper, Copper alloy		Heat Resistant Alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 316, Ti-6Al-4V				Inconel 718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
10	—	—	4800	2000	—	—	1300	260
12	—	—	4000	2000	—	—	1100	230
16	4000	2200	3000	1600	2400	1400	800	180
20	3200	1900	2400	1400	1900	1100	640	150



DC: Dia.

#### Trochoid Milling

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	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
10	—	—	4800	1400
12	—	—	4000	1200
16	4000	1600	3000	1100
20	3200	1400	2400	900



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 workpiece 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.

● : Inventory maintained in Japan.

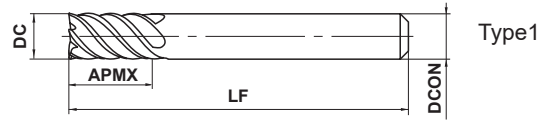
# VF6MHV

End mill, 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	Aluminium 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	

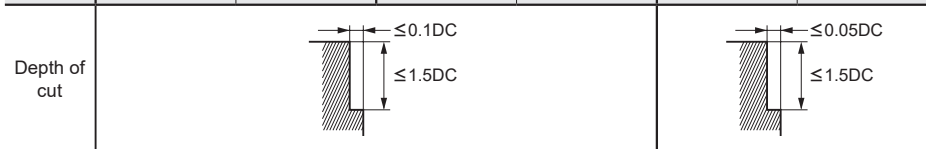
● Newly developed irregular helix 6 flute geometry reduces vibrations and achieves high efficiency machining. Suitable for machining of difficult-to-cut materials such as stainless steel, titanium alloy and inconel.

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 alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
6	10600	2900	8000	2000	2100	320
8	8000	2900	6000	2000	1600	300
10	6400	2700	4800	2000	1300	260
12	5300	2700	4000	2000	1100	230
16	4000	2200	3000	1600	800	180
20	3200	1900	2400	1400	640	150



DC: Dia.

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

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

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 workpiece 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.

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ROUGHING

↓

SOLID END MILLS



# SOLID END MILLS

## VFSD

End mill, Short cut length, For hardened materials



TOOL NEWS

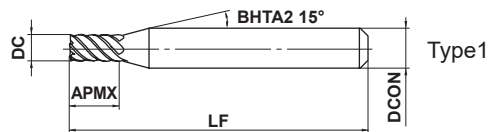
DC<3

DC≥3

DC<3

DC≥3

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	Aluminium Alloy
	○	◎	◎				



1 ≤ DC ≤ 12				
0				
-0.02				



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

● End mill with Impact Miracle coating for high hardened 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

● : Inventory maintained in Japan.

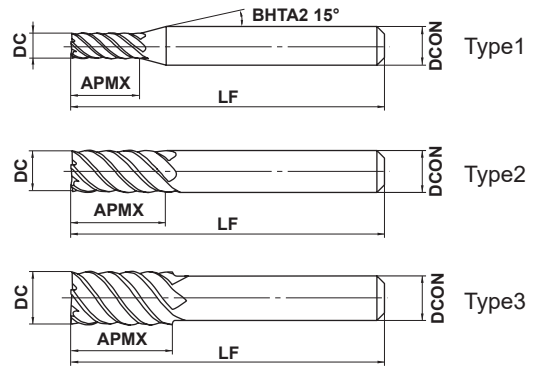
# VFMD

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	Aluminium Alloy
	○	◎	◎				



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.02 \end{matrix}$	$\begin{matrix} 0 \\ -0.03 \end{matrix}$			
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● End mill with Impact Miracle coating for high hardened materials.

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

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SOLID END MILLS

# SOLID END MILLS

## VFSD

End mill, Short cut length, For hardened materials

## VFMD

End mill, Medium cut length, For hardened materials

### 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		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	1200	0.05	40000	800	0.03	32000	500	0.02
<b>2</b>	40000	2000	0.1	24000	1000	0.05	16000	600	0.05
<b>3</b>	32000	3800	0.2	16000	1900	0.1	11000	1200	0.05
<b>4</b>	24000	4400	0.2	12000	2200	0.1	8000	1300	0.05
<b>6</b>	16000	5800	0.3	8000	2900	0.2	5300	1800	0.1
<b>8</b>	12000	5800	0.4	6000	2900	0.2	4000	1800	0.1
<b>10</b>	9600	5800	0.5	4800	2900	0.3	3200	1800	0.2
<b>12</b>	8000	4800	0.6	4000	2400	0.3	2700	1500	0.2
<b>16</b>	6000	3600	0.8	3000	1800	0.5	2000	1100	0.3
<b>20</b>	4800	2900	1.0	2400	1400	0.5	1600	880	0.3
<b>25</b>	3800	2300	1.0	1900	1100	0.5	1300	720	0.3

Depth of cut	
	≤1.5DC
Depth of cut	
	≤1.0DC

DC: Dia.

### Slot milling with small diameter tools

Work Material	Hardened steel (45–55HRC)			Hardened steel (55–62HRC)		
	AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	15000	300	0.1	9500	110	0.05
<b>2</b>	8000	320	0.2	4800	190	0.1

Depth of cut	
	DC: Dia.

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

Note 2) 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.

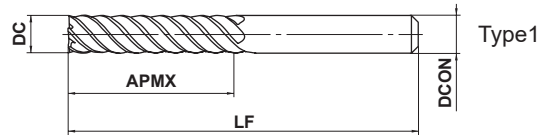
# VCLD

End mill, Long 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	Aluminium 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

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		AISI H13		AISI D2		AISI W1, AISI M2	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
6	2100	450	1600	330	1300	240	1100	190
8	1600	430	1200	310	1000	230	800	170
10	1300	420	960	290	800	220	640	150
12	1100	380	800	260	660	200	530	140
16	800	310	600	220	500	160	400	120
20	640	270	480	190	400	140	320	110
25	510	230	380	160	320	120	260	90

Depth of cut		
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DC: Dia.

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.

● : Inventory maintained in Japan.

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SOLID END MILLS

# SOLID END MILLS

## VF8MHVCH

End mill, Medium cut length, Irregular helix flutes, with multiple internal through coolant holes



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	Aluminium Alloy
○	○			◎	◎		

**CoolStar**  
END MILLS



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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.

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

#### Side milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Heat resistant alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	4000	2400	3000	2100	800	240
20	3200	1900	2400	1900	640	200

Depth of cut	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy	
		≤ 0.08DC	0.5DC - 1.5DC	
				0.5DC - 1.5DC

DC: Dia.

#### Trochoidal slotting

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	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	4000	1900	3000	1400
20	3200	1500	2400	1200

Depth of cut	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy	
		1.5DC ≤	≤ 0.08DC	

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 workpiece 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.

● : Inventory maintained in Japan.

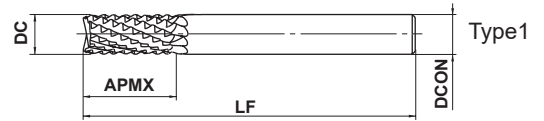
# DFCJRT

Diamond coating endmill with cross-nick



CARBIDE

CFRP



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ROUGHING

SOLID END MILLS



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

Note 1) Please contact Mitsubishi Materials for geometries and through coolant types that are non-standard.

## RECOMMENDED CUTTING CONDITIONS

Work Material	CFRP	
	Dia. DC (mm)	Feed rate (mm/min)
	Revolution (min <sup>-1</sup> )	
<b>6</b>	11000	1200
<b>8</b>	8000	1000
<b>10</b>	6400	900
<b>12</b>	5300	850

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 workpiece. 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.

# SOLID END MILLS

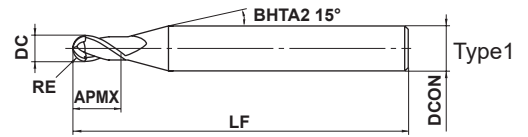
## MP2SSB

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



TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	



$0.1 \leq RE \leq 6$				
$\pm 0.005$				



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

● 2-flute ball nose end mills with short cutting edge length for general purpose. Excellent performance for a wide range of workpiece 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

● : Inventory maintained in Japan.

# MP2SB

Ball nose, Short cut length, 2 flute

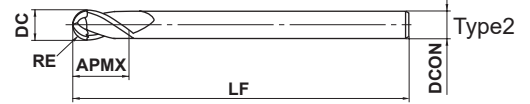
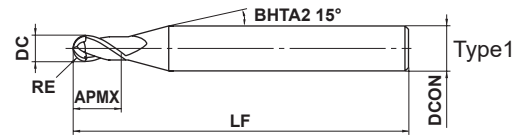


TOOL NEWS



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	Aluminium 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 workpiece materials such as carbon steel, alloy steel and hardened steel.

(mm)

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

SQUARE

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ROUGHING

SOLID END MILLS



# SOLID END MILLS

## MP2MB

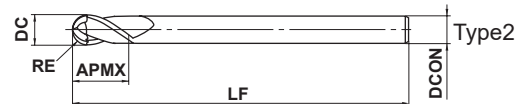
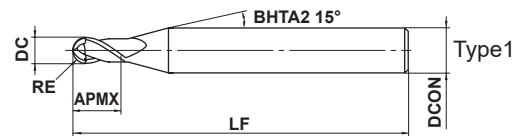
Ball nose, Medium cutting length, 2 flute



TOOL NEWS



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	Aluminium Alloy
○	○	○		○	○	○	



	0.25 ≤ RE ≤ 6				
	±0.005				
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
	<sup>0</sup> / <sub>-0.005</sub>	<sup>0</sup> / <sub>-0.006</sub>	<sup>0</sup> / <sub>-0.008</sub>		

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

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
MP2MBR0150	1.5	3	8	70	6	2	●	1
MP2MBR0150S03	1.5	3	8	70	3	2	●	2
MP2MBR0175	1.75	3.5	8	70	6	2	●	1
MP2MBR0200	2	4	8	70	6	2	●	1
MP2MBR0200S04	2	4	8	70	4	2	●	2
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

● : Inventory maintained in Japan.

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

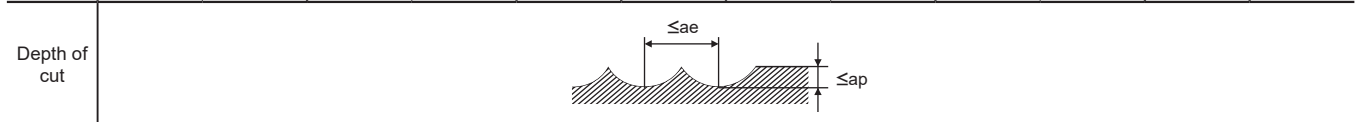
Ball nose, Short cut length, 2 flute **MP2SB** Ball nose, Medium cutting length, 2 flute **MP2MB**

CARBIDE

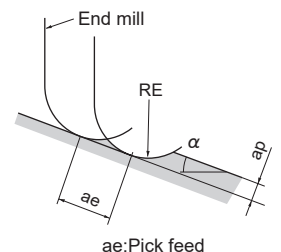
**RECOMMENDED CUTTING CONDITIONS**

R RE (mm)	Mild Steel, Carbon steel, Alloy steel, Pre-hardened steel, Hardened steel (–45HRC) AISI 1050, AISI P21, AISI H13						Austenitic Stainless Steel (≤200HB), Titanium Alloy AISI 304, AISI 316, Ti-6Al-4V					
	α≤15°		α>15°		Depth of cut ap (mm)	Depth of cut ae (mm)	α≤15°		α>15°		Depth of cut ap (mm)	Depth of cut ae (mm)
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)			Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)		
<b>R0.1</b>	40000	300	40000	250	0.003	0.02	40000	300	40000	250	0.003	0.02
<b>R0.15</b>	40000	500	40000	350	0.007	0.03	40000	500	40000	350	0.007	0.03
<b>R0.2</b>	40000	1600	40000	1200	0.02	0.04	40000	1300	40000	1000	0.015	0.04
<b>R0.25</b>	40000	2400	40000	1400	0.025	0.05	40000	1900	40000	1200	0.02	0.05
<b>R0.3</b>	40000	3200	40000	1600	0.03	0.06	40000	2400	40000	1400	0.025	0.06
<b>R0.4</b>	40000	4800	40000	2400	0.05	0.08	40000	2400	40000	1900	0.04	0.08
<b>R0.5</b>	40000	5600	40000	3200	0.06	0.1	40000	3200	38000	2400	0.05	0.1
<b>R0.75</b>	40000	6500	40000	4000	0.09	0.15	40000	3200	25000	1600	0.08	0.15
<b>R1</b>	40000	6500	39000	4700	0.11	0.2	32000	3200	19000	1500	0.11	0.2
<b>R1.25</b>	40000	7000	33000	4500	0.12	0.25	25000	2500	15000	1200	0.12	0.25
<b>R1.5</b>	40000	7500	27000	4300	0.13	0.3	21000	2100	13000	1100	0.13	0.3
<b>R2</b>	32000	7500	20000	3600	0.15	0.4	16000	1900	9500	900	0.15	0.4
<b>R2.5</b>	25000	6000	16000	2900	0.2	0.5	13000	1600	7600	750	0.2	0.5
<b>R3</b>	21000	5800	13000	2600	0.25	0.6	11000	1500	6400	700	0.25	0.6
<b>R4</b>	16000	4500	10000	2000	0.3	0.8	8000	1400	4800	670	0.3	0.8
<b>R5</b>	13000	3600	8000	1700	0.5	1.0	6400	1300	3800	620	0.5	1.0
<b>R6</b>	9000	2500	6000	1300	0.5	1.2	5300	1300	3200	620	0.5	1.2

R RE (mm)	Hardened steel (45–55HRC) AISI 420, AISI H13						Copper, Copper alloys					
	α≤15°		α>15°		Depth of cut ap (mm)	Depth of cut ae (mm)	α≤15°		α>15°		Depth of cut ap (mm)	Depth of cut ae (mm)
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)			Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)		
<b>R0.1</b>	40000	300	40000	250	0.003	0.02	40000	300	40000	250	0.003	0.02
<b>R0.15</b>	40000	500	40000	350	0.007	0.03	40000	500	40000	350	0.007	0.03
<b>R0.2</b>	40000	1300	40000	950	0.015	0.04	40000	1300	40000	950	0.015	0.04
<b>R0.25</b>	40000	1900	40000	1100	0.02	0.05	40000	1900	40000	1100	0.02	0.05
<b>R0.3</b>	40000	2500	40000	1300	0.025	0.06	40000	2500	40000	1300	0.025	0.06
<b>R0.4</b>	40000	4000	40000	1900	0.04	0.08	40000	4000	40000	1900	0.04	0.08
<b>R0.5</b>	40000	5600	40000	3000	0.05	0.1	40000	5600	40000	3000	0.05	0.1
<b>R0.75</b>	40000	6500	32000	3200	0.08	0.15	40000	6500	32000	3200	0.08	0.15
<b>R1</b>	40000	6500	31000	3500	0.11	0.2	40000	6500	31000	3500	0.11	0.2
<b>R1.25</b>	36000	6500	26000	3500	0.12	0.25	36000	6500	26000	3500	0.12	0.25
<b>R1.5</b>	32000	6000	22000	3400	0.13	0.3	32000	6000	22000	3400	0.13	0.3
<b>R2</b>	25000	6000	16000	2700	0.15	0.4	25000	6000	16000	2700	0.15	0.6
<b>R2.5</b>	20000	5400	13000	2300	0.2	0.5	20000	5400	13000	2300	0.2	0.75
<b>R3</b>	17000	4700	10000	2000	0.25	0.6	17000	4700	10000	2000	0.25	0.9
<b>R4</b>	13000	3600	8000	1500	0.3	0.8	13000	3600	8000	1500	0.3	1.6
<b>R5</b>	10000	2900	6400	1200	0.5	1.0	10000	2900	6400	1200	0.5	2.0
<b>R6</b>	7200	2000	4800	1000	0.5	1.2	8500	2300	5300	1100	0.5	2.4



- Note 1)  $\alpha$  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% feedrate. (Hardened steel (45–55HRC) table above)



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS

# SOLID END MILLS

## MP2SDB

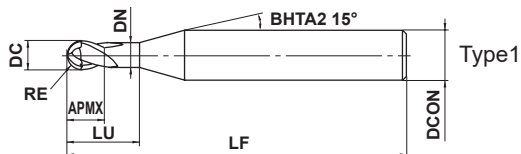
Ball nose, Short cut length, 2 flute, High strength



TOOL NEWS



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	Aluminium Alloy
○	◎	◎					



	$0.5 \leq RE \leq 6$				
	$\pm 0.01$				
	$4 \leq DCON \leq 6$	DCON=8			
	$0$	$0$			
	$-0.005$	$-0.006$			
	DCON=10	DCON=12			
	$0$	$0$			
	$-0.009$	$-0.011$			

● 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.

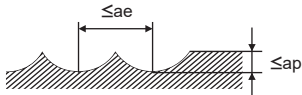
● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

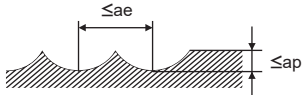
### Overhang below 5D (D:Dia.)

R RE (mm)	Carbon steel, Alloy steel, Tool steel, Alloy tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21				Hardened steel (45–55HRC) AISI H13, AISI L6							
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		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)
	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)			Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)		
<b>R 0.5</b>	40000	3900	36000	2100	0.1	0.25	40000	4300	36000	2200	0.1	0.25
<b>R 0.75</b>	40000	4200	36000	2600	0.15	0.35	40000	4700	36000	2700	0.15	0.35
<b>R 1</b>	40000	4500	36000	3100	0.2	0.5	40000	5000	36000	3300	0.2	0.5
<b>R 1.5</b>	37000	5300	24000	2700	0.3	0.75	37000	5800	24000	2800	0.3	0.75
<b>R 2X4</b>	24000	3200	15000	2000	0.25	0.7	19000	2800	13000	1600	0.25	0.7
<b>R 2</b>	30000	4900	19000	2500	0.4	1	28000	5000	19000	2400	0.4	1
<b>R 2.5</b>	25000	4500	16000	2300	0.5	1.3	22000	4200	16000	2200	0.5	1.25
<b>R 3</b>	22000	4300	14000	2200	0.6	1.8	18000	3800	12000	1800	0.6	1.5
<b>R 4</b>	19000	3900	12000	2000	0.8	2.4	15000	3200	9500	1600	0.8	2
<b>R 5</b>	15000	3300	9500	1800	1	3	11000	2500	7000	1400	1	2.5
<b>R 6</b>	12000	2550	8000	1600	1.2	3.6	9000	2000	6000	1300	1.2	3

Depth of cut 

### Overhang below 7D (D:Dia.)

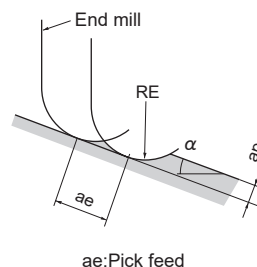
R RE (mm)	Carbon steel, Alloy steel, Tool steel, Alloy tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21				Hardened steel (45–55HRC) AISI H13, AISI L6							
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut $a_p$ (mm)	Depth of cut $a_e$ (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut $a_p$ (mm)	Depth of cut $a_e$ (mm)
	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)			Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)		
<b>R 3</b>	10000	1500	6900	1000	0.2	1	8000	1400	5300	770	0.2	0.8
<b>R 4</b>	8000	1400	5600	900	0.3	1.5	6400	1300	4000	650	0.3	1.2
<b>R 5</b>	6000	1200	4100	740	0.4	2	4800	1100	3200	580	0.4	1.6
<b>R 6</b>	5000	1000	3400	600	0.45	2.4	4000	900	2700	490	0.45	2

Depth of cut 

Note 1)  $\alpha$  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.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## MP2XLB

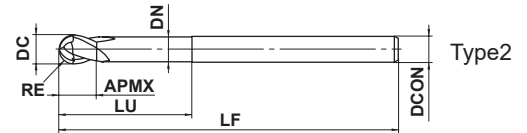
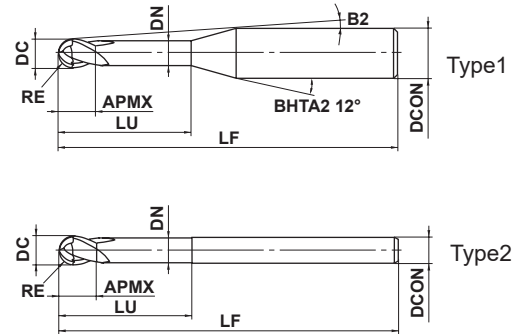
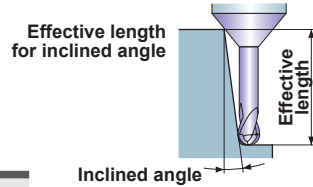
End mill, Short cut length, 2 flute, Long neck



TOOL NEWS



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	Aluminium Alloy
○	○	○		○	○	○	



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



● 2-flute long neck ball nose end mills. Excellent performance for a wide range of workpiece 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°
MP2XLB0005N003	0.05	0.1	0.08	0.3	0.085	11.6°	50	4	2	●	1	0.3	0.3	0.4	0.4
MP2XLB0005N005	0.05	0.1	0.08	0.5	0.085	11.4°	50	4	2	●	1	0.5	0.5	0.6	0.7
MP2XLB0010N005	0.1	0.2	0.15	0.5	0.18	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.7
MP2XLB0010N008	0.1	0.2	0.15	0.75	0.18	11.2°	50	4	2	●	1	0.8	0.8	0.9	1.0
MP2XLB0010N010	0.1	0.2	0.15	1	0.18	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLB0010N013	0.1	0.2	0.15	1.25	0.18	10.6°	50	4	2	●	1	1.3	1.4	1.5	1.7
MP2XLB0010N015	0.1	0.2	0.15	1.5	0.18	10.4°	50	4	2	●	1	1.6	1.6	1.8	2.0
MP2XLB0010N018	0.1	0.2	0.15	1.75	0.18	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
MP2XLB0010N020	0.1	0.2	0.15	2	0.18	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLB0010N025	0.1	0.2	0.15	2.5	0.18	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLB0015N005	0.15	0.3	0.24	0.5	0.28	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.6
MP2XLB0015N008	0.15	0.3	0.24	0.75	0.28	11.2°	50	4	2	●	1	0.8	0.8	0.9	1.0
MP2XLB0015N010	0.15	0.3	0.24	1	0.28	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLB0015N010S06	0.15	0.3	0.24	1	0.28	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3
MP2XLB0015N013	0.15	0.3	0.24	1.25	0.28	10.7°	50	4	2	●	1	1.3	1.4	1.5	1.6
MP2XLB0015N013S06	0.15	0.3	0.24	1.25	0.28	11.1°	50	6	2	●	1	1.3	1.4	1.5	1.6
MP2XLB0015N015	0.15	0.3	0.24	1.5	0.28	10.4°	50	4	2	●	1	1.6	1.6	1.8	2.0
MP2XLB0015N015S06	0.15	0.3	0.24	1.5	0.28	10.9°	50	6	2	●	1	1.6	1.6	1.8	2.0
MP2XLB0015N018	0.15	0.3	0.24	1.75	0.28	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
MP2XLB0015N020	0.15	0.3	0.24	2	0.28	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLB0015N025	0.15	0.3	0.24	2.5	0.28	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLB0015N030	0.15	0.3	0.24	3	0.28	9.1°	50	4	2	●	1	3.1	3.3	3.6	4.0
MP2XLB0015N035	0.15	0.3	0.24	3.5	0.28	8.7°	50	4	2	●	1	3.7	3.8	4.2	4.6
MP2XLB0015N040	0.15	0.3	0.24	4	0.28	8.4°	50	4	2	●	1	4.2	4.4	4.8	5.3
MP2XLB0020N005	0.2	0.4	0.3	0.5	0.37	11.6°	50	4	2	●	1	0.5	0.5	0.5	0.6
MP2XLB0020N008	0.2	0.4	0.3	0.75	0.37	11.3°	50	4	2	●	1	0.7	0.8	0.9	0.9
MP2XLB0020N010	0.2	0.4	0.3	1	0.37	11°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLB0020N010S06	0.2	0.4	0.3	1	0.37	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3
MP2XLB0020N015	0.2	0.4	0.3	1.5	0.37	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
MP2XLB0020N020	0.2	0.4	0.3	2	0.37	9.9°	50	4	2	●	1	2.1	2.2	2.3	2.6
MP2XLB0020N020S06	0.2	0.4	0.3	2	0.37	10.6°	50	6	2	●	1	2.1	2.2	2.3	2.6
MP2XLB0020N025	0.2	0.4	0.3	2.5	0.37	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.3

● : Inventory maintained in Japan.

(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°
												MP2XLBR0020N030	0.2	0.4	0.3
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
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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS





# SOLID END MILLS

## MP2XLB

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

(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°
SQUARE	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
BALL	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
RADIUS	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
TAPER	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
BARREL	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
	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

● : Inventory maintained in Japan.

(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°
												MP2XLBR0060N200	0.6	1.2	0.9
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
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

\* No interference



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



# SOLID END MILLS

## MP2XLB

End mill, 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°
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	*	*
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	*	*	*	*

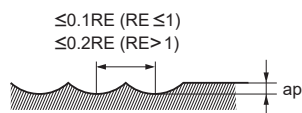
\* No interference

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Alloy steel, Alloy Tool Steel, Pre-hardened steel, Precipitation hardening stainless steel AISI 1055, AISI P21, ASTM 630			Hardened steel (45—55HRC)			Copper, Copper alloys		
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
R0.05	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
R0.1	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
R0.15	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
R0.2	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
R0.25	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
R0.3	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

Depth of cut



RE:Radius

Note 1) When the inclination angle of machined surface is large, or machining with large cutting load such as corner area, 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 increase for the small depth of cut.

Note 4) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

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

Note 6) 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

↪

SOLID END MILLS

# SOLID END MILLS

## MP2XLB

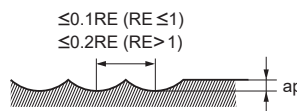
End mill, Short cut length, 2 flute, Long neck

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Work Material	Carbon steel, Alloy steel, Alloy Tool Steel, Pre-hardened steel, Precipitation hardening stainless steel AISI 1055, AISI P21, ASTM 630				Hardened steel (45–55HRC)			Copper, Copper alloys		
	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
R0.4	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
R0.5	12	22000	500	0.006	22000	400	0.006	22000	400	0.012
	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
R0.6	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
	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
R0.7	24	11000	300	0.006	11000	240	0.006	11000	240	0.012
	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
R0.75	16	17000	1400	0.03	17000	1120	0.03	17000	896	0.06
	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
R0.8	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
	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
R0.9	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
	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
R0.9	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

Depth of cut



RE: Radius

Note 1) When the inclination angle of machined surface is large, or machining with large cutting load such as corner area, 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 increase for the small depth of cut.

Note 4) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

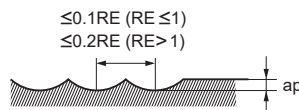
Note 5) For hardened steel over 55HRC, use VF2XLB.

Note 6) 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)

● : Inventory maintained in Japan.

Work Material		Carbon steel, Alloy steel, Alloy Tool Steel, Pre-hardened steel, Precipitation hardening stainless steel AISI 1055, AISI P21, ASTM 630			Hardened steel (45–55HRC)			Copper, Copper alloys		
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
R1	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	
R1.25	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
R1.5	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
R1.75	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
R2	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
R2.5	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
R3	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 large, or machining with large cutting load such as corner area, 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 increase for the small depth of cut.

Note 4) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

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

Note 6) 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)

# SOLID END MILLS

## VFR2SSB NEW

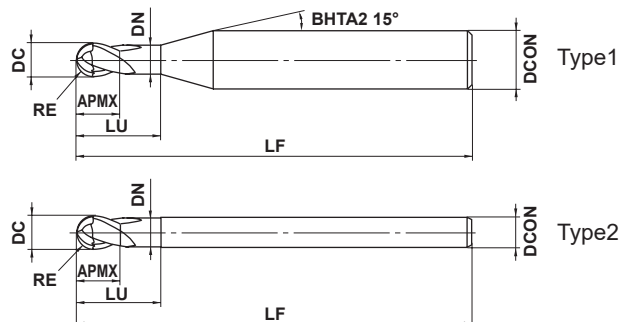
Ball nose, Short cut length, 2 flute, Short shank



TOOL NEWS



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	Aluminium Alloy
	○	◎	◎				



RE ≤ 6				
±0.005				



4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
<sup>0</sup> / <sub>-0.005</sub>	<sup>0</sup> / <sub>-0.006</sub>	<sup>0</sup> / <sub>-0.008</sub>		

● 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

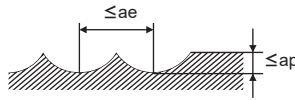
● : Inventory maintained in Japan.

CARBIDE  
 SQUARE  
 BALL  
 RADIUS  
 TAPER  
 BARREL  
 ROUGHING  
 SOLID END MILLS

## 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					
	R 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)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)
Revolution (min <sup>-1</sup> )		Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )			Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )			Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	
<b>R 0.1</b>	40000	320	40000	240	0.003	0.02	40000	320	40000	160	0.003	0.02	40000	320	40000	160	0.002	0.02
<b>R 0.15</b>	40000	640	40000	560	0.01	0.03	40000	640	40000	400	0.007	0.03	40000	640	40000	400	0.005	0.03
<b>R 0.2</b>	40000	1600	40000	1200	0.02	0.04	40000	1400	40000	1000	0.015	0.04	40000	1200	40000	1000	0.01	0.04
<b>R 0.3</b>	40000	3200	40000	1600	0.03	0.06	40000	2800	40000	1200	0.025	0.06	40000	2000	40000	1200	0.02	0.06
<b>R 0.4</b>	40000	6400	40000	2400	0.05	0.08	40000	4000	40000	1600	0.04	0.08	40000	2800	40000	1600	0.03	0.08
<b>R 0.5</b>	40000	8000	40000	3200	0.06	0.10	40000	5600	40000	2400	0.05	0.10	40000	3600	32000	1300	0.04	0.10
<b>R 0.75</b>	40000	9600	40000	4000	0.09	0.15	40000	7200	32000	2500	0.075	0.15	32000	4500	21000	1200	0.05	0.15
<b>R 1</b>	40000	9600	39000	4700	0.11	0.20	40000	8000	24000	2400	0.1	0.20	24000	3800	16000	1000	0.07	0.20
<b>R 1.25</b>	40000	10400	32000	4500	0.12	0.25	37000	8100	19000	2300	0.11	0.25	19000	3400	13000	1000	0.08	0.25
<b>R 1.5</b>	40000	12000	27000	4300	0.13	0.30	32000	7700	16000	2200	0.12	0.30	16000	3200	11000	880	0.09	0.30
<b>R 2</b>	32000	10880	20000	3600	0.15	0.40	24000	6200	12000	1900	0.13	0.40	12000	2400	8000	800	0.1	0.40
<b>R 2.5</b>	25000	9000	16000	2900	0.20	0.50	19000	5300	9600	1700	0.15	0.50	9600	2100	6000	600	0.1	0.50
<b>R 3</b>	21000	8400	13000	2600	0.25	0.60	16000	4800	8000	1600	0.2	0.60	8000	1700	5000	600	0.11	0.60
<b>R 4</b>	16000	6400	10000	2000	0.30	0.80	12000	3600	6000	1200	0.2	0.80	6000	1400	4000	480	0.11	0.80
<b>R 5</b>	13000	5200	8000	1700	0.50	1.00	10000	3200	4800	960	0.2	1.00	4800	1100	3000	420	0.12	1.00
<b>R 6</b>	9000	3600	6000	1300	0.50	1.20	7000	2200	3600	720	0.3	1.20	3600	860	2200	310	0.12	1.20
<b>R 8</b>	6000	2400	4000	1000	0.50	1.60	5000	1600	2500	500	0.3	1.60	2500	650	1500	240	0.15	1.60
<b>R 10</b>	4500	1800	3000	780	0.50	2.00	4000	1300	1800	360	0.3	2.00	1800	470	1000	160	0.15	2.00

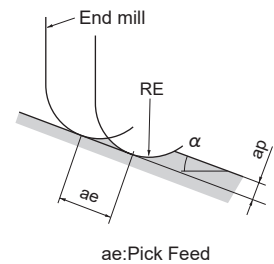
Depth of cut



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)  $\alpha$  is the inclination angle of the machined surface.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↓

SOLID END MILLS

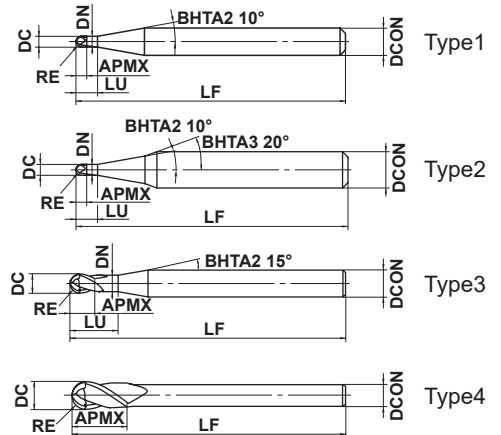
# SOLID END MILLS

## VFR2SB

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	Aluminium Alloy
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	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
VFR2SBR0150	1.5	3	3	6	2.9	70	6	2	●	3
VFR2SBR0150S03	1.5	3	3	—	—	60	3	2	●	4
VFR2SBR0200	2	4	4	8	3.9	70	6	2	●	3
VFR2SBR0200S04	2	4	4	—	—	60	4	2	●	4
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

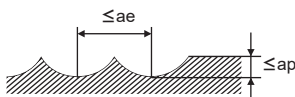
● : Inventory maintained in Japan.



## 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					
	R 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)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut ap (mm)
Revolution (min <sup>-1</sup> )		Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )			Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )			Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	
<b>R 0.1</b>	40000	320	40000	240	0.003	0.02	40000	320	40000	160	0.003	0.02	40000	320	40000	160	0.002	0.02
<b>R 0.15</b>	40000	640	40000	560	0.01	0.03	40000	640	40000	400	0.007	0.03	40000	640	40000	400	0.005	0.03
<b>R 0.2</b>	40000	1600	40000	1200	0.02	0.04	40000	1400	40000	1000	0.015	0.04	40000	1200	40000	1000	0.01	0.04
<b>R 0.3</b>	40000	3200	40000	1600	0.03	0.06	40000	2800	40000	1200	0.025	0.06	40000	2000	40000	1200	0.02	0.06
<b>R 0.4</b>	40000	6400	40000	2400	0.05	0.08	40000	4000	40000	1600	0.04	0.08	40000	2800	40000	1600	0.03	0.08
<b>R 0.5</b>	40000	8000	40000	3200	0.06	0.10	40000	5600	40000	2400	0.05	0.10	40000	3600	32000	1300	0.04	0.10
<b>R 0.75</b>	40000	9600	40000	4000	0.09	0.15	40000	7200	32000	2500	0.075	0.15	32000	4500	21000	1200	0.05	0.15
<b>R 1</b>	40000	9600	39000	4700	0.11	0.20	40000	8000	24000	2400	0.1	0.20	24000	3800	16000	1000	0.07	0.20
<b>R 1.25</b>	40000	10400	32000	4500	0.12	0.25	37000	8100	19000	2300	0.11	0.25	19000	3400	13000	1000	0.08	0.25
<b>R 1.5</b>	40000	12000	27000	4300	0.13	0.30	32000	7700	16000	2200	0.12	0.30	16000	3200	11000	880	0.09	0.30
<b>R 2</b>	32000	10880	20000	3600	0.15	0.40	24000	6200	12000	1900	0.13	0.40	12000	2400	8000	800	0.1	0.40
<b>R 2.5</b>	25000	9000	16000	2900	0.20	0.50	19000	5300	9600	1700	0.15	0.50	9600	2100	6000	600	0.1	0.50
<b>R 3</b>	21000	8400	13000	2600	0.25	0.60	16000	4800	8000	1600	0.2	0.60	8000	1700	5000	600	0.11	0.60
<b>R 4</b>	16000	6400	10000	2000	0.30	0.80	12000	3600	6000	1200	0.2	0.80	6000	1400	4000	480	0.11	0.80
<b>R 5</b>	13000	5200	8000	1700	0.50	1.00	10000	3200	4800	960	0.2	1.00	4800	1100	3000	420	0.12	1.00
<b>R 6</b>	9000	3600	6000	1300	0.50	1.20	7000	2200	3600	720	0.3	1.20	3600	860	2200	310	0.12	1.20
<b>R 8</b>	6000	2400	4000	1000	0.50	1.60	5000	1600	2500	500	0.3	1.60	2500	650	1500	240	0.15	1.60
<b>R 10</b>	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

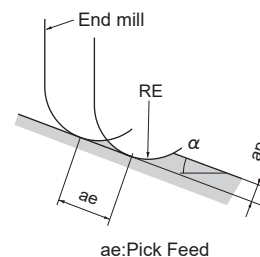


Note 1) If the rigidity of the machine or the work materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

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)  $\alpha$  is the inclination angle of the machined surface.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

└

SOLID END MILLS



# SOLID END MILLS

## VFR2SBF

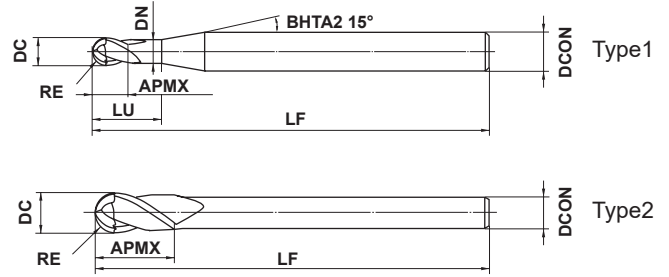
Ball nose, Short cut length, 2 flute, For Mirror finish cutting



TOOL NEWS



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	Aluminium Alloy
	○	◎	◎				



	RE ≤ 3				
	±0.010				
	4 ≤ DCON ≤ 6				
	0 - 0.005				

● New ball geometry for mirror finish cutting.

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	(mm)	
										Type	
VFR2SBFR0050	0.5	1	1	2	0.94	45	4	2	●	1	1
VFR2SBFR0075	0.75	1.5	1.5	3	1.44	45	4	2	●	1	1
VFR2SBFR0100	1	2	2	4	1.9	60	6	2	●	1	1
VFR2SBFR0125	1.25	2.5	2.5	5	2.4	60	6	2	●	1	1
VFR2SBFR0150	1.5	3	3	6	2.9	70	6	2	●	1	1
VFR2SBFR0200	2	4	4	8	3.9	70	6	2	●	1	1
VFR2SBFR0250	2.5	5	5	10	4.9	80	6	2	●	1	1
VFR2SBFR0300	3	6	12	—	—	80	6	2	●	2	2

● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

R RE (mm)	Carbon Steel, Alloy Steel (180—280HB) Alloy steel ( $\leq 350\text{HB}$ ), Pre-hardened steel (35—45HRC) Hardened steel (45—52HRC), Hardened steel (55—62HRC) AISI 1045, AISI 4140, SKD, SKT, AISI P21, AISI P20, AISI H13, L6, AISI D2						Hardened steel (62—70HRC) 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)
	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)			Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)		
<b>R 0.5</b>	40000	800	40000	800	0.007	0.007	40000	560	40000	560	0.005	0.005
<b>R 0.75</b>	40000	800	40000	800	0.009	0.009	40000	560	40000	560	0.007	0.007
<b>R 1.0</b>	35000	1050	35000	1050	0.011	0.011	35000	700	35000	700	0.009	0.009
<b>R 1.25</b>	35000	1050	35000	1050	0.013	0.013	35000	700	35000	700	0.011	0.011
<b>R 1.5</b>	35000	1050	35000	1050	0.015	0.015	35000	700	35000	700	0.013	0.013
<b>R 2.0</b>	25000	1000	25000	1000	0.017	0.017	25000	750	25000	750	0.015	0.015
<b>R 2.5</b>	25000	1000	25000	1000	0.020	0.020	25000	750	25000	750	0.015	0.015
<b>R 3.0</b>	25000	1000	25000	1000	0.020	0.020	25000	750	25000	750	0.015	0.015

Depth of cut

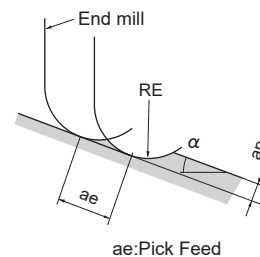
Note 1) The tools are recommended for use only in finish machining.

Note 2) Air blowing or oil mist is 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)  $\alpha$  is the inclination angle of the machined surface.



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS

# SOLID END MILLS

## VF2SDB

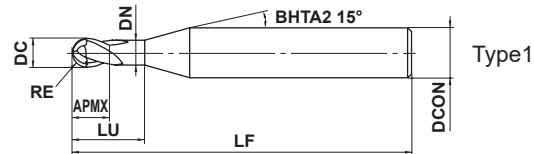
Ball nose, Short cut length, 2 flute, Strong geometry type



TOOL NEWS



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	Aluminium Alloy
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	RE ≤ 6.5	RE > 6.5			
	±0.01	±0.02			
	DC ≤ 12	DC > 12			
	<sup>0</sup> / <sub>-0.02</sub>	<sup>0</sup> / <sub>-0.03</sub>			
	DCON=3	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON=20
	<sup>0</sup> / <sub>-0.006</sub>	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>	<sup>0</sup> / <sub>-0.013</sub>

● 2 flute ball nose end mill with Impact Miracle coating for high hardness materials and achieves excellent fracture resistance.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2SDBR0050	0.5	1	1	2	0.94	45	4	2	▲	1
VF2SDBR0100	1	2	2	4	1.9	60	6	2	▲	1
VF2SDBR0100S04	1	2	2	4	1.9	50	4	2	▲	1
VF2SDBR0150	1.5	3	3	6	2.9	70	6	2	▲	1
VF2SDBR0150S03	1.5	3	3	6	2.9	60	3	2	▲	2
VF2SDBR0200	2	4	4	8	3.9	70	6	2	▲	1
VF2SDBR0200S04	2	4	4	8	3.9	60	4	2	▲	2
VF2SDBR0250	2.5	5	5	10	4.9	80	6	2	▲	1
VF2SDBR0300	3	6	12	22	5.85	80	6	2	▲	2
VF2SDBR0400	4	8	14	27	7.85	90	8	2	▲	2
VF2SDBR0500	5	10	18	31	9.7	100	10	2	▲	2
VF2SDBR0600	6	12	22	35	11.7	110	12	2	▲	2
VF2SDBR0800	8	16	30	50	15.5	140	16	2	▲	2
VF2SDBR1000	10	20	38	58	19.5	160	20	2	▲	2

▲ : Product scheduled to be discontinued at the end of March 2020

MP2SDB(J200) is alternative product.

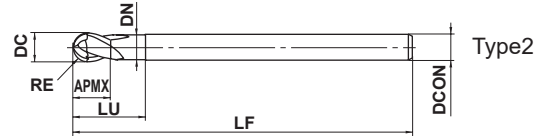
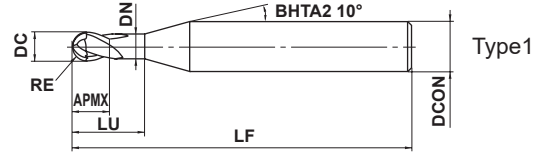
# VF2SDBL

Ball nose, Short cut length, 2 flute, Strong geometry type, Long 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	Aluminium Alloy
○	◎	◎	○				



	RE ≤ 6.5	RE > 6.5			
	±0.01	±0.02			
	DC ≤ 12	DC > 12			
	<sup>0</sup> / <sub>-0.02</sub>	<sup>0</sup> / <sub>-0.03</sub>			
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>	<sup>0</sup> / <sub>-0.013</sub>	

● 2 flute end mill with long shank for general use.

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2SDBLR0050	0.5	1	1	2	0.94	60	6	2	▲	1
VF2SDBLR0100	1	2	2	4	1.9	80	6	2	▲	1
VF2SDBLR0150	1.5	3	3	6	2.9	90	6	2	▲	1
VF2SDBLR0200	2	4	4	8	3.9	90	6	2	▲	1
VF2SDBLR0250	2.5	5	5	10	4.9	110	8	2	▲	1
VF2SDBLR0300	3	6	12	22	5.85	120	6	2	▲	2
VF2SDBLR0400	4	8	14	27	7.85	130	8	2	▲	2
VF2SDBLR0500	5	10	18	31	9.7	140	10	2	▲	2
VF2SDBLR0600	6	12	22	35	11.7	140	12	2	▲	2
VF2SDBLR0800	8	16	30	50	15.5	200	16	2	▲	2
VF2SDBLR1000	10	20	38	58	19.5	200	20	2	▲	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VF2SDB

Ball nose, Short cut length, 2 flute, Strong geometry type

## VF2SDBL

Ball nose, Short cut length, 2 flute, Strong geometry type, Long shank

### RECOMMENDED CUTTING CONDITIONS

#### Overhang below DC×5 (DC:Dia.)

Work Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21						Hardened steel (45–55HRC) AISI H13						Hardened steel (55–62HRC) AISI D2					
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		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)
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)			Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)			Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)		
<b>R 0.5</b>	40000	5200	36000	2300	0.10	0.25	40000	5200	36000	2300	0.10	0.25	40000	5000	40000	2400	0.05	0.10
<b>R 1</b>	40000	6000	36000	3500	0.20	0.50	40000	6000	36000	3500	0.20	0.50	36000	5000	24000	2400	0.10	0.20
<b>R 1.5x3</b>	29000	4600	19000	2400	0.20	0.50	25000	4000	16000	2000	0.20	0.50	17000	2400	11000	1000	0.12	0.30
<b>R 1.5</b>	37000	7000	24000	3000	0.30	0.75	37000	7000	24000	3000	0.30	0.75	25000	6000	16000	2200	0.12	0.30
<b>R 2x4</b>	24000	4300	15000	2200	0.25	0.70	19000	3400	13000	1700	0.25	0.70	12000	1900	8200	900	0.13	0.40
<b>R 2</b>	30000	6500	19000	2800	0.40	1.00	28000	6000	19000	2600	0.40	1.00	18000	4800	12000	2000	0.13	0.40
<b>R 2.5</b>	25000	6000	16000	2600	0.50	1.30	22000	5000	16000	2300	0.50	1.25	15000	4200	9500	1700	0.15	0.50
<b>R 3</b>	22000	6000	14000	2400	0.60	1.80	18000	4500	12000	1900	0.60	1.50	12000	3500	8000	1600	0.20	0.60
<b>R 4</b>	19000	5200	12000	2200	0.80	2.40	15000	3800	9500	1700	0.80	2.00	9800	3000	6500	1300	0.20	0.80
<b>R 5</b>	15000	4300	9500	2000	1.00	3.00	11000	3000	7000	1500	1.00	2.50	7500	2400	5000	1000	0.20	1.00
<b>R 6</b>	12000	3400	8000	1800	1.20	3.60	9000	2400	6000	1400	1.20	3.00	6000	1900	4000	800	0.30	1.20
<b>R 8</b>	9000	2600	6000	1500	1.60	4.80	7000	1900	4500	1100	1.60	4.00	4500	1500	3000	600	0.30	1.60
<b>R10</b>	7500	2200	4800	1200	2.00	6.00	5500	1500	3600	900	2.00	5.00	3600	1200	2500	500	0.30	2.00

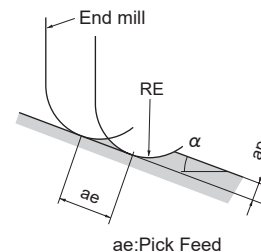
Note 1)  $\alpha$  is the inclination angle of the machined surface.

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.

#### Overhang DC×7 (DC:Dia.)

Work Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21				Hardened steel (45–55HRC) AISI H13			
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R 1.5x3</b>	16000	2000	0.10	0.30	13000	1500	0.10	0.30
<b>R 2x4</b>	13000	2000	0.15	0.50	10000	1500	0.15	0.50
<b>R 3</b>	10000	2000	0.20	1.00	8000	1600	0.20	0.80
<b>R 4</b>	8000	1800	0.30	1.50	6400	1400	0.40	1.20
<b>R 5</b>	6000	1600	0.40	2.00	4800	1200	0.40	1.60
<b>R 6</b>	5000	1300	0.45	2.40	4000	1000	0.45	2.00
<b>R 8</b>	3800	1000	0.60	3.00	3100	800	0.60	2.50
<b>R10</b>	3000	800	0.80	4.00	2500	650	0.80	3.00



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.

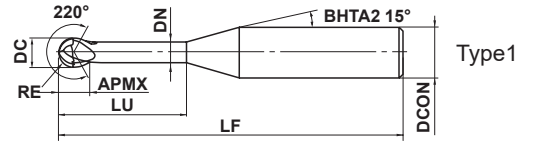
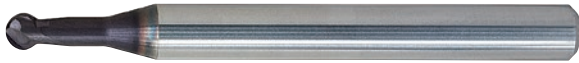
# VF2WB

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	Aluminium Alloy
○	○	○		◎	◎		



	$1 \leq RE \leq 3$				
	$\pm 0.01$				
	DCON=6				
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$				

- Ball nose end mill suitable for machining of undercut geometries and complex geometries using a 5-axis machine.

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2WBR0100N060	1	2	1.3	6	1.6	60	6	2	●	1
VF2WBR0150N080	1.5	3	2	8	2.4	60	6	2	●	1
VF2WBR0200N100	2	4	2.6	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)		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
AISI 1050, AISI No 35 B, AISI P20				AISI H13, AISI W1-10, AISI P21			AISI 304, AISI 306, Ti-6Al-4V			AISI H13		
<b>R1</b>	40000	5000	0.07	40000	5000	0.06	32000	2500	0.05	32000	3000	0.03
<b>R1.5</b>	32000	5000	0.12	32000	5000	0.11	26000	2500	0.10	26000	3000	0.07
<b>R2</b>	24000	3800	0.15	24000	3800	0.13	20000	2000	0.12	20000	2800	0.10
<b>R3</b>	16000	2800	0.20	16000	2800	0.18	13000	1500	0.15	13000	2100	0.12

Depth of cut	
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RE:Radius

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

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

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

# SOLID END MILLS

## VF2XLBS

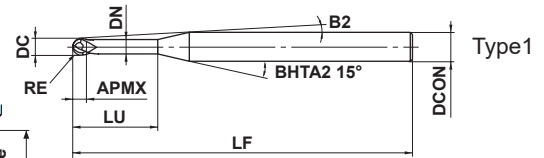
IMPACT MIRACLE, Ball nose, 2 flute, Long neck, Short shank



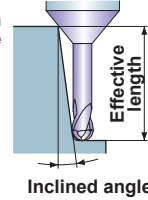
TOOL NEWS



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	Aluminium Alloy
○	◎	◎	◎				



Effective length for inclined angle



	$0.2 \leq RE \leq 1$ $\pm 0.007$				
	$0.4 \leq DC \leq 2$ $0$ $- 0.02$				
	$DCON=4$ $0$ $- 0.008$				

- 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)

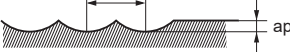
Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
												0.5°	1°	2°	3°
VF2XLBSR0020N010	0.2	0.4	0.32	1	0.36	13.4°	40	4	2	●	1	1.0	1.0	1.1	1.2
VF2XLBSR0020N020	0.2	0.4	0.32	2	0.36	11.9°	40	4	2	●	1	2.0	2.1	2.3	2.5
VF2XLBSR0020N030	0.2	0.4	0.32	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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45–55HRC)			Hardened steel (55–62HRC)		
		AISI H13			AISI D2		
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>R 0.2</b>	<b>1</b>	40000	1400	0.015	40000	1400	0.01
	<b>2</b>	40000	1000	0.01	40000	1000	0.006
	<b>3</b>	40000	700	0.005	40000	700	0.003
	<b>4</b>	40000	600	0.004	40000	500	0.003
<b>R 0.25</b>	<b>4</b>	36000	900	0.01	36000	900	0.007
	<b>6</b>	36000	600	0.006	36000	500	0.004
<b>R 0.3</b>	<b>2</b>	40000	2800	0.03	40000	2800	0.02
	<b>3</b>	40000	2800	0.03	40000	2800	0.02
	<b>4</b>	35000	2000	0.02	35000	2000	0.015
	<b>6</b>	30000	800	0.008	30000	800	0.005
<b>R 0.4</b>	<b>4</b>	40000	3000	0.02	40000	3000	0.015
	<b>6</b>	30000	1600	0.02	30000	1600	0.01
<b>R 0.5</b>	<b>3</b>	40000	4000	0.05	40000	4000	0.04
	<b>4</b>	40000	4000	0.05	40000	4000	0.04
	<b>6</b>	35000	2000	0.03	35000	2000	0.02
	<b>8</b>	30000	1600	0.02	30000	1600	0.01
<b>R 1</b>	<b>6</b>	40000	6000	0.1	24000	3400	0.1
	<b>8</b>	40000	5000	0.1	24000	3000	0.1
	<b>10</b>	40000	5000	0.08	24000	3000	0.07

Depth of cut	<div style="text-align: center;"> <math>\leq 0.1RE</math> (<math>RE \leq 1</math>)  <math>\leq 0.2RE</math> (<math>RE &gt; 1</math>)                 </div>  <p style="text-align: right;">RE:Radius</p>
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Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

SQUARE

BALL

RADIUS

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BARREL

ROUGHING

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SOLID END MILLS



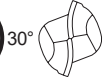
# SOLID END MILLS

## VF2XLB

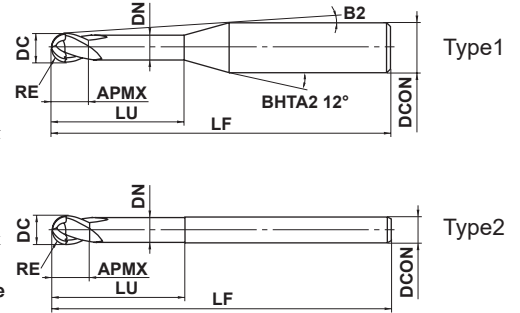
IMPACT MIRACLE, Ball nose, 2 flute, Long neck



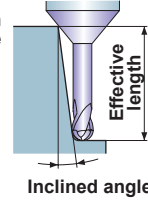
TOOL NEWS



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Effective length for inclined angle



	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°
VF2XLBR0010N005S04	0.1	0.2	0.16	0.5	0.17	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.6
VF2XLBR0010N005S06	0.1	0.2	0.16	0.5	0.17	11.7°	50	6	2	●	1	0.5	0.5	0.6	0.6
VF2XLBR0010N008S04	0.1	0.2	0.16	0.75	0.17	11.2°	50	4	2	●	1	0.7	0.8	0.9	1.0
VF2XLBR0010N010S04	0.1	0.2	0.16	1	0.17	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
VF2XLBR0010N010S06	0.1	0.2	0.16	1	0.17	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3
VF2XLBR0010N013S04	0.1	0.2	0.16	1.25	0.17	10.7°	50	4	2	●	1	1.3	1.3	1.5	1.6
VF2XLBR0010N015S04	0.1	0.2	0.16	1.5	0.17	10.4°	50	4	2	●	1	1.5	1.6	1.8	2.0
VF2XLBR0010N015S06	0.1	0.2	0.16	1.5	0.17	10.9°	50	6	2	●	1	1.5	1.6	1.8	2.0
VF2XLBR0010N018S04	0.1	0.2	0.16	1.75	0.17	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
VF2XLBR0010N020S04	0.1	0.2	0.16	2	0.17	10°	50	4	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0010N025S04	0.1	0.2	0.16	2.5	0.17	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
VF2XLBR0015N010S04	0.15	0.3	0.24	1	0.27	11°	50	4	2	●	1	1.0	1.1	1.2	1.3
VF2XLBR0015N010S06	0.15	0.3	0.24	1	0.27	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3
VF2XLBR0015N013S04	0.15	0.3	0.24	1.25	0.27	10.7°	50	4	2	●	1	1.3	1.3	1.5	1.6
VF2XLBR0015N015S04	0.15	0.3	0.24	1.5	0.27	10.4°	50	4	2	●	1	1.5	1.6	1.8	1.9
VF2XLBR0015N015S06	0.15	0.3	0.24	1.5	0.27	10.9°	50	6	2	●	1	1.5	1.6	1.8	1.9
VF2XLBR0015N018S04	0.15	0.3	0.24	1.75	0.27	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
VF2XLBR0015N020S04	0.15	0.3	0.24	2	0.27	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0015N020S06	0.15	0.3	0.24	2	0.27	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0015N025S04	0.15	0.3	0.24	2.5	0.27	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
VF2XLBR0015N030S04	0.15	0.3	0.24	3	0.27	9.1°	50	4	2	●	1	3.1	3.2	3.6	3.9
VF2XLBR0015N040S04	0.15	0.3	0.24	4	0.27	8.4°	50	4	2	●	1	4.2	4.3	4.8	5.3
VF2XLBR0020N010S04	0.2	0.4	0.32	1	0.36	11°	50	4	2	●	1	1.0	1.0	1.1	1.2
VF2XLBR0020N010S06	0.2	0.4	0.32	1	0.36	11.3°	50	6	2	●	1	1.0	1.0	1.1	1.2
VF2XLBR0020N015S04	0.2	0.4	0.32	1.5	0.36	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
VF2XLBR0020N015S06	0.2	0.4	0.32	1.5	0.36	11°	50	6	2	●	1	1.5	1.6	1.7	1.9
VF2XLBR0020N020S04	0.2	0.4	0.32	2	0.36	10°	50	4	2	●	1	2.0	2.1	2.3	2.6
VF2XLBR0020N020S06	0.2	0.4	0.32	2	0.36	10.6°	50	6	2	●	1	2.0	2.1	2.3	2.6
VF2XLBR0020N025S04	0.2	0.4	0.32	2.5	0.36	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
VF2XLBR0020N025S06	0.2	0.4	0.32	2.5	0.36	10.3°	50	6	2	●	1	2.6	2.7	2.9	3.2
VF2XLBR0020N030S04	0.2	0.4	0.32	3	0.36	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
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

● : Inventory maintained in Japan.

(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°
												VF2XLBR0025N015S04	0.25	0.5	0.4
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
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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## VF2XLB

IMPACT MIRACLE, 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°
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
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

\* No interference

● : Inventory maintained in Japan.

(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°
												VF2XLBR0100N080S04	1	2	1.6
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
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	*	*

\* No interference



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VF2XLB

IMPACT MIRACLE, Ball nose, 2 flute, Long neck

(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°
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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

←

SOLID END MILLS

● : Inventory maintained in Japan.

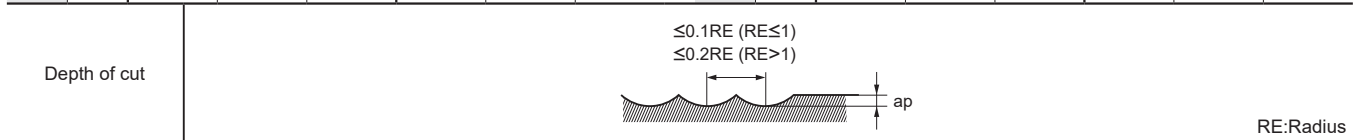


### RECOMMENDED CUTTING CONDITIONS

Work Material		Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
		AISI H13			AISI D2		
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
R 0.1	0.5	40000	300	0.003	40000	300	0.002
	1	40000	300	0.002	40000	300	0.002
	1.5	40000	300	0.001	40000	200	0.001
	2	40000	200	0.001	40000	100	0.001
	2.5	40000	100	0.001	40000	60	0.001
R 0.15	1	40000	500	0.007	40000	500	0.005
	1.5	40000	500	0.005	40000	500	0.003
	2	40000	500	0.003	40000	500	0.002
	2.5	40000	400	0.003	40000	400	0.002
	3	40000	300	0.002	40000	300	0.001
R 0.2	4	30000	200	0.002	30000	200	0.001
	1	40000	1400	0.015	40000	1400	0.01
	1.5	40000	1000	0.01	40000	1000	0.006
	2	40000	1000	0.01	40000	1000	0.006
	2.5	40000	700	0.005	40000	700	0.003
R 0.25	3	40000	700	0.005	40000	700	0.003
	4	40000	600	0.004	40000	500	0.003
	5	40000	400	0.003	40000	300	0.002
	1.5	40000	2000	0.02	40000	2000	0.015
	2	40000	2000	0.02	40000	2000	0.015
	3	40000	1200	0.015	40000	1200	0.01
R 0.3	4	36000	900	0.01	36000	900	0.007
	5	36000	700	0.007	36000	600	0.005
	6	36000	600	0.006	36000	500	0.004
	2	40000	2800	0.03	40000	2800	0.02
	3	40000	2800	0.03	40000	2800	0.02
R 0.4	4	35000	2000	0.02	35000	2000	0.015
	5	30000	1000	0.01	30000	1000	0.007
	6	30000	800	0.008	30000	800	0.005
	7	30000	600	0.008	30000	600	0.005
	8	25000	400	0.006	25000	400	0.004
R 0.5	2	40000	3500	0.04	40000	3500	0.03
	3	40000	3000	0.04	40000	3000	0.03
	4	40000	3000	0.02	40000	3000	0.015
	6	30000	1600	0.02	30000	1600	0.01
	8	25000	1000	0.01	25000	1000	0.007
	10	25000	600	0.008	25000	600	0.005
R 0.6	3	40000	4000	0.05	40000	4000	0.04
	4	40000	4000	0.05	40000	4000	0.04
	5	40000	3000	0.03	40000	3000	0.02
	6	35000	2000	0.03	35000	2000	0.02
	8	30000	1600	0.02	30000	1600	0.01
	10	20000	1000	0.01	20000	1000	0.01
R 0.7	12	20000	1000	0.01	18000	800	0.008
	14	18000	600	0.008	18000	480	0.008
	16	18000	500	0.008	18000	400	0.006
	18	13000	300	0.005	13000	240	0.004
	20	13000	250	0.005	13000	200	0.004
	6	40000	4000	0.05	35000	3500	0.04
R 0.75	8	40000	3000	0.05	27000	2000	0.04
	10	27000	1900	0.03	24000	1700	0.02
	12	16000	1100	0.02	16000	1000	0.01
	14	16000	850	0.01	16000	780	0.01
	16	15000	500	0.01	14000	400	0.006
R 0.8	8	40000	4500	0.06	28000	3200	0.05
	12	32000	3000	0.03	19000	1800	0.02
	16	15000	1000	0.02	14000	800	0.01
	6	40000	5000	0.07	32000	4000	0.06
	8	40000	5000	0.07	28000	3500	0.06
R 0.85	10	40000	4500	0.06	21000	2400	0.04
	12	32000	3400	0.04	19000	2000	0.03
	14	16000	1500	0.04	13000	1200	0.03
	16	13000	1200	0.03	13000	1200	0.02

Work Material		Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
		AISI H13			AISI D2		
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
R 0.75	18	13000	1100	0.02	10000	800	0.02
	20	12000	900	0.02	9000	700	0.01
R 0.8	8	40000	5000	0.08	26000	3200	0.07
	12	35000	3800	0.05	20000	2100	0.03
	16	13000	1200	0.04	12000	1100	0.02
R 0.9	20	10000	750	0.02	8000	600	0.01
	8	40000	5000	0.09	25000	3100	0.08
	12	36000	3800	0.06	18000	1900	0.04
	16	25000	2500	0.04	14000	1300	0.025
R 1	20	10000	1000	0.03	8000	800	0.02
	6	40000	6000	0.1	24000	3400	0.1
	8	40000	5000	0.1	24000	3000	0.1
	10	40000	5000	0.08	24000	3000	0.07
	12	40000	5000	0.08	24000	2600	0.05
	14	40000	5000	0.06	21000	2300	0.05
	16	32000	3500	0.05	16000	1700	0.03
	18	24000	2400	0.04	13000	1300	0.03
	20	10000	1000	0.04	10000	1000	0.03
	22	10000	1000	0.04	10000	1000	0.02
	25	10000	1000	0.04	8000	800	0.02
R 1.25	30	10000	800	0.02	8000	800	0.015
	35	10000	500	0.02	8000	400	0.01
	10	36000	5000	0.12	20000	2600	0.11
	15	36000	4600	0.08	18000	2000	0.075
	20	26000	3000	0.07	13000	1400	0.05
	25	10000	1100	0.06	8000	800	0.04
R 1.5	30	8000	800	0.05	7000	700	0.03
	35	8000	500	0.03	5000	400	0.03
	8	32000	6400	0.15	16000	3000	0.15
	10	32000	5100	0.15	16000	2200	0.15
	12	32000	5100	0.13	16000	2200	0.13
	14	32000	4500	0.13	16000	2200	0.1
	16	32000	4500	0.1	16000	1800	0.1
	20	27000	3800	0.1	14000	1600	0.06
R 1.75	25	21000	2700	0.08	11000	1200	0.06
	30	9000	1000	0.08	7000	700	0.05
	35	6000	700	0.06	6000	600	0.04
	40	6000	600	0.04	5000	400	0.03
	16	28000	4200	0.13	14000	1600	0.13
	20	26000	3800	0.13	13000	1600	0.11
R 2	25	23000	3300	0.12	11000	1200	0.08
	30	13000	1900	0.09	9000	1000	0.07
	35	9000	1200	0.08	6000	600	0.06
	40	8500	1100	0.07	5500	500	0.04
	10	24000	4800	0.2	12000	2200	0.2
	12	24000	4800	0.2	12000	2200	0.2
	14	24000	3800	0.15	12000	1500	0.15
	16	24000	3800	0.15	12000	1500	0.15
	20	24000	3800	0.15	12000	1500	0.15
	25	24000	3800	0.15	10000	1100	0.1
R 2.5	30	20000	3000	0.1	10000	1100	0.08
	35	12000	1700	0.1	8000	900	0.08
	40	11000	1500	0.1	5000	500	0.06
	45	10000	1300	0.08	5000	500	0.05
	50	8000	1000	0.05	4000	400	0.04
	20	19000	3400	0.2	10000	1400	0.2
R 3	25	19000	3400	0.2	10000	1400	0.2
	30	19000	3200	0.15	8000	1000	0.15
	35	16000	2700	0.1	8000	900	0.1
R 3	30	16000	3500	0.2	8000	1000	0.2
	40	16000	3000	0.15	8000	800	0.15
	50	16000	2700	0.15	6000	500	0.15

SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS



Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.  
 Note 2) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

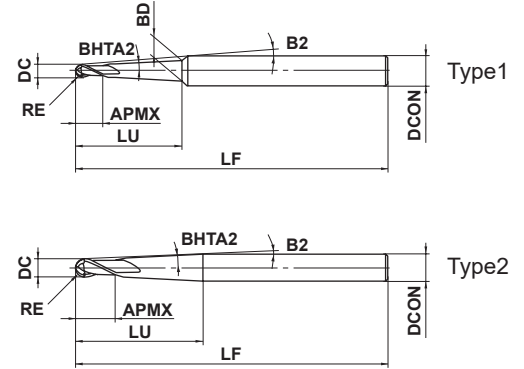
# SOLID END MILLS

## VCXB

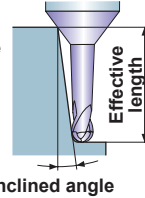
Ball nose taper end mill, Medium cut length, Taper neck



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	Aluminium Alloy
○	◎	○		○	○		



Effective length for inclined angle



	$0.5 \leq RE \leq 6$				
	$\pm 0.01$				
	$1 \leq DC \leq 12$				
	$0 - 0.020$				
	$DCON=6$	$8 \leq DCON \leq 10$	$12 \leq DCON \leq 16$		
	$0 - 0.008$	$0 - 0.009$	$0 - 0.011$		

● 2 flute taper end mill with taper neck.

(mm)

Order Number	RE	DC	BHTA2	APMX	LU	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle		
													1°	2°	3°
VCXBR0050T0100L016	0.5	1	1°	2	16	6.6°	1.38	50	6	2	▲	1	16.2	17.0	18.0
VCXBR0050T0100L021	0.5	1	1°	2	21	5.4°	1.56	60	6	2	▲	1	21.2	22.3	23.5
VCXBR0050T0100L026	0.5	1	1°	2	26	4.6°	1.73	70	6	2	▲	1	26.2	27.6	29.1
VCXBR0050T0130	0.5	1	1.5°	2	23	5.1°	1.97	60	6	2	▲	1	—	23.9	25.2
VCXBR0050T0300	0.5	1	3°	2	42	3.4°	5.08	80	6	2	▲	1	—	—	42.4
VCXBR0050T0500	0.5	1	5°	2	23	5.8°	4.46	60	6	2	▲	1	—	—	—
VCXBR0100T0100L021	1	2	1°	4	21	4.6°	2.43	50	6	2	▲	1	21.3	22.4	23.6
VCXBR0100T0100L031	1	2	1°	4	31	3.4°	2.78	60	6	2	▲	1	31.3	33.0	34.8
VCXBR0100T0100L041	1	2	1°	4	41	2.7°	3.13	70	6	2	▲	1	41.3	43.5	*
VCXBR0100T0130	1	2	1.5°	4	23	4.4°	2.8	60	6	2	▲	1	—	24.1	25.4
VCXBR0100T0300	1	2	3°	4	41	2.9°	5.71	80	6	2	▲	1	—	—	*
VCXBR0100T0500	1	2	5°	4	23	4.9°	5.02	60	6	2	▲	1	—	—	—
VCXBR0150T0100L031	1.5	3	1°	6	31	2.7°	3.71	60	6	2	▲	1	31.4	33.0	*
VCXBR0150T0100L041	1.5	3	1°	6	41	2.1°	4.06	70	6	2	▲	1	41.4	43.5	*
VCXBR0150T0100L051	1.5	3	1°	6	51	1.7°	4.41	80	6	2	▲	1	51.4	*	*
VCXBR0150T0130	1.5	3	1.5°	6	52	1.7°	5.21	90	6	2	▲	1	—	*	*
VCXBR0150T0300	1.5	3	3°	6	32	2.8°	5.56	70	6	2	▲	1	—	—	*
VCXBR0200T0100L036	2	4	1°	8	36	1.7°	4.81	70	6	2	▲	1	36.5	*	*
VCXBR0200T0100L046	2	4	1°	8	46	1.3°	5.16	80	6	2	▲	1	46.5	*	*
VCXBR0200T0100L060	2	4	1°	8	60	1°	5.65	90	6	2	▲	1	60.5	*	*
VCXBR0200T0130	2	4	1.5°	8	49	1.3°	5.95	90	6	2	▲	1	—	*	*
VCXBR0200T0300	2	4	3°	8	28	2.2°	—	70	6	2	▲	2	—	—	*
VCXBR0250T0100L036	2.5	5	1°	10	36	0.9°	5.71	80	6	2	▲	1	*	*	*
VCXBR0250T0100L065	2.5	5	1°	10	65	1.4°	6.72	110	8	2	▲	1	65.6	*	*
VCXBR0250T0130	2.5	5	1.5°	10	61	1.5°	7.42	110	8	2	▲	1	—	*	*
VCXBR0250T0300	2.5	5	3°	10	41	2.3°	—	90	8	2	▲	2	—	—	*
VCXBR0300T0100L051	3	6	1°	12	51	1.2°	7.11	90	8	2	▲	1	51.8	*	*
VCXBR0300T0100L065	3	6	1°	12	65	1°	7.6	110	8	2	▲	1	65.8	*	*
VCXBR0300T0100L092	3	6	1°	12	92	1.3°	8.54	140	10	2	▲	1	92.8	*	*
VCXBR0300T0130	3	6	1.5°	12	53	1.2°	7.85	110	8	2	▲	1	—	*	*
VCXBR0300T0300	3	6	3°	12	34	1.9°	—	90	8	2	▲	2	—	—	*
VCXBR0400T0100L068	4	8	1°	14	68	0.9°	9.64	110	10	2	▲	1	*	*	*
VCXBR0400T0100L092	4	8	1°	14	92	1.3°	10.47	140	12	2	▲	1	92.8	*	*
VCXBR0400T0130	4	8	1.5°	14	55	1.2°	9.85	120	10	2	▲	1	—	*	*

\* No interference

▲ : Product scheduled to be discontinued at the end of March 2020

MP3XB(J254) is alternative product.

(mm)

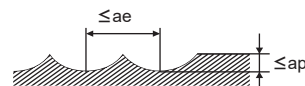
Order Number	RE	DC	BHTA2	APMX	LU	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle		
													1°	2°	3°
													VCXBR0400T0300	4	8
VCXBR0500T0100L070	5	10	1°	18	70	0.9°	11.76	130	12	2	▲	1	*	*	*
VCXBR0500T0100L100	5	10	1°	18	100	1.8°	12.8	160	16	2	▲	1	100.7	*	*
VCXBR0500T0130	5	10	1.5°	18	59	1.1°	—	130	12	2	▲	2	—	*	*
VCXBR0500T0300	5	10	3°	18	40	1.7°	—	110	12	2	▲	2	—	—	*
VCXBR0600T0100L070	6	12	1°	22	70	1.8°	13.62	140	16	2	▲	1	70.9	*	*
VCXBR0600T0100L100	6	12	1°	22	100	1.2°	14.66	160	16	2	▲	1	100.9	*	*
VCXBR0600T0130	6	12	1.5°	22	83	1.5°	15.08	160	16	2	▲	1	—	*	*
VCXBR0600T0300	6	12	3°	22	63	2.1°	—	140	16	2	▲	2	—	—	*

\* No interference

### RECOMMENDED CUTTING CONDITIONS

Work Material					Alloy steel, Tool steel, Pre-hardened steel		Hardened steel (45–55HRC)	
					AISI H13, AISI W1-10, AISI P21		AISI H13	
R RE (mm)	Taper angle one side BHTA2	Neck length LU (mm)	Depth of cut		Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
			ap (mm)	ae (mm)				
<b>R0.5</b>	1°	16	<b>0.02</b>		22000	530	12000	230
	1°	21	<b>0.01</b>					
	1°	26	<b>0.01</b>					
	1.5°	23	<b>0.02</b>					
	3°	42	<b>0.05</b>					
<b>R1</b>	5°	23	<b>0.05</b>		18000	570	10000	260
	1°	21	<b>0.05</b>					
	1°	31	<b>0.04</b>					
	1°	41	<b>0.03</b>					
	1.5°	23	<b>0.1</b>					
<b>R2</b>	3°	41	<b>0.1</b>		14000	670	6000	200
	5°	23	<b>0.1</b>					
	1°	36	<b>0.2</b>					
	1°	46	<b>0.15</b>					
	1°	60	<b>0.1</b>					
<b>R3</b>	1.5°	49	<b>0.2</b>		10000	840	5000	220
	3°	28	<b>0.2</b>					
	1°	51	<b>0.3</b>					
	1°	65	<b>0.2</b>					
	1°	92	<b>0.1</b>					
<b>R4</b>	1.5°	53	<b>0.3</b>		8000	840	4000	270
	3°	34	<b>0.3</b>					
<b>R5</b>	1.5°	55	<b>0.4</b>		6000	840	3000	310
	3°	36	<b>0.4</b>					
	1°	70	<b>0.4</b>					
	1°	100	<b>0.3</b>					
<b>R6</b>	1.5°	59	<b>0.5</b>		5000	900	2500	340
	3°	40	<b>0.5</b>					
	1°	70	<b>0.6</b>					
	1°	100	<b>0.4</b>					
<b>R6</b>	1.5°	83	<b>0.6</b>		5000	900	2500	340
	3°	63	<b>0.6</b>					

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS



# SOLID END MILLS

## CRN2MB

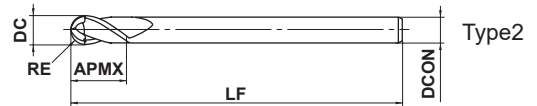
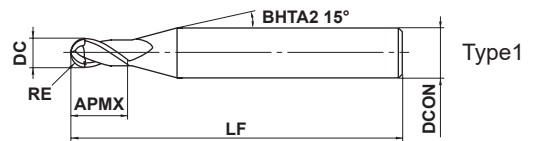
Ball nose, Medium cut length, 2 flute, For copper electrodes



TOOL NEWS



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	Aluminium Alloy
						○	○



	$0.2 \leq RE \leq 6$				
	$\pm 0.01$				
	$0.4 \leq DC \leq 12$				
	$0$ $- 0.02$				
	$DCON=3$	$4 \leq DCON \leq 6$	$8 \leq DCON \leq 10$	$DCON=12$	
	$0$ $- 0.006$	$0$ $- 0.008$	$0$ $- 0.009$	$0$ $- 0.011$	

● 2 flute ball nose end mill with CRN coating for copper electrode machining.

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
								Type	
CRN2MBR0020S04	0.2	0.4	0.8	45	4	2	●	1	
CRN2MBR0020S06	0.2	0.4	0.8	50	6	2	●	1	
CRN2MBR0030S04	0.3	0.6	1.2	45	4	2	●	1	
CRN2MBR0030S06	0.3	0.6	1.2	50	6	2	●	1	
CRN2MBR0040S04	0.4	0.8	1.6	45	4	2	●	1	
CRN2MBR0040S06	0.4	0.8	1.6	50	6	2	●	1	
CRN2MBR0050S04	0.5	1	2.5	45	4	2	●	1	
CRN2MBR0050S06	0.5	1	2.5	50	6	2	●	1	
CRN2MBR0075S04	0.75	1.5	4	45	4	2	●	1	
CRN2MBR0075S06	0.75	1.5	4	50	6	2	●	1	
CRN2MBR0100S06	1	2	6	50	6	2	●	1	
CRN2MBR0125S06	1.25	2.5	6	50	6	2	●	1	
CRN2MBR0150S03	1.5	3	8	70	3	2	●	2	
CRN2MBR0150S06	1.5	3	8	70	6	2	●	1	
CRN2MBR0175S06	1.75	3.5	8	70	6	2	●	1	
CRN2MBR0200S04	2	4	8	70	4	2	●	2	
CRN2MBR0200S06	2	4	8	70	6	2	●	1	
CRN2MBR0250S06	2.5	5	12	80	6	2	●	1	
CRN2MBR0300S06	3	6	12	80	6	2	●	2	
CRN2MBR0400S08	4	8	14	90	8	2	●	2	
CRN2MBR0500S10	5	10	18	100	10	2	●	2	
CRN2MBR0600S12	6	12	22	110	12	2	●	2	

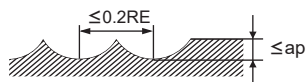
● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

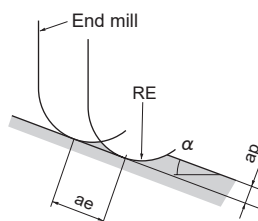
## RECOMMENDED CUTTING CONDITIONS

Work Material	Copper, Copper alloys				Depth of cut $a_p$ (mm)
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		
R RE (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	
<b>R0.2</b>	40000	1600	40000	1200	0.02
<b>R0.3</b>	40000	3200	40000	1600	0.03
<b>R0.4</b>	40000	6400	40000	2400	0.05
<b>R0.5</b>	40000	8000	40000	3200	0.06
<b>R0.75</b>	40000	9600	40000	4000	0.09
<b>R1</b>	40000	9600	39000	4700	0.11
<b>R1.25</b>	40000	12000	30000	4500	0.12
<b>R1.5</b>	40000	12000	27000	4300	0.13
<b>R2</b>	32000	11000	20000	3600	0.15
<b>R2.5</b>	25000	9000	16000	2900	0.20
<b>R3</b>	21000	8400	13000	2600	0.25
<b>R4</b>	16000	6400	10000	2000	0.30
<b>R5</b>	13000	5200	8000	1700	0.50
<b>R6</b>	9000	3600	6000	1300	0.50

Depth of cut



RE:Radius



ae:Pick Feed

Note 1)  $\alpha$  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) Water-soluble cutting fluid is recommended.

Note 4) 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.

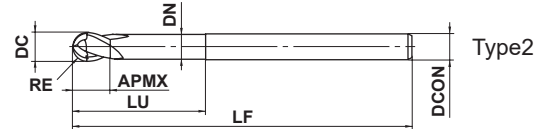
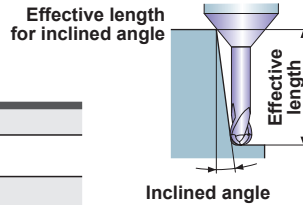
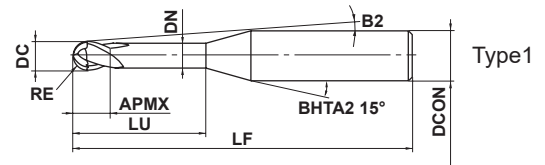
# SOLID END MILLS

## CRN2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For copper electrodes



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	Aluminium Alloy
						○	○



	$0.1 \leq RE \leq 3$		
	$\pm 0.01$		
	$0.2 \leq DC \leq 6$		
	$0$ $- 0.02$		
	$4 \leq DCON \leq 6$		
	$0$ $- 0.008$		

● 2 flute long neck ball nose end mill with CRN coating for copper electrode 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°
CRN2XLB0010N005S04	0.1	0.2	0.2	0.5	0.17	14.1°	50	4	2	●	1	0.5	0.5	0.6	0.6
CRN2XLB0010N005S06	0.1	0.2	0.2	0.5	0.17	14.4°	50	6	2	●	1	0.5	0.5	0.6	0.6
CRN2XLB0010N010S04	0.1	0.2	0.2	1	0.17	13.3°	50	4	2	●	1	1.0	1.1	1.2	1.3
CRN2XLB0010N010S06	0.1	0.2	0.2	1	0.17	13.8°	50	6	2	●	1	1.0	1.1	1.2	1.3
CRN2XLB0010N015S04	0.1	0.2	0.2	1.5	0.17	12.5°	50	4	2	●	1	1.5	1.6	1.7	1.9
CRN2XLB0010N015S06	0.1	0.2	0.2	1.5	0.17	13.3°	50	6	2	●	1	1.5	1.6	1.7	1.9
CRN2XLB0015N010S04	0.15	0.3	0.3	1	0.27	13.3°	50	4	2	●	1	1.0	1.1	1.2	1.3
CRN2XLB0015N010S06	0.15	0.3	0.3	1	0.27	13.9°	50	6	2	●	1	1.0	1.1	1.2	1.3
CRN2XLB0015N015S04	0.15	0.3	0.3	1.5	0.27	12.5°	50	4	2	●	1	1.5	1.6	1.7	1.9
CRN2XLB0015N015S06	0.15	0.3	0.3	1.5	0.27	13.3°	50	6	2	●	1	1.5	1.6	1.7	1.9
CRN2XLB0015N020S04	0.15	0.3	0.3	2	0.27	11.9°	50	4	2	●	1	2.1	2.2	2.3	2.5
CRN2XLB0015N020S06	0.15	0.3	0.3	2	0.27	12.8°	50	6	2	●	1	2.1	2.2	2.3	2.5
CRN2XLB0020N010S04	0.2	0.4	0.4	1	0.36	13.4°	50	4	2	●	1	1.0	1.0	1.1	1.2
CRN2XLB0020N010S06	0.2	0.4	0.4	1	0.36	13.9°	50	6	2	●	1	1.0	1.0	1.1	1.2
CRN2XLB0020N015S04	0.2	0.4	0.4	1.5	0.36	12.6°	50	4	2	●	1	1.5	1.6	1.7	1.8
CRN2XLB0020N015S06	0.2	0.4	0.4	1.5	0.36	13.4°	50	6	2	●	1	1.5	1.6	1.7	1.8
CRN2XLB0020N020S04	0.2	0.4	0.4	2	0.36	11.9°	50	4	2	●	1	2.0	2.1	2.3	2.5
CRN2XLB0020N020S06	0.2	0.4	0.4	2	0.36	12.8°	50	6	2	●	1	2.0	2.1	2.3	2.5
CRN2XLB0020N030S04	0.2	0.4	0.4	3	0.36	10.7°	50	4	2	●	1	3.1	3.2	3.4	3.7
CRN2XLB0020N030S06	0.2	0.4	0.4	3	0.36	11.9°	50	6	2	●	1	3.1	3.2	3.4	3.7
CRN2XLB0025N015S04	0.25	0.5	0.5	1.5	0.46	12.6°	50	4	2	●	1	1.5	1.6	1.7	1.8
CRN2XLB0025N015S06	0.25	0.5	0.5	1.5	0.46	13.4°	50	6	2	●	1	1.5	1.6	1.7	1.8
CRN2XLB0025N020S04	0.25	0.5	0.5	2	0.46	11.9°	50	4	2	●	1	2.0	2.1	2.3	2.4
CRN2XLB0025N020S06	0.25	0.5	0.5	2	0.46	12.9°	50	6	2	●	1	2.0	2.1	2.3	2.4
CRN2XLB0025N030S04	0.25	0.5	0.5	3	0.46	10.6°	50	4	2	●	1	3.1	3.2	3.4	3.7
CRN2XLB0025N030S06	0.25	0.5	0.5	3	0.46	11.9°	50	6	2	●	1	3.1	3.2	3.4	3.7
CRN2XLB0025N040S04	0.25	0.5	0.5	4	0.46	9.6°	50	4	2	●	1	4.1	4.3	4.6	4.9
CRN2XLB0025N040S06	0.25	0.5	0.5	4	0.46	11.1°	50	6	2	●	1	4.1	4.3	4.6	4.9
CRN2XLB0025N060S04	0.25	0.5	0.5	6	0.46	8.1°	50	4	2	●	1	6.2	6.4	6.9	7.4
CRN2XLB0025N060S06	0.25	0.5	0.5	6	0.46	9.7°	50	6	2	●	1	6.2	6.4	6.9	7.4
CRN2XLB0025N080S04	0.25	0.5	0.5	8	0.46	7°	50	4	2	●	1	8.3	8.5	9.2	9.9
CRN2XLB0025N080S06	0.25	0.5	0.5	8	0.46	8.7°	50	6	2	●	1	8.3	8.5	9.2	9.9
CRN2XLB0025N100S04	0.25	0.5	0.5	10	0.46	6.2°	50	4	2	●	1	10.3	10.7	11.5	12.4
CRN2XLB0025N100S06	0.25	0.5	0.5	10	0.46	7.8°	50	6	2	●	1	10.3	10.7	11.5	12.4

● : Inventory maintained in Japan.

(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°
												CRN2XLBR0030N020S04	0.3	0.6	0.6
CRN2XLBR0030N020S06	0.3	0.6	0.6	2	0.56	12.8°	50	6	2	●	1	2.1	2.2	2.3	2.5
CRN2XLBR0030N040S04	0.3	0.6	0.6	4	0.56	9.5°	50	4	2	●	1	4.2	4.3	4.6	5.0
CRN2XLBR0030N040S06	0.3	0.6	0.6	4	0.56	11°	50	6	2	●	1	4.2	4.3	4.6	5.0
CRN2XLBR0030N060S04	0.3	0.6	0.6	6	0.56	8°	50	4	2	●	1	6.3	6.5	6.9	7.5
CRN2XLBR0030N060S06	0.3	0.6	0.6	6	0.56	9.7°	50	6	2	●	1	6.3	6.5	6.9	7.5
CRN2XLBR0030N080S04	0.3	0.6	0.6	8	0.56	6.9°	50	4	2	●	1	8.3	8.6	9.2	10.0
CRN2XLBR0030N080S06	0.3	0.6	0.6	8	0.56	8.6°	50	6	2	●	1	8.3	8.6	9.2	10.0
CRN2XLBR0030N100S04	0.3	0.6	0.6	10	0.56	6°	50	4	2	●	1	10.4	10.8	11.5	12.5
CRN2XLBR0030N100S06	0.3	0.6	0.6	10	0.56	7.8°	50	6	2	●	1	10.4	10.8	11.5	12.5
CRN2XLBR0040N020S04	0.4	0.8	0.8	2	0.76	11.7°	50	4	2	●	1	2.1	2.2	2.3	2.5
CRN2XLBR0040N020S06	0.4	0.8	0.8	2	0.76	12.8°	50	6	2	●	1	2.1	2.2	2.3	2.5
CRN2XLBR0040N040S04	0.4	0.8	0.8	4	0.76	9.4°	50	4	2	●	1	4.2	4.3	4.6	5.0
CRN2XLBR0040N040S06	0.4	0.8	0.8	4	0.76	11°	50	6	2	●	1	4.2	4.3	4.6	5.0
CRN2XLBR0040N060S04	0.4	0.8	0.8	6	0.76	7.8°	50	4	2	●	1	6.3	6.5	6.9	7.5
CRN2XLBR0040N060S06	0.4	0.8	0.8	6	0.76	9.6°	50	6	2	●	1	6.3	6.5	6.9	7.5
CRN2XLBR0040N080S04	0.4	0.8	0.8	8	0.76	6.7°	50	4	2	●	1	8.3	8.6	9.2	10.0
CRN2XLBR0040N080S06	0.4	0.8	0.8	8	0.76	8.5°	50	6	2	●	1	8.3	8.6	9.2	10.0
CRN2XLBR0040N100S04	0.4	0.8	0.8	10	0.76	5.9°	50	4	2	●	1	10.4	10.8	11.5	12.4
CRN2XLBR0040N100S06	0.4	0.8	0.8	10	0.76	7.7°	50	6	2	●	1	10.4	10.8	11.5	12.4
CRN2XLBR0050N030S04	0.5	1	1	3	0.94	10.1°	50	4	2	●	1	3.2	3.3	3.6	3.9
CRN2XLBR0050N030S06	0.5	1	1	3	0.94	11.6°	50	6	2	●	1	3.2	3.3	3.6	3.9
CRN2XLBR0050N040S04	0.5	1	1	4	0.94	9.1°	50	4	2	●	1	4.2	4.4	4.8	5.2
CRN2XLBR0050N040S06	0.5	1	1	4	0.94	10.8°	50	6	2	●	1	4.2	4.4	4.8	5.2
CRN2XLBR0050N050S04	0.5	1	1	5	0.94	8.2°	50	4	2	●	1	5.3	5.5	6.0	6.4
CRN2XLBR0050N050S06	0.5	1	1	5	0.94	10.1°	50	6	2	●	1	5.3	5.5	6.0	6.4
CRN2XLBR0050N060S04	0.5	1	1	6	0.94	7.5°	50	4	2	●	1	6.3	6.6	7.1	7.7
CRN2XLBR0050N060S06	0.5	1	1	6	0.94	9.4°	50	6	2	●	1	6.3	6.6	7.1	7.7
CRN2XLBR0050N070S04	0.5	1	1	7	0.94	6.9°	50	4	2	●	1	7.4	7.7	8.3	8.9
CRN2XLBR0050N070S06	0.5	1	1	7	0.94	8.8°	50	6	2	●	1	7.4	7.7	8.3	8.9
CRN2XLBR0050N080S04	0.5	1	1	8	0.94	6.4°	50	4	2	●	1	8.4	8.8	9.4	10.2
CRN2XLBR0050N080S06	0.5	1	1	8	0.94	8.3°	50	6	2	●	1	8.4	8.8	9.4	10.2
CRN2XLBR0050N100S04	0.5	1	1	10	0.94	5.6°	50	4	2	●	1	10.5	10.9	11.7	12.6
CRN2XLBR0050N100S06	0.5	1	1	10	0.94	7.5°	50	6	2	●	1	10.5	10.9	11.7	12.6
CRN2XLBR0050N120S04	0.5	1	1	12	0.94	5°	50	4	2	●	1	12.6	13.1	14.0	15.1
CRN2XLBR0050N120S06	0.5	1	1	12	0.94	6.8°	50	6	2	●	1	12.6	13.1	14.0	15.1
CRN2XLBR0050N140S04	0.5	1	1	14	0.94	4.5°	50	4	2	●	1	14.7	15.2	16.3	17.6
CRN2XLBR0050N140S06	0.5	1	1	14	0.94	6.2°	55	6	2	●	1	14.7	15.2	16.3	17.6
CRN2XLBR0050N160S04	0.5	1	1	16	0.94	4.1°	55	4	2	●	1	16.8	17.4	18.6	20.1
CRN2XLBR0050N160S06	0.5	1	1	16	0.94	5.7°	55	6	2	●	1	16.8	17.4	18.6	20.1
CRN2XLBR0050N180S04	0.5	1	1	18	0.94	3.7°	55	4	2	●	1	18.9	19.5	20.9	22.6
CRN2XLBR0050N180S06	0.5	1	1	18	0.94	5.3°	60	6	2	●	1	18.9	19.5	20.9	22.6
CRN2XLBR0050N200S04	0.5	1	1	20	0.94	3.4°	55	4	2	●	1	20.9	21.6	23.2	25.1
CRN2XLBR0050N200S06	0.5	1	1	20	0.94	5°	60	6	2	●	1	20.9	21.6	23.2	25.1
CRN2XLBR0075N080S04	0.75	1.5	1.5	8	1.44	5.9°	50	4	2	●	1	8.4	8.8	9.4	10.1
CRN2XLBR0075N080S06	0.75	1.5	1.5	8	1.44	8.1°	50	6	2	●	1	8.4	8.8	9.4	10.1
CRN2XLBR0075N100S04	0.75	1.5	1.5	10	1.44	5.1°	50	4	2	●	1	10.5	10.9	11.7	12.6
CRN2XLBR0075N100S06	0.75	1.5	1.5	10	1.44	7.2°	50	6	2	●	1	10.5	10.9	11.7	12.6
CRN2XLBR0075N120S04	0.75	1.5	1.5	12	1.44	4.4°	50	4	2	●	1	12.6	13.1	14.0	15.1
CRN2XLBR0075N120S06	0.75	1.5	1.5	12	1.44	6.5°	50	6	2	●	1	12.6	13.1	14.0	15.1
CRN2XLBR0075N140S04	0.75	1.5	1.5	14	1.44	4°	50	4	2	●	1	14.7	15.2	16.3	17.6
CRN2XLBR0075N140S06	0.75	1.5	1.5	14	1.44	5.9°	55	6	2	●	1	14.7	15.2	16.3	17.6

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## CRN2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For copper electrodes

(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°
CRN2XLBR0075N160S04	0.75	1.5	1.5	16	1.44	3.6°	55	4	2	●	1	16.8	17.3	18.6	20.0
CRN2XLBR0075N160S06	0.75	1.5	1.5	16	1.44	5.4°	55	6	2	●	1	16.8	17.3	18.6	20.0
CRN2XLBR0075N180S04	0.75	1.5	1.5	18	1.44	3.3°	55	4	2	●	1	18.8	19.5	20.9	22.5
CRN2XLBR0075N180S06	0.75	1.5	1.5	18	1.44	5°	60	6	2	●	1	18.8	19.5	20.9	22.5
CRN2XLBR0075N200S04	0.75	1.5	1.5	20	1.44	3°	55	4	2	●	1	20.9	21.6	23.2	*
CRN2XLBR0075N200S06	0.75	1.5	1.5	20	1.44	4.6°	60	6	2	●	1	20.9	21.6	23.2	25.0
CRN2XLBR0100N080S04	1	2	2	8	1.90	5.3°	50	4	2	●	1	8.3	8.7	9.2	9.9
CRN2XLBR0100N080S06	1	2	2	8	1.90	7.8°	50	6	2	●	1	8.3	8.7	9.2	9.9
CRN2XLBR0100N100S04	1	2	2	10	1.90	4.5°	50	4	2	●	1	10.4	10.8	11.5	12.4
CRN2XLBR0100N100S06	1	2	2	10	1.90	6.9°	50	6	2	●	1	10.4	10.8	11.5	12.4
CRN2XLBR0100N120S04	1	2	2	12	1.90	3.9°	50	4	2	●	1	12.5	12.9	13.8	14.9
CRN2XLBR0100N120S06	1	2	2	12	1.90	6.1°	50	6	2	●	1	12.5	12.9	13.8	14.9
CRN2XLBR0100N140S04	1	2	2	14	1.90	3.4°	50	4	2	●	1	14.6	15.1	16.1	17.4
CRN2XLBR0100N140S06	1	2	2	14	1.90	5.6°	55	6	2	●	1	14.6	15.1	16.1	17.4
CRN2XLBR0100N160S04	1	2	2	16	1.90	3.1°	55	4	2	●	1	16.7	17.2	18.4	19.9
CRN2XLBR0100N160S06	1	2	2	16	1.90	5.1°	55	6	2	●	1	16.7	17.2	18.4	19.9
CRN2XLBR0100N200S04	1	2	2	20	1.90	2.5°	60	4	2	●	1	20.8	21.5	23.0	*
CRN2XLBR0100N200S06	1	2	2	20	1.90	4.3°	60	6	2	●	1	20.8	21.5	23.0	24.8
CRN2XLBR0100N250S06	1	2	2	25	1.90	3.7°	65	6	2	●	1	26.0	26.8	28.8	31.0
CRN2XLBR0100N300S06	1	2	2	30	1.90	3.2°	70	6	2	●	1	31.1	32.2	34.5	37.3
CRN2XLBR0150N160S06	1.5	3	3	16	2.90	4.3°	60	6	2	●	1	16.6	17.2	18.4	19.7
CRN2XLBR0150N250S06	1.5	3	3	25	2.90	3°	70	6	2	●	1	26.0	26.8	28.7	*
CRN2XLBR0150N350S06	1.5	3	3	35	2.90	2.2°	80	6	2	●	1	36.3	37.5	40.2	*
CRN2XLBR0200N160S06	2	4	4	16	3.90	3.2°	70	6	2	●	1	16.6	17.1	18.3	19.6
CRN2XLBR0200N200S06	2	4	4	20	3.90	2.7°	70	6	2	●	1	20.8	21.4	22.9	*
CRN2XLBR0200N300S06	2	4	4	30	3.90	1.8°	70	6	2	●	1	31.1	32.1	*	*
CRN2XLBR0200N400S06	2	4	4	40	3.90	1.4°	90	6	2	●	1	41.4	42.8	*	*
CRN2XLBR0200N500S06	2	4	4	50	3.90	1.2°	100	6	2	●	1	51.8	53.5	*	*
CRN2XLBR0250N200S06	2.5	5	5	20	4.90	1.5°	70	6	2	●	1	20.7	21.4	*	*
CRN2XLBR0250N300S06	2.5	5	5	30	4.90	1°	80	6	2	●	1	31.1	*	*	*
CRN2XLBR0300N300S06	3	6	6	30	5.85	—	80	6	2	●	2	*	*	*	*
CRN2XLBR0300N500S06	3	6	6	50	5.85	—	100	6	2	●	2	*	*	*	*

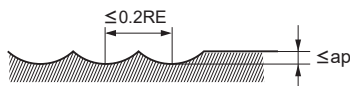
\* No interference

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Copper, Copper alloys			Work Material		Copper, Copper alloys		
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap(mm)	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap(mm)
<b>R0.1</b>	<b>0.5</b>	40000	800	0.003	<b>R0.75</b>	<b>8</b>	40000	8000	0.07
	<b>1.0</b>	40000	600	0.002		<b>12</b>	35000	4500	0.04
	<b>1.5</b>	40000	400	0.001		<b>16</b>	20000	2000	0.03
<b>R0.15</b>	<b>1</b>	40000	1200	0.007		<b>20</b>	12000	900	0.02
	<b>2</b>	40000	800	0.003	<b>R1</b>	<b>8</b>	40000	9600	0.10
<b>R0.2</b>	<b>1</b>	40000	2000	0.015		<b>10</b>	40000	6400	0.08
	<b>2</b>	40000	1300	0.01		<b>12</b>	40000	6000	0.08
	<b>3</b>	40000	800	0.005		<b>16</b>	30000	3000	0.05
<b>R0.25</b>	<b>2</b>	40000	2000	0.02		<b>20</b>	20000	2000	0.04
	<b>4</b>	40000	1200	0.01	<b>30</b>	10000	800	0.02	
	<b>6</b>	36000	600	0.006	<b>R1.5</b>	<b>16</b>	40000	12000	0.10
	<b>10</b>	26000	200	0.002		<b>25</b>	25000	6000	0.08
<b>R0.3</b>	<b>2</b>	40000	3200	0.03		<b>35</b>	6000	700	0.06
	<b>6</b>	40000	1200	0.008	<b>R2</b>	<b>16</b>	32000	11000	0.15
	<b>10</b>	30000	500	0.003		<b>20</b>	32000	9000	0.15
<b>R0.4</b>	<b>4</b>	40000	4000	0.02		<b>30</b>	20000	4500	0.10
	<b>6</b>	40000	2500	0.02		<b>40</b>	15000	3000	0.08
	<b>10</b>	30000	700	0.008		<b>50</b>	8000	1000	0.05
<b>R0.5</b>	<b>4</b>	40000	6400	0.05	<b>R2.5</b>	<b>20</b>	25000	9500	0.20
	<b>6</b>	40000	4800	0.03		<b>30</b>	20000	3300	0.15
	<b>8</b>	40000	3000	0.02	<b>R3</b>	<b>30</b>	21000	8400	0.20
	<b>10</b>	33000	2000	0.01		<b>50</b>	20000	3000	0.15
	<b>16</b>	18000	500	0.008					
	<b>20</b>	13000	250	0.005					

Depth of cut



RE:Radius

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

Note 2) Water-soluble cutting fluid is recommended.

Note 3) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

# SOLID END MILLS

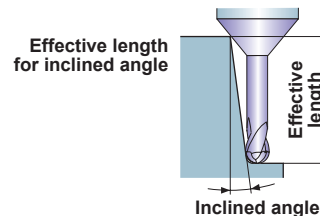
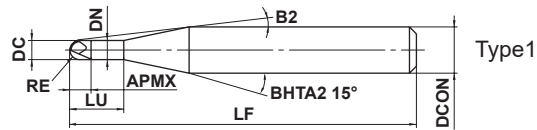
## CBN2XLB

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



TOOL NEWS

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	Aluminium Alloy
	○	○	○				



	$0.2 \leq RE \leq 1$				
	$\pm 0.005$				
	$4 \leq DCON \leq 6$				
	$0$				
	$- 0.005$				

● Solid CBN ball nose. A wide variation of neck lengths available.

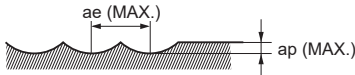
Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle (mm)			
												0.5°	1°	2°	3°
												CBN2XLB0020N010S04	0.2	0.4	0.3
CBN2XLB0020N010S06	0.2	0.4	0.3	1	0.36	13.9°	51	6	2	●	1	1	1	1.1	1.2
CBN2XLB0020N016S04	0.2	0.4	0.3	1.6	0.36	12.4°	51	4	2	●	1	1.6	1.7	1.8	2
CBN2XLB0020N016S06	0.2	0.4	0.3	1.6	0.36	13.3°	51	6	2	●	1	1.6	1.7	1.8	2
* CBN2XLB0030N009S06	0.3	0.6	0.4	0.9	0.56	14.1°	62	6	2	●	1	0.9	0.9	1	1.1
CBN2XLB0030N015S04	0.3	0.6	0.5	1.5	0.56	12.6°	51	4	2	●	1	1.5	1.6	1.7	1.8
CBN2XLB0030N015S06	0.3	0.6	0.5	1.5	0.56	13.4°	51	6	2	●	1	1.5	1.6	1.7	1.8
CBN2XLB0030N024S04	0.3	0.6	0.5	2.4	0.56	11.3°	51	4	2	●	1	2.5	2.6	2.7	2.9
CBN2XLB0030N024S06	0.3	0.6	0.5	2.4	0.56	12.5°	51	6	2	●	1	2.5	2.6	2.7	2.9
* CBN2XLB0040N010S06	0.4	0.8	0.5	1	0.76	14.1°	62	6	2	●	1	1	1	1.1	1.2
CBN2XLB0040N020S04	0.4	0.8	0.6	2	0.76	11.8°	51	4	2	●	1	2	2.1	2.3	2.4
CBN2XLB0040N020S06	0.4	0.8	0.6	2	0.76	12.9°	51	6	2	●	1	2	2.1	2.3	2.4
CBN2XLB0040N032S04	0.4	0.8	0.6	3.2	0.76	10.3°	51	4	2	●	1	3.3	3.4	3.6	3.9
CBN2XLB0040N032S06	0.4	0.8	0.6	3.2	0.76	11.7°	51	6	2	●	1	3.3	3.4	3.6	3.9
* CBN2XLB0050N011S06	0.5	1	0.6	1.1	0.94	14.1°	62	6	2	●	1	1.1	1.1	1.2	1.2
CBN2XLB0050N025S04	0.5	1	0.8	2.5	0.94	11°	51	4	2	●	1	2.6	2.7	2.8	3
CBN2XLB0050N025S06	0.5	1	0.8	2.5	0.94	12.3°	51	6	2	●	1	2.6	2.7	2.8	3
CBN2XLB0050N040S04	0.5	1	0.8	4	0.94	9.3°	51	4	2	●	1	4.1	4.3	4.6	4.9
CBN2XLB0050N040S06	0.5	1	0.8	4	0.94	11°	51	6	2	●	1	4.1	4.3	4.6	4.9
CBN2XLB0075N038S04	0.75	1.5	1.1	3.8	1.44	9.1°	52	4	2	●	1	3.9	4.1	4.3	4.6
CBN2XLB0075N038S06	0.75	1.5	1.1	3.8	1.44	11°	52	6	2	●	1	3.9	4.1	4.3	4.6
CBN2XLB0075N060S04	0.75	1.5	1.1	6	1.44	7.1°	52	4	2	●	1	6.2	6.4	6.8	7.3
CBN2XLB0075N060S06	0.75	1.5	1.1	6	1.44	9.3°	52	6	2	●	1	6.2	6.4	6.8	7.3
* CBN2XLB0100N017S06	1	2	1.2	1.7	1.9	13.6°	62	6	2	●	1	1.7	1.7	1.8	1.9
CBN2XLB0100N050S04	1	2	1.5	5	1.9	7.3°	52	4	2	●	1	5.1	5.3	5.6	6
CBN2XLB0100N050S06	1	2	1.5	5	1.9	9.8°	52	6	2	●	1	5.1	5.3	5.6	6
CBN2XLB0100N080S04	1	2	1.5	8	1.9	5.3°	52	4	2	●	1	8.2	8.5	9	9.7
CBN2XLB0100N080S06	1	2	1.5	8	1.9	7.9°	52	6	2	●	1	8.2	8.5	9	9.7

\* Designed with short cutting edge and neck lengths for high rigidity.

● : Inventory maintained in Japan.



## 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			
R RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R0.2</b>	50000	1500	0.006	0.01	50000	1200	0.006	0.01	50000	1200	0.004	0.008
<b>R0.3</b>	50000	2000	0.01	0.02	50000	1500	0.01	0.02	50000	1500	0.008	0.015
<b>R0.4</b>	50000	3000	0.02	0.05	50000	2000	0.02	0.04	50000	2000	0.015	0.03
<b>R0.5</b>	50000	3000	0.03	0.06	50000	2000	0.03	0.05	50000	2000	0.02	0.03
<b>R0.75</b>	50000	3500	0.04	0.08	50000	2500	0.03	0.06	50000	2500	0.02	0.04
<b>R1</b>	50000	4000	0.05	0.1	50000	3000	0.04	0.07	50000	3000	0.03	0.05
Depth of cut												

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

Note 2) Oil mist coolant is recommended.

Note 3) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS



# SOLID END MILLS

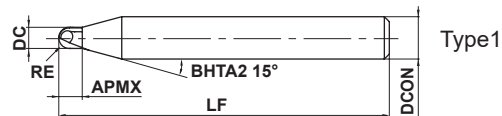
## DC2SB

Ball nose, Short cut length, 2 flute, For hard brittle materials

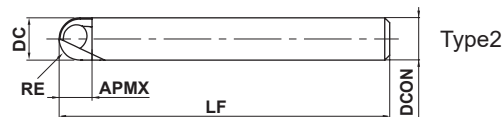


TOOL NEWS

Cemented carbide	Alumina Zirconia	Silicon carbide Silicon nitride	Quartz glass
○	○	○	○



Type1



Type2

	$0.1 \leq RE \leq 3$				
	$\pm 0.01$				
	$4 \leq DCON \leq 6$				
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$				

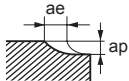
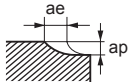
● Suitable DC ball end mill for cemented carbide and other hard brittle materials processing.

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

● : Inventory maintained in Japan.

CARBIDE  
 SQUARE  
 BALL  
 RADIUS  
 TAPER  
 BARREL  
 ROUGHING  
 SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

Work Material		Cemented carbide				Alumina Zirconia			
Dia. DC (mm)	R RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.2</b>	<b>0.1</b>	30000	100	0.01	0.01	30000	100	0.01	0.01
<b>0.4</b>	<b>0.2</b>	30000	150	0.02	0.08	30000	150	0.02	0.08
<b>0.6</b>	<b>0.3</b>	30000	200	0.03	0.14	30000	200	0.03	0.14
<b>0.8</b>	<b>0.4</b>	30000	250	0.04	0.19	30000	250	0.04	0.19
<b>1</b>	<b>0.5</b>	30000	300	0.05	0.25	30000	300	0.05	0.25
<b>1.5</b>	<b>0.75</b>	30000	300	0.075	0.275	30000	300	0.075	0.275
<b>2</b>	<b>1</b>	30000	300	0.1	0.3	30000	300	0.1	0.3
<b>3</b>	<b>1.5</b>	27500	275	0.125	0.33	27500	275	0.125	0.33
<b>4</b>	<b>2</b>	24000	240	0.15	0.35	24000	240	0.15	0.35
<b>5</b>	<b>2.5</b>	22000	220	0.175	0.37	22000	220	0.175	0.37
<b>6</b>	<b>3</b>	20000	200	0.2	0.4	20000	200	0.2	0.4
Depth of cut									
Work Material		Silicon carbide Silicon nitride				Quartz glass			
Dia. DC (mm)	R RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.2</b>	<b>0.1</b>	30000	50	0.005	0.005	30000	150	0.015	0.015
<b>0.4</b>	<b>0.2</b>	30000	75	0.01	0.04	30000	225	0.03	0.12
<b>0.6</b>	<b>0.3</b>	30000	100	0.015	0.07	30000	300	0.045	0.21
<b>0.8</b>	<b>0.4</b>	30000	125	0.02	0.095	30000	375	0.06	0.285
<b>1</b>	<b>0.5</b>	30000	150	0.025	0.125	30000	450	0.075	0.375
<b>1.5</b>	<b>0.75</b>	30000	150	0.038	0.138	30000	450	0.113	0.413
<b>2</b>	<b>1</b>	30000	150	0.05	0.15	30000	450	0.15	0.45
<b>3</b>	<b>1.5</b>	27500	138	0.063	0.165	27500	413	0.188	0.495
<b>4</b>	<b>2</b>	24000	120	0.075	0.175	24000	360	0.225	0.525
<b>5</b>	<b>2.5</b>	22000	110	0.088	0.185	22000	330	0.263	0.555
<b>6</b>	<b>3</b>	20000	100	0.1	0.2	20000	300	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 machining is recommended with cemented carbide machining.

\*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) 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 6) Implementation of special counter measures is recommended since fine chip discharge may enter gaps in the processing machinery.

# SOLID END MILLS

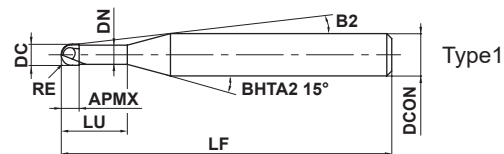
## DC2XLB

Ball nose, Short cut length, 2 flute, For hard brittle materials

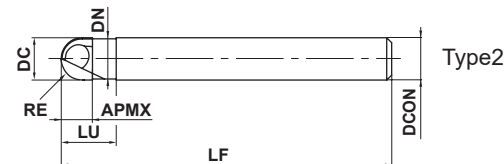


TOOL NEWS

Cemented carbide	Alumina Zirconia	Silicon carbide Silicon nitride	Quartz glass
○	○	○	○



Type1



Type2



$0.1 \leq RE \leq 3$

$\pm 0.01$



$4 \leq DCON \leq 6$

$\begin{matrix} 0 \\ -0.008 \end{matrix}$

● Suitable DC long neck ball end mill for cemented carbide and other hard brittle materials processing.

(mm)

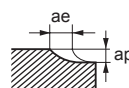
Order Number	RE	DC	APMX	LU	DN	LF	B2	DCON	No. of Flutes	Stock	Type
DC2XLBR0010N005	0.1	0.2	0.12	0.5	0.18	50	11.5°	4	2	●	1
DC2XLBR0020N010	0.2	0.4	0.24	1	0.36	50	11°	4	2	●	1
DC2XLBR0030N015	0.3	0.6	0.36	1.5	0.56	50	10.4°	4	2	●	1
DC2XLBR0040N020	0.4	0.8	0.48	2	0.76	50	9.9°	4	2	●	1
DC2XLBR0050N025	0.5	1	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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

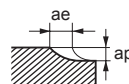
Work Material			Cemented carbide				Alumina Zirconia			
Dia. DC (mm)	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.2</b>	<b>0.1</b>	<b>0.5</b>	30000	30	0.005	0.01	30000	30	0.005	0.01
<b>0.4</b>	<b>0.2</b>	<b>1</b>	30000	100	0.015	0.08	30000	100	0.015	0.08
<b>0.6</b>	<b>0.3</b>	<b>1.5</b>	30000	200	0.03	0.14	30000	200	0.03	0.14
<b>0.8</b>	<b>0.4</b>	<b>2</b>	30000	250	0.04	0.19	30000	250	0.04	0.19
<b>1</b>	<b>0.5</b>	<b>2.5</b>	30000	300	0.05	0.25	30000	300	0.05	0.25
<b>1</b>	<b>0.5</b>	<b>5</b>	30000	300	0.05	0.25	30000	300	0.05	0.25
<b>1.5</b>	<b>0.75</b>	<b>3.8</b>	30000	300	0.075	0.275	30000	300	0.075	0.275
<b>2</b>	<b>1</b>	<b>6</b>	30000	300	0.1	0.3	30000	300	0.1	0.3
<b>2</b>	<b>1</b>	<b>10</b>	30000	300	0.1	0.3	30000	300	0.1	0.3
<b>3</b>	<b>1.5</b>	<b>8</b>	27500	275	0.125	0.33	27500	275	0.125	0.33
<b>4</b>	<b>2</b>	<b>10</b>	24000	240	0.15	0.35	24000	240	0.15	0.35
<b>5</b>	<b>2.5</b>	<b>10</b>	22000	220	0.175	0.37	22000	220	0.175	0.37
<b>6</b>	<b>3</b>	<b>10</b>	20000	200	0.2	0.4	20000	200	0.2	0.4

Depth of cut



Work Material			Silicon carbide Silicon nitride				Quartz glass			
Dia. DC (mm)	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.2</b>	<b>0.1</b>	<b>0.5</b>	30000	15	0.003	0.005	30000	45	0.008	0.015
<b>0.4</b>	<b>0.2</b>	<b>1</b>	30000	50	0.008	0.04	30000	150	0.023	0.12
<b>0.6</b>	<b>0.3</b>	<b>1.5</b>	30000	100	0.015	0.07	30000	300	0.045	0.21
<b>0.8</b>	<b>0.4</b>	<b>2</b>	30000	125	0.02	0.095	30000	375	0.06	0.285
<b>1</b>	<b>0.5</b>	<b>2.5</b>	30000	150	0.025	0.125	30000	450	0.075	0.375
<b>1</b>	<b>0.5</b>	<b>5</b>	30000	150	0.025	0.125	30000	450	0.075	0.375
<b>1.5</b>	<b>0.75</b>	<b>3.8</b>	30000	150	0.038	0.138	30000	450	0.113	0.413
<b>2</b>	<b>1</b>	<b>6</b>	30000	150	0.05	0.15	30000	450	0.15	0.45
<b>2</b>	<b>1</b>	<b>10</b>	30000	150	0.05	0.15	30000	450	0.15	0.45
<b>3</b>	<b>1.5</b>	<b>8</b>	27500	138	0.063	0.165	27500	413	0.188	0.495
<b>4</b>	<b>2</b>	<b>10</b>	24000	120	0.075	0.175	24000	360	0.225	0.525
<b>5</b>	<b>2.5</b>	<b>10</b>	22000	110	0.088	0.185	22000	330	0.263	0.555
<b>6</b>	<b>3</b>	<b>10</b>	20000	100	0.1	0.2	20000	300	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 machining is recommended with cemented carbide machining.

\*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) 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 6) Implementation of special counter measures is recommended since fine chip discharge may enter gaps in the processing machinery.

# SOLID END MILLS

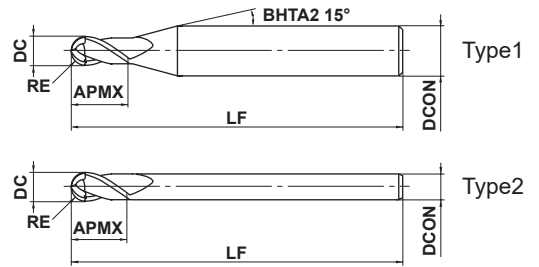
## DLC2MB

Ball nose, Medium cut length, 2 flute



TOOL NEWS

Copper Alloy	Aluminium Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎		○	



	RE ≤ 6	RE > 6			
	±0.01	±0.02			
	DC ≤ 12	DC > 12			
	<sup>0</sup> / <sub>-0.020</sub>	<sup>0</sup> / <sub>-0.030</sub>			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>	<sup>0</sup> / <sub>-0.013</sub>	

● 2 flute ball nose end mill with new high welding resistance DLC coating, ideal for machining non-ferrous materials.

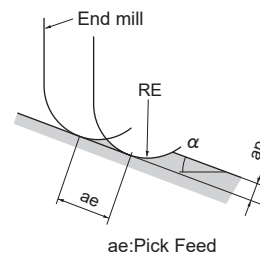
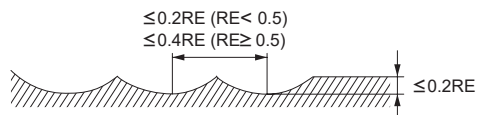
Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DLC2MBR0010	0.1	0.2	0.4	40	4	2	●	1
DLC2MBR0015	0.15	0.3	0.6	40	4	2	●	1
DLC2MBR0020	0.2	0.4	0.8	40	4	2	●	1
DLC2MBR0025	0.25	0.5	1	40	4	2	●	1
DLC2MBR0030	0.3	0.6	1.2	40	4	2	●	1
DLC2MBR0040	0.4	0.8	1.6	40	4	2	●	1
DLC2MBR0050	0.5	1	2.5	40	4	2	●	1
DLC2MBR0075	0.75	1.5	4	40	4	2	●	1
DLC2MBR0100	1	2	6	60	6	2	●	1
DLC2MBR0125	1.25	2.5	6	60	6	2	●	1
DLC2MBR0150	1.5	3	8	70	6	2	●	1
DLC2MBR0200	2	4	8	70	6	2	●	1
DLC2MBR0250	2.5	5	12	80	6	2	●	1
DLC2MBR0300	3	6	12	80	6	2	●	2
DLC2MBR0400	4	8	14	90	8	2	●	2
DLC2MBR0500	5	10	18	100	10	2	●	2
DLC2MBR0600	6	12	22	110	12	2	●	2
DLC2MBR0800	8	16	30	140	16	2	●	2
DLC2MBR1000	10	20	38	160	20	2	●	2

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material	Aluminium alloy				Aluminium alloy casting, Copper, Copper alloys			
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		$\alpha \leq 15^\circ$		$\alpha > 15^\circ$	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>R 0.1</b>	40000	350	40000	260	40000	280	40000	210
<b>R 0.15</b>	40000	480	40000	360	40000	380	40000	290
<b>R 0.2</b>	40000	600	40000	450	40000	480	40000	360
<b>R 0.25</b>	40000	800	40000	600	40000	640	40000	480
<b>R 0.3</b>	40000	1000	40000	750	40000	800	40000	600
<b>R 0.4</b>	40000	1500	40000	1100	40000	1200	40000	880
<b>R 0.5</b>	40000	2000	40000	1500	40000	1600	40000	1200
<b>R 0.75</b>	40000	2200	40000	1600	40000	1800	40000	1300
<b>R 1</b>	40000	2800	40000	2200	40000	2200	32000	1400
<b>R 1.25</b>	40000	3200	38000	2200	32000	2000	30000	1400
<b>R 1.5</b>	40000	4000	32000	2600	32000	2600	26000	1700
<b>R 2</b>	30000	4200	24000	2800	24000	2700	19000	1800
<b>R 2.5</b>	24000	4400	19000	2800	19000	2800	15000	1800
<b>R 3</b>	20000	4000	16000	2800	16000	2600	13000	1800
<b>R 4</b>	15000	3600	12000	2400	12000	2300	9600	1500
<b>R 5</b>	12000	3600	9500	2000	9600	2300	7600	1300
<b>R 6</b>	10000	3200	8000	2200	8000	2000	6400	1400
<b>R 8</b>	7500	2800	6000	1800	6000	1800	4800	1200
<b>R10</b>	6000	2500	4800	1600	4800	1600	3800	1000

Depth of cut



Note 1)  $\alpha$  is the inclination angle of the machined surface.

Note 2) When cutting a very hard workpiece, reduce the feed rate.

Note 3) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 4) 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

SOLID END MILLS

# SOLID END MILLS

## DF2MB

Ball nose, Medium cut length, 2 flute, For graphite



TOOL NEWS



CARBIDE

SQUARE

BALL

RADIUS

TAPER

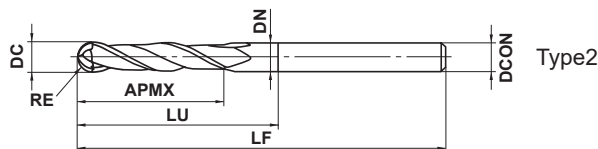
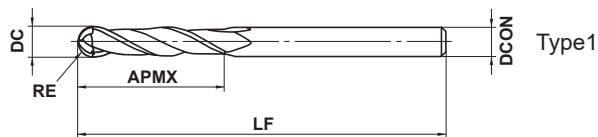
BARREL

ROUGHING

↩

SOLID END MILLS

Aluminium Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



	$3 \leq RE \leq 6$				
	$\pm 0.01$				
	DCON=6	$8 \leq DCON \leq 10$	DCON=12		
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$		

● 2 flute ball nose end mill with original diamond coating for graphite machining.

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

(Effective Coating Length : 1-1.5DC)

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Graphite				Copper, Copper alloys			
R RE (mm)	Overall Length LF (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R3</b>	<b>100</b>	16000	1900	0.6	1.5	16000	1500	0.6	1.5
	<b>150</b>	12000	1200	0.4	1.2	12000	960	0.4	1.2
<b>R4</b>	<b>110</b>	12000	2000	0.8	2.0	12000	1600	0.8	2.0
	<b>150</b>	9200	1400	0.6	1.6	9200	1100	0.6	1.6
<b>R5</b>	<b>120</b>	9500	2200	1.0	2.5	9500	1800	1.0	2.5
	<b>180</b>	7300	1500	0.8	2.0	7300	1200	0.8	2.0
<b>R6</b>	<b>130</b>	8000	1800	1.2	3.0	8000	1400	1.2	3.0
	<b>200</b>	6100	1200	1.0	2.5	6100	960	1.0	2.5
Depth of cut									

Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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.



# SOLID END MILLS

## DF2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For graphite



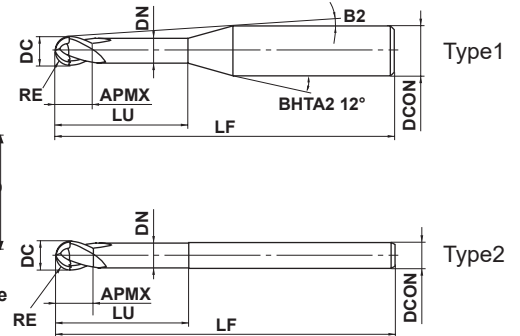
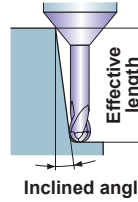
TOOL NEWS

CARBIDE

Aluminium Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



Effective length  
for inclined angle



$0.1 \leq RE \leq 3$				
$\pm 0.01$				
$DCON = 4,6$				
$h6$	$0$			
	$- 0.008$			



● 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°
DF2XLB0010N005	0.1	0.2	0.2	0.5	0.18	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.7
DF2XLB0015N020	0.15	0.3	0.3	2	0.27	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
DF2XLB0015N030	0.15	0.3	0.3	3	0.27	9.1°	50	4	2	●	1	3.1	3.2	3.6	3.9
DF2XLB0020N010	0.2	0.4	0.6	1	0.36	11°	50	4	2	●	1	1.0	1.0	1.1	1.2
DF2XLB0020N020	0.2	0.4	0.6	2	0.36	10°	50	4	2	●	1	2.0	2.1	2.3	2.6
DF2XLB0020N030	0.2	0.4	0.6	3	0.36	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
DF2XLB0020N040	0.2	0.4	0.6	4	0.36	8.4°	60	4	2	●	1	4.1	4.3	4.7	5.2
DF2XLB0020N080	0.2	0.4	0.6	8	0.36	6.4°	60	4	2	●	1	8.3	8.7	9.5	10.5
DF2XLB0020N120	0.2	0.4	0.6	12	0.36	5.1°	60	4	2	●	1	12.5	13.0	14.3	15.8
DF2XLB0025N040	0.25	0.5	0.6	4	0.46	8.3°	60	4	2	●	1	4.1	4.3	4.7	5.2
DF2XLB0025N050	0.25	0.5	0.6	5	0.46	7.7°	60	4	2	●	1	5.2	5.4	5.9	6.5
DF2XLB0025N080	0.25	0.5	0.6	8	0.46	6.3°	60	4	2	●	1	8.3	8.7	9.5	10.5
DF2XLB0030N020	0.3	0.6	0.9	2	0.56	9.9°	60	4	2	●	1	2.1	2.2	2.4	2.6
DF2XLB0030N040	0.3	0.6	0.9	4	0.56	8.3°	60	4	2	●	1	4.2	4.4	4.8	5.2
DF2XLB0030N050	0.3	0.6	0.9	5	0.56	7.6°	60	4	2	●	1	5.2	5.4	6.0	6.6
DF2XLB0030N060	0.3	0.6	0.9	6	0.56	7.1°	60	4	2	●	1	6.3	6.5	7.1	7.9
DF2XLB0030N080	0.3	0.6	0.9	8	0.56	6.2°	60	4	2	●	1	8.3	8.7	9.5	10.6
DF2XLB0030N100	0.3	0.6	0.9	10	0.56	5.5°	60	4	2	●	1	10.4	10.9	11.9	13.2
DF2XLB0030N160	0.3	0.6	0.9	16	0.56	4.1°	60	4	2	●	1	16.7	17.4	19.1	21.2
DF2XLB0040N060	0.4	0.8	1.2	6	0.76	7°	60	4	2	●	1	6.3	6.5	7.1	7.9
DF2XLB0040N080	0.4	0.8	1.2	8	0.76	6.1°	60	4	2	●	1	8.3	8.7	9.5	10.5
DF2XLB0050N040	0.5	1	1.5	4	0.94	8°	60	4	2	●	1	4.2	4.4	4.8	5.3
DF2XLB0050N060	0.5	1	1.5	6	0.94	6.8°	60	4	2	●	1	6.3	6.6	7.2	8.0
DF2XLB0050N080	0.5	1	1.5	8	0.94	5.9°	60	4	2	●	1	8.4	8.8	9.6	10.6
DF2XLB0050N100	0.5	1	1.5	10	0.94	5.2°	60	4	2	●	1	10.5	11.0	12.0	13.3
DF2XLB0050N120	0.5	1	1.5	12	0.94	4.6°	60	4	2	●	1	12.6	13.2	14.4	15.9
NEW DF2XLB0050N160	0.5	1	1.5	16	0.94	3.8°	80	4	2	●	1	16.8	17.5	19.2	21.3
DF2XLB0050N200	0.5	1	1.5	20	0.94	3.3°	80	4	2	●	1	21.0	21.9	24.0	26.6
DF2XLB0050N300	0.5	1	1.5	30	0.94	2.4°	80	4	2	●	1	31.4	32.8	36.0	*
DF2XLB0050N400	0.5	1	1.5	40	0.94	1.9°	80	4	2	●	1	41.8	43.7	*	*
DF2XLB0075N080	0.75	1.5	2.3	8	1.44	5.4°	60	4	2	●	1	8.4	8.8	9.6	10.6
DF2XLB0075N100	0.75	1.5	2.3	10	1.44	4.7°	60	4	2	●	1	10.5	11.0	12.0	13.2
DF2XLB0075N160	0.75	1.5	2.3	16	1.44	3.4°	80	4	2	●	1	16.8	17.5	19.2	21.2
NEW DF2XLB0075N200	0.75	1.5	2.3	20	1.44	2.8°	80	4	2	●	1	21.0	21.9	23.9	26.5

\* No interference

● : Inventory maintained in Japan.

(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°
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°	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

# SOLID END MILLS

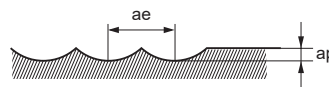
## DF2XLB

Ball nose, Medium cut length, 2 flute, Long neck, For graphite

### RECOMMENDED CUTTING CONDITIONS

Work Material	Graphite					Copper, Copper alloys				
	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
R0.1	0.5	40000	800	0.01	0.03	40000	800	0.003	0.02	
		2	40000	1200	0.03	0.08	40000	800	0.003	0.03
R0.15	3	40000	1200	0.03	0.08	40000	600	0.002	0.03	
		1	40000	1500	0.05	0.15	40000	2000	0.015	0.04
R0.2	2	40000	1500	0.05	0.12	40000	1300	0.01	0.04	
		3	40000	1300	0.04	0.12	40000	800	0.005	0.04
		4	40000	1300	0.04	0.1	32000	600	0.004	0.04
		8	30000	800	0.03	0.1	—	—	—	—
		12	20000	450	0.03	0.08	—	—	—	—
R0.25	4	40000	1500	0.05	0.15	40000	800	0.01	0.05	
		5	38000	1300	0.05	0.15	36000	700	0.008	0.05
		8	30000	1000	0.04	0.12	28000	500	0.002	0.05
R0.3	2	40000	1800	0.07	0.2	40000	1500	0.03	0.06	
		4	40000	1500	0.06	0.18	40000	1200	0.02	0.06
		5	40000	1500	0.06	0.17	40000	1100	0.015	0.06
		6	40000	1500	0.06	0.15	40000	1000	0.008	0.06
		8	37000	1200	0.05	0.15	35000	800	0.005	0.06
		10	35000	1000	0.05	0.15	—	—	—	—
		16	22000	530	0.04	0.12	—	—	—	—
R0.4	6	40000	1700	0.08	0.2	40000	1500	0.02	0.08	
		8	40000	1700	0.08	0.15	30000	1200	0.008	0.08
R0.5	4	40000	2500	0.12	0.3	40000	2000	0.05	0.1	
		6	40000	2500	0.1	0.3	40000	2000	0.03	0.1
		8	40000	2000	0.1	0.25	40000	1800	0.02	0.1
		10	40000	2000	0.1	0.2	33000	1400	0.01	0.1
		12	40000	2000	0.1	0.2	30000	1000	0.007	0.1
		20	30000	1100	0.08	0.2	—	—	—	—
		30	20000	600	0.06	0.15	—	—	—	—
40	15000	400	0.04	0.12	—	—	—	—		

Depth of cut



Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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.

Work Material		Graphite				Copper, Copper alloys			
R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R0.75</b>	<b>8</b>	40000	2800	0.15	0.45	40000	2400	0.07	0.15
	<b>10</b>	40000	2800	0.15	0.45	32000	1800	0.05	0.15
	<b>16</b>	35000	2000	0.15	0.3	20000	900	0.03	0.15
	<b>30</b>	27000	1000	0.1	0.3	—	—	—	—
	<b>40</b>	21000	700	0.08	0.25	—	—	—	—
<b>R1</b>	<b>8</b>	40000	3000	0.23	0.7	40000	3000	0.1	0.2
	<b>10</b>	40000	3000	0.2	0.6	40000	2800	0.08	0.2
	<b>12</b>	35000	2500	0.2	0.6	35000	2300	0.08	0.2
	<b>16</b>	30000	2000	0.2	0.5	30000	1800	0.05	0.2
	<b>20</b>	30000	2000	0.2	0.5	20000	1200	0.04	0.2
	<b>25</b>	25000	1500	0.18	0.45	20000	1000	0.03	0.2
	<b>40</b>	20000	1000	0.15	0.4	—	—	—	—
	<b>60</b>	15000	500	0.1	0.3	—	—	—	—
<b>R1.5</b>	<b>16</b>	28000	3000	0.3	0.9	28000	3000	0.3	0.3
	<b>25</b>	20000	2000	0.25	0.75	20000	2000	0.25	0.3
	<b>40</b>	16000	1500	0.2	0.6	16000	1500	0.2	0.3
	<b>60</b>	14000	1000	0.17	0.45	—	—	—	—
<b>R2</b>	<b>8</b>	24000	3800	0.5	1.5	24000	3800	0.5	0.4
	<b>20</b>	21000	3300	0.5	1.5	21000	3300	0.4	0.4
	<b>30</b>	15000	2000	0.4	1.2	15000	2000	0.3	0.4
	<b>40</b>	13000	1600	0.35	1.0	13000	1600	0.25	0.4
	<b>60</b>	12000	1400	0.3	0.9	12000	1400	0.2	0.4
<b>R3</b>	<b>12</b>	17000	2800	0.6	2.0	17000	2800	0.6	0.6
Depth of cut									

Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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

J

SOLID END MILLS

# SOLID END MILLS

## DF2XLBF (For Finishing)

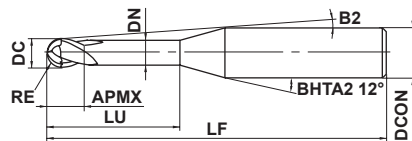
NEW

Ball nose, Medium cut length, 2 flute, Long neck, For graphite



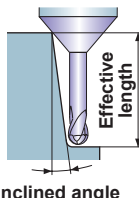
TOOL NEWS

Aluminium Alloy	Copper Alloy	Graphite	Zirconia (Before Sintering)	Rigid Composite Resin (Composite Resin)	Machineable Ceramics
○	◎	◎	◎	◎	○



Type1

Effective length for inclined angle



Inclined angle



$0.3 \leq RE \leq 1$	$1.5 \leq RE$			
$\pm 0.005$	$\pm 0.01$			



DCON=4				
$\begin{matrix} 0 \\ -0.008 \end{matrix}$				

● DF 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

● : Inventory maintained in Japan.



ROUGHING

BARREL

TAPER

RADIUS

BALL

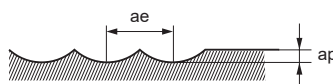
SQUARE

CARBIDE

## RECOMMENDED CUTTING CONDITIONS

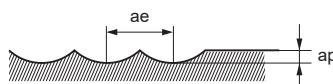
Work Material			Graphite				Zirconia (Before Sintering)			
Dia. DC (mm)	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.6</b>	<b>R0.3</b>	<b>10</b>	35000	1000	0.05	0.015	26000	600	0.06	0.03
		<b>10</b>	40000	2000	0.10	0.200	26000	600	0.10	0.05
<b>1</b>	<b>R0.5</b>	<b>16</b>	35000	1500	0.09	0.200	26000	600	0.08	0.04
		<b>20</b>	30000	1100	0.08	0.200	26000	600	0.08	0.04
		<b>16</b>	30000	2000	0.20	0.500	18000	1400	0.06	0.80
<b>2</b>	<b>R1</b>	<b>20</b>	30000	2000	0.20	0.500	18000	1200	0.50	0.60
		<b>16</b>	28000	3000	0.30	0.900	15000	1600	0.90	0.90
<b>3</b>	<b>R1.5</b>	<b>20</b>	25000	2500	0.20	0.900	15000	1400	0.60	0.80

Depth of cut



Work Material			Copper, Copper alloys				Rigid Composite Resin (Composite Resin)			
Dia. DC (mm)	R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.6</b>	<b>R0.3</b>	<b>10</b>	30000	600	0.005	0.040	28000	450	0.050	0.050
		<b>10</b>	33000	1400	0.010	0.100	25000	900	0.100	0.100
<b>1</b>	<b>R0.5</b>	<b>16</b>	25000	800	0.007	0.080	25000	700	0.080	0.080
		<b>20</b>	20000	500	0.005	0.050	25000	600	0.080	0.080
		<b>16</b>	30000	1800	0.050	0.200	25000	2100	0.800	0.800
<b>2</b>	<b>R1</b>	<b>20</b>	20000	1200	0.040	0.200	25000	1800	0.500	0.500
		<b>16</b>	28000	3000	0.300	0.300	25000	2400	1.000	1.000
<b>3</b>	<b>R1.5</b>	<b>20</b>	25000	2500	0.200	0.300	25000	2100	0.800	0.800

Depth of cut



Note 1) When high machining accuracy is needed, or the workpiece 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.

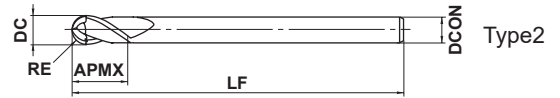
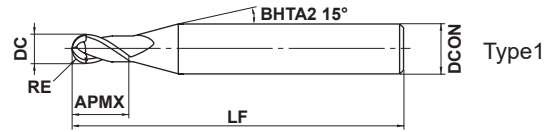
# SOLID END MILLS

## C2MB

Ball nose end mill, 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	Aluminium Alloy
○	○			○	○	○	○



	RE ≤ 6.5	RE > 6.5			
	±0.01	±0.02			
	DC ≤ 12	DC > 12			
	<sup>0</sup> / <sub>-0.020</sub>	<sup>0</sup> / <sub>-0.030</sub>			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16		
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>		

● 2 flute ultra micro-grain carbide end mill for contour milling of alloy and hardened steels.

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2MBR0050	0.5	1	2.5	40	4	2	▲	1
C2MBR0075	0.75	1.5	4	40	4	2	▲	1
C2MBR0100	1	2	6	60	6	2	▲	1
C2MBR0150	1.5	3	8	70	6	2	▲	1
C2MBR0200	2	4	8	70	6	2	▲	1
C2MBR0250	2.5	5	12	80	6	2	▲	1
C2MBR0300	3	6	12	80	6	2	▲	2
C2MBR0400	4	8	14	90	8	2	▲	2
C2MBR0500	5	10	18	100	10	2	▲	2
C2MBR0550	5.5	11	22	110	12	2	▲	1
C2MBR0650	6.5	13	26	120	12	2	▲	3
C2MBR0700	7	14	26	120	12	2	▲	3
C2MBR0750	7.5	15	30	140	16	2	▲	1

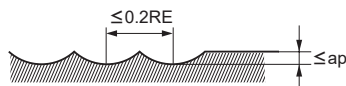
▲ : Product scheduled to be discontinued at the end of March 2020

CRN2MB(J230) are alternative for non-ferrous metal cutting such as aluminum alloys and copper alloys, and MP2MB(J198) is alternative for processing of other cutting materials.

## RECOMMENDED CUTTING CONDITIONS

Work Material	Roughing (Depth of cut $a_p \leq 0.8RE$ )				Finishing (Depth of cut $a_p \leq 0.05RE$ )							
	Carbon steel, Alloy steel (-30HRC) AISI 1055, AISI P20		Alloy steel, Tool steel, Pre-hardened steel (30-45HRC) AISI H13, AISI P21		Carbon steel, Alloy steel (-30HRC) AISI 1055, AISI P20				Alloy steel, Tool steel, Pre-hardened steel (30-45HRC) AISI H13, AISI P21			
	R RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		$\alpha \leq 15^\circ$		$\alpha > 15^\circ$
Revolution (min <sup>-1</sup> )						Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>R 0.5</b>	—	—	—	—	14000	180	10000	120	12000	150	7000	80
<b>R 1</b>	4100	70	2800	40	10500	350	7300	210	8400	220	5500	130
<b>R 2</b>	2600	120	1650	85	7200	500	5100	300	5900	360	4300	210
<b>R 3</b>	1900	150	1200	95	5200	560	3600	350	4200	410	2900	240
<b>R 4</b>	1400	160	900	105	4000	640	2700	380	3100	440	2200	240
<b>R 5</b>	1100	140	710	95	3200	700	2200	380	2500	460	1750	250
<b>R 6</b>	940	130	600	85	2600	640	1750	350	2100	430	1450	250
<b>R 8</b>	700	100	450	60	1900	620	1300	330	1550	430	1100	250
<b>R 10</b>	560	80	360	50	1500	590	1000	310	1250	410	860	250

Depth of cut

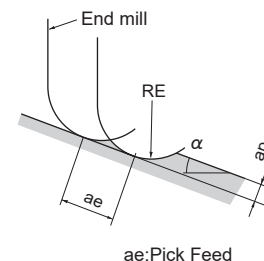


RE:Radius

Note 1)  $\alpha$  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.



ae:Pick Feed

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



# SOLID END MILLS

## MP3XB

Ball nose, 3 flute, Taper neck

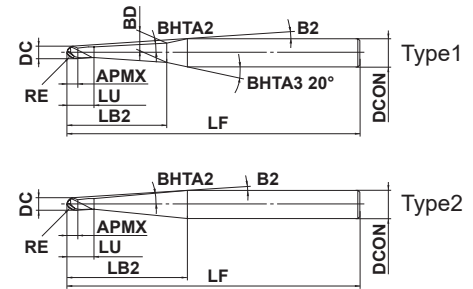
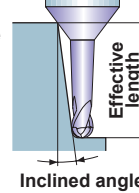


TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	



Effective length for inclined angle



RE ≤ 3	RE ≥ 4		
±0.005	±0.010		



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



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

● Ideal for rough milling of long overhang applications and semi-finishing of forging dies (40-52 HRC).

● Rigid, high helix, 3 flute design enables large depths of cut and high feed rates for increased machining efficiency.

(mm)

Order Number	RE	DC	BHTA2	APMX	LU	LB2	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
MP3XBR0050N008T05	0.5	1	0.5°	0.8	2.3	8	9.3°	1.04	60	6	3	●	1	8.5	8.8	9.3	9.8
MP3XBR0050N012T05	0.5	1	0.5°	0.8	2.3	12	7.5°	1.1	60	6	3	●	1	12.6	13	13.6	14.4
MP3XBR0050N016T05	0.5	1	0.5°	0.8	2.3	16	6.3°	1.18	60	6	3	●	1	16.6	17.1	18	18.9
MP3XBR0050N020T05	0.5	1	0.5°	0.8	2.3	20	5.4°	1.24	60	6	3	●	1	20.6	21.2	22.3	23.5
MP3XBR0050N025T05	0.5	1	0.5°	0.8	2.3	25	4.6°	1.34	70	6	3	●	1	25.7	26.3	27.7	29.3
MP3XBR0050N030T05	0.5	1	0.5°	0.8	2.3	30	4°	1.42	70	6	3	●	1	30.7	31.5	33.1	35
MP3XBR0050N050T05	0.5	1	0.5°	0.8	2.3	50	2.6°	1.78	90	6	3	●	1	50.8	52.1	54.8	*
MP3XBR0050N010T10	0.5	1	1°	0.8	2.3	10	8.4°	1.2	60	6	3	●	1	—	10.6	11.2	11.8
MP3XBR0050N016T10	0.5	1	1°	0.8	2.3	16	6.4°	1.42	60	6	3	●	1	—	16.7	17.6	18.5
MP3XBR0050N020T10	0.5	1	1°	0.8	2.3	20	5.5°	1.56	60	6	3	●	1	—	20.7	21.8	23
MP3XBR0050N025T10	0.5	1	1°	0.8	2.3	25	4.7°	1.74	70	6	3	●	1	—	25.7	27.1	28.6
MP3XBR0050N030T10	0.5	1	1°	0.8	2.3	30	4.1°	1.9	70	6	3	●	1	—	30.8	32.4	34.2
MP3XBR0050N035T10	0.5	1	1°	0.8	2.3	35	3.6°	2.08	90	6	3	●	1	—	35.8	37.7	39.8
MP3XBR0050N050T10	0.5	1	1°	0.8	2.3	50	2.7°	2.6	90	6	3	●	1	—	50.9	53.6	*
MP3XBR0050N010T15	0.5	1	1.5°	0.8	2.3	10	8.5°	1.34	60	6	3	●	1	—	—	11	11.6
MP3XBR0050N016T15	0.5	1	1.5°	0.8	2.3	16	6.5°	1.66	60	6	3	●	1	—	—	17.2	18.1
MP3XBR0050N020T15	0.5	1	1.5°	0.8	2.3	20	5.6°	1.86	60	6	3	●	1	—	—	21.3	22.5
MP3XBR0050N023T15	0.5	1	1.5°	0.8	2.3	23	5°	2.02	70	6	3	●	1	—	—	24.4	25.7
MP3XBR0050N025T15	0.5	1	1.5°	0.8	2.3	25	4.7°	2.12	70	6	3	●	1	—	—	26.5	27.9
MP3XBR0050N010T30	0.5	1	3°	0.8	2.3	10	8.8°	1.74	60	6	3	●	1	—	—	—	10.8
MP3XBR0050N020T30	0.5	1	3°	0.8	2.3	20	5.9°	2.8	60	6	3	●	1	—	—	—	20.9
MP3XBR0050N030T30	0.5	1	3°	0.8	2.3	30	4.4°	3.84	70	6	3	●	1	—	—	—	31
MP3XBR0050N042T30	0.5	1	3°	0.8	2.3	42	3.4°	5.1	90	6	3	●	1	—	—	—	43
MP3XBR0050N025T50	0.5	1	5°	0.8	2.3	25	5.4°	4.92	60	6	3	●	1	—	—	—	—
MP3XBR0075N010T05	0.75	1.5	0.5°	1.2	2.7	10	7.8°	1.56	60	6	3	●	1	10.6	10.9	11.4	12
MP3XBR0075N016T05	0.75	1.5	0.5°	1.2	2.7	16	5.8°	1.68	60	6	3	●	1	16.6	17.1	17.9	18.9
MP3XBR0075N020T05	0.75	1.5	0.5°	1.2	2.7	20	5°	1.74	60	6	3	●	1	20.6	21.2	22.3	23.5
MP3XBR0075N030T05	0.75	1.5	0.5°	1.2	2.7	30	3.7°	1.92	80	6	3	●	1	30.7	31.5	33.1	35
MP3XBR0075N010T10	0.75	1.5	1°	1.2	2.7	10	7.9°	1.7	60	6	3	●	1	—	10.6	11.2	11.8
MP3XBR0075N016T10	0.75	1.5	1°	1.2	2.7	16	5.9°	1.9	60	6	3	●	1	—	16.7	17.6	18.5
MP3XBR0075N020T10	0.75	1.5	1°	1.2	2.7	20	5.1°	2.04	60	6	3	●	1	—	20.7	21.8	23
MP3XBR0075N030T10	0.75	1.5	1°	1.2	2.7	30	3.7°	2.4	80	6	3	●	1	—	30.8	32.4	34.2

\* No interference

● : Inventory maintained in Japan.

(mm)

Order Number	RE	DC	BHTA2	APMX	LU	LB2	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
MP3XBR0075N010T15	0.75	1.5	1.5°	1.2	2.7	10	8°	1.82	60	6	3	●	1	—	—	11	11.6
MP3XBR0075N016T15	0.75	1.5	1.5°	1.2	2.7	16	6°	2.14	60	6	3	●	1	—	—	17.2	18.1
MP3XBR0075N020T15	0.75	1.5	1.5°	1.2	2.7	20	5.1°	2.34	60	6	3	●	1	—	—	21.3	22.5
MP3XBR0075N025T15	0.75	1.5	1.5°	1.2	2.7	25	4.4°	2.6	80	6	3	●	1	—	—	26.5	27.9
MP3XBR0075N030T15	0.75	1.5	1.5°	1.2	2.7	30	3.8°	2.86	80	6	3	●	1	—	—	31.6	33.4
MP3XBR0075N046T30	0.75	1.5	3°	1.2	2.7	46	2.9°	—	80	6	3	●	2	—	—	—	*
MP3XBR0100N016T05	1	2	0.5°	1.6	3.6	16	5.2°	2.12	60	6	3	●	1	17	17.6	18.6	19.5
MP3XBR0100N020T05	1	2	0.5°	1.6	3.6	20	4.5°	2.18	60	6	3	●	1	21.1	21.8	22.9	24.1
MP3XBR0100N030T05	1	2	0.5°	1.6	3.6	30	3.3°	2.36	70	6	3	●	1	31.1	32.1	33.7	35.6
MP3XBR0100N035T05	1	2	0.5°	1.6	3.6	35	2.9°	2.44	80	6	3	●	1	36.2	37.2	39.2	*
MP3XBR0100N040T05	1	2	0.5°	1.6	3.6	40	2.6°	2.54	80	6	3	●	1	41.2	42.4	44.6	*
MP3XBR0100N016T10	1	2	1°	1.6	3.6	16	5.3°	2.34	60	6	3	●	1	—	17.1	18.2	19.1
MP3XBR0100N020T10	1	2	1°	1.6	3.6	20	4.5°	2.48	60	6	3	●	1	—	21.2	22.4	23.6
MP3XBR0100N025T10	1	2	1°	1.6	3.6	25	3.8°	2.64	70	6	3	●	1	—	26.2	27.7	29.2
MP3XBR0100N030T10	1	2	1°	1.6	3.6	30	3.3°	2.82	70	6	3	●	1	—	31.3	33	34.8
MP3XBR0100N035T10	1	2	1°	1.6	3.6	35	3°	3	80	6	3	●	1	—	36.3	38.3	40.4
MP3XBR0100N040T10	1	2	1°	1.6	3.6	40	2.7°	3.18	80	6	3	●	1	—	41.3	43.6	*
MP3XBR0100N050T10	1	2	1°	1.6	3.6	50	2.2°	3.52	110	6	3	●	1	—	51.4	54.2	*
MP3XBR0100N070T10	1	2	1°	1.6	3.6	70	1.7°	4.22	110	6	3	●	1	—	71.5	*	*
MP3XBR0100N016T15	1	2	1.5°	1.6	3.6	16	5.4°	2.54	60	6	3	●	1	—	—	22.8	18.7
MP3XBR0100N020T15	1	2	1.5°	1.6	3.6	20	4.6°	2.76	60	6	3	●	1	—	—	21.9	23.1
MP3XBR0100N025T15	1	2	1.5°	1.6	3.6	25	3.9°	3.02	70	6	3	●	1	—	—	27.1	28.5
MP3XBR0100N030T15	1	2	1.5°	1.6	3.6	30	3.4°	3.28	70	6	3	●	1	—	—	32.2	34
MP3XBR0100N035T15	1	2	1.5°	1.6	3.6	35	3°	3.54	80	6	3	●	1	—	—	37.4	39.4
MP3XBR0100N040T15	1	2	1.5°	1.6	3.6	40	2.7°	3.8	80	6	3	●	1	—	—	42.6	*
MP3XBR0100N020T30	1	2	3°	1.6	3.6	20	4.8°	3.62	60	6	3	●	1	—	—	—	20.5
MP3XBR0100N030T30	1	2	3°	1.6	3.6	30	3.6°	4.66	70	6	3	●	1	—	—	—	30.6
MP3XBR0100N042T30	1	2	3°	1.6	3.6	42	2.8°	—	80	6	3	●	2	—	—	—	*
MP3XBR0100N027T50	1	2	5°	1.6	3.6	27	4.3°	—	60	6	3	●	2	—	—	—	—
MP3XBR0150N010T05	1.5	3	0.5°	2.4	5.4	10	5.7°	2.98	60	6	3	●	1	11	11.4	12	12.6
MP3XBR0150N020T05	1.5	3	0.5°	2.4	5.4	20	3.5°	3.16	60	6	3	●	1	21.1	21.8	22.9	24.1
MP3XBR0150N030T05	1.5	3	0.5°	2.4	5.4	30	2.6°	3.32	70	6	3	●	1	31.2	32.1	33.7	*
MP3XBR0150N040T05	1.5	3	0.5°	2.4	5.4	40	2°	3.5	80	6	3	●	1	41.3	42.4	44.6	*
MP3XBR0150N050T05	1.5	3	0.5°	2.4	5.4	50	1.7°	3.68	90	6	3	●	1	51.3	52.7	*	*
MP3XBR0150N020T10	1.5	3	1°	2.4	5.4	20	3.6°	3.4	60	6	3	●	1	—	21.3	22.4	23.6
MP3XBR0150N030T10	1.5	3	1°	2.4	5.4	30	2.6°	3.76	70	6	3	●	1	—	31.3	33	*
MP3XBR0150N035T10	1.5	3	1°	2.4	5.4	35	2.3°	3.94	80	6	3	●	1	—	36.4	38.3	*
MP3XBR0150N040T10	1.5	3	1°	2.4	5.4	40	2.1°	4.1	80	6	3	●	1	—	41.4	43.6	*
MP3XBR0150N050T10	1.5	3	1°	2.4	5.4	50	1.7°	4.46	90	6	3	●	1	—	51.5	*	*
MP3XBR0150N060T10	1.5	3	1°	2.4	5.4	60	1.5°	4.8	110	6	3	●	1	—	61.5	*	*
MP3XBR0150N070T10	1.5	3	1°	2.4	5.4	70	1.3°	5.16	110	6	3	●	1	—	71.6	*	*
MP3XBR0150N020T15	1.5	3	1.5°	2.4	5.4	20	3.7°	3.66	60	6	3	●	1	—	—	22	23.2
MP3XBR0150N030T15	1.5	3	1.5°	2.4	5.4	30	2.7°	4.18	70	6	3	●	1	—	—	32.3	*
MP3XBR0150N035T15	1.5	3	1.5°	2.4	5.4	35	2.4°	4.46	70	6	3	●	1	—	—	37.5	*
MP3XBR0150N040T15	1.5	3	1.5°	2.4	5.4	40	2.1°	4.72	80	6	3	●	1	—	—	42.6	*
MP3XBR0150N045T15	1.5	3	1.5°	2.4	5.4	45	1.9°	4.98	80	6	3	●	1	—	—	*	*
MP3XBR0150N052T15	1.5	3	1.5°	2.4	5.4	52	1.7°	5.34	90	6	3	●	1	—	—	*	*
MP3XBR0150N064T15	1.5	3	1.5°	2.4	5.4	64	1.4°	—	110	6	3	●	2	—	—	*	*
MP3XBR0150N025T30	1.5	3	3°	2.4	5.4	25	3.3°	4.96	60	6	3	●	1	—	—	—	26.8
MP3XBR0150N034T30	1.5	3	3°	2.4	5.4	34	2.6°	—	70	6	3	●	2	—	—	—	*

\* No interference



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## MP3XB

Ball nose, 3 flute, Taper neck

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

Order Number	RE	DC	BHTA2	APMX	LU	LB2	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
MP3XBR0150N040T30	1.5	3	3°	2.4	5.4	40	3.4°	6.52	90	8	3	●	1	—	—	—	41.9
MP3XBR0150N054T30	1.5	3	3°	2.4	5.4	54	2.7°	—	90	8	3	●	2	—	—	—	*
MP3XBR0200N030T05	2	4	0.5°	3.2	6.2	30	1.8°	4.32	70	6	3	●	1	31.2	32.1	*	*
MP3XBR0200N040T05	2	4	0.5°	3.2	6.2	40	1.4°	4.48	80	6	3	●	1	41.3	42.4	*	*
MP3XBR0200N060T05	2	4	0.5°	3.2	6.2	60	1°	4.84	100	6	3	●	1	61.4	63	*	*
MP3XBR0200N020T10	2	4	1°	3.2	6.2	20	2.6°	4.38	70	6	3	●	1	—	21.3	22.4	*
MP3XBR0200N030T10	2	4	1°	3.2	6.2	30	1.8°	4.74	70	6	3	●	1	—	31.4	*	*
MP3XBR0200N035T10	2	4	1°	3.2	6.2	35	1.6°	4.9	70	6	3	●	1	—	36.4	*	*
MP3XBR0200N040T10	2	4	1°	3.2	6.2	40	1.5°	5.08	80	6	3	●	1	—	41.4	*	*
MP3XBR0200N045T10	2	4	1°	3.2	6.2	45	1.3°	5.26	80	6	3	●	1	—	46.5	*	*
MP3XBR0200N066T10	2	4	1°	3.2	6.2	66	1°	—	100	6	3	●	2	—	*	*	*
MP3XBR0200N050T15	2	4	1.5°	3.2	6.2	50	2.2°	6.2	90	8	3	●	1	—	—	53	*
MP3XBR0200N084T15	2	4	1.5°	3.2	6.2	84	1.5°	—	120	8	3	●	2	—	—	*	*
MP3XBR0200N030T30	2	4	3°	3.2	6.2	30	3.6°	6.4	90	8	3	●	1	—	—	—	31.9
MP3XBR0200N045T30	2	4	3°	3.2	6.2	45	2.6°	—	90	8	3	●	2	—	—	—	*
MP3XBR0250N038T10	2.5	5	1°	4	7	38	0.8°	—	80	6	3	●	2	—	*	*	*
MP3XBR0250N050T10	2.5	5	1°	4	7	50	1.7°	6.4	90	8	3	●	1	—	51.5	*	*
MP3XBR0250N065T10	2.5	5	1°	4	7	65	1.4°	6.92	110	8	3	●	1	—	66.6	*	*
MP3XBR0250N066T15	2.5	5	1.5°	4	7	66	1.4°	—	110	8	3	●	2	—	—	*	*
MP3XBR0250N036T30	2.5	5	3°	4	7	36	2.4°	—	90	8	3	●	2	—	—	—	*
MP3XBR0300N040T10	3	6	1°	9	12	40	1.4°	6.82	80	8	3	●	1	—	41.8	*	*
MP3XBR0300N050T10	3	6	1°	9	12	50	1.2°	7.18	90	8	3	●	1	—	51.8	*	*
MP3XBR0300N073T10	3	6	1°	9	12	73	0.9°	—	110	8	3	●	2	—	*	*	*
MP3XBR0300N090T10	3	6	1°	9	12	90	1.3°	8.58	140	10	3	●	1	—	92	*	*
MP3XBR0300N053T15	3	6	1.5°	9	12	53	1.2°	—	90	8	3	●	2	—	—	*	*
MP3XBR0300N032T30	3	6	3°	9	12	32	1.9°	—	80	8	3	●	2	—	—	—	*
MP3XBR0400N050T10	4	8	1°	12	15	50	1.2°	9.08	110	10	3	●	1	—	51.9	*	*
MP3XBR0400N065T10	4	8	1°	12	15	65	1°	9.6	130	10	3	●	1	—	67	*	*
MP3XBR0400N076T10	4	8	1°	12	15	76	0.8°	—	130	10	3	●	2	—	*	*	*
MP3XBR0400N090T10	4	8	1°	12	15	90	1.3°	10.46	150	12	3	●	1	—	92.1	*	*
MP3XBR0400N040T15	4	8	1.5°	12	15	40	1.5°	9.16	90	10	3	●	1	—	—	*	*
MP3XBR0400N056T15	4	8	1.5°	12	15	56	1.1°	—	110	10	3	●	2	—	—	*	*
MP3XBR0400N035T30	4	8	3°	12	15	35	1.7°	—	90	10	3	●	2	—	—	—	*
MP3XBR0500N060T10	5	10	1°	15	25	60	1°	10.92	120	12	3	●	1	—	62.6	*	*
MP3XBR0500N070T10	5	10	1°	15	25	70	0.9°	11.28	120	12	3	●	1	—	*	*	*
MP3XBR0500N100T10	5	10	1°	15	25	100	1.7°	12.32	160	16	3	●	1	—	102.8	*	*
MP3XBR0500N050T15	5	10	1.5°	15	25	50	1.2°	11	100	12	3	●	1	—	—	*	*
MP3XBR0500N068T15	5	10	1.5°	15	25	68	0.9°	—	120	12	3	●	2	—	—	*	*
MP3XBR0500N046T30	5	10	3°	15	25	46	1.3°	—	100	12	3	●	2	—	—	—	*
MP3XBR0600N070T10	6	12	1°	18	28	70	1.6°	13.16	130	16	3	●	1	—	72.7	*	*
MP3XBR0600N100T10	6	12	1°	18	28	100	1.2°	14.22	160	16	3	●	1	—	102.9	*	*
MP3XBR0600N080T15	6	12	1.5°	18	28	80	1.5°	14.42	130	16	3	●	1	—	—	*	*
MP3XBR0600N069T30	6	12	3°	18	28	69	1.8°	—	130	16	3	●	2	—	—	—	*

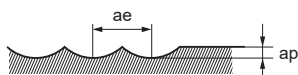
\* No interference

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material			Carbon steel, Alloy steel (180—280HB) Alloy Tool Steel ( $\leq 350\text{HB}$ ) Pre-hardened steel (35—45HRC) AISI 1045, AISI 4140, SKD, SKT, AISI 4140, AISI P21				Hardened steel (45—52HRC) AISI H13, AISI L6				Copper, Copper alloys			
R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R0.5</b>	<b>0.5°</b>	<b>8</b>	40000	1200	0.07	0.22	39000	1200	0.06	0.19	39000	1200	0.12	0.38
		<b>12</b>	40000	1200	0.06	0.19	39000	1200	0.05	0.16	39000	1200	0.1	0.32
		<b>16</b>	35000	1100	0.06	0.18	33000	900	0.04	0.14	33000	900	0.09	0.29
		<b>20</b>	32000	960	0.05	0.14	29000	800	0.04	0.11	29000	800	0.07	0.22
		<b>25</b>	28000	830	0.03	0.11	24000	600	0.02	0.07	24000	600	0.05	0.15
		<b>30</b>	24000	720	0.03	0.1	21000	450	0.02	0.06	21000	450	0.04	0.13
		<b>50</b>	10000	300	0.003	0.015	11000	150	0.003	0.015	11000	150	0.006	0.019
	<b>1°</b>	<b>10</b>	40000	1200	0.07	0.22	39000	1300	0.06	0.19	39000	1300	0.12	0.38
		<b>16</b>	35000	1100	0.06	0.18	33000	1000	0.05	0.14	33000	1000	0.09	0.29
		<b>20</b>	32000	960	0.05	0.14	29000	900	0.04	0.11	29000	900	0.07	0.22
		<b>25</b>	28000	830	0.04	0.11	24000	700	0.03	0.08	24000	700	0.05	0.16
		<b>30</b>	24000	720	0.03	0.1	21000	550	0.02	0.06	21000	550	0.04	0.13
		<b>35</b>	17000	500	0.03	0.08	13000	350	0.02	0.05	13000	350	0.03	0.1
	<b>1.5°</b>	<b>10</b>	40000	1200	0.07	0.22	39000	1400	0.06	0.19	39000	1400	0.12	0.38
		<b>16</b>	35000	1100	0.06	0.18	33000	1100	0.05	0.14	33000	1100	0.09	0.29
		<b>20</b>	32000	960	0.05	0.14	29000	1000	0.04	0.11	29000	1000	0.07	0.22
		<b>23</b>	27000	830	0.04	0.11	24000	800	0.03	0.08	24000	800	0.05	0.16
		<b>25</b>	27000	830	0.04	0.12	24000	800	0.03	0.09	24000	800	0.05	0.17
	<b>3°</b>	<b>10</b>	40000	1200	0.07	0.22	39000	1500	0.06	0.19	39000	1500	0.12	0.38
		<b>20</b>	32000	960	0.05	0.14	29000	1100	0.04	0.11	29000	1100	0.07	0.22
		<b>30</b>	22000	660	0.03	0.1	19000	700	0.02	0.06	19000	700	0.04	0.13
		<b>42</b>	13000	390	0.005	0.02	11000	390	0.005	0.02	11000	390	0.01	0.03
	<b>5°</b>	<b>25</b>	32000	960	0.04	0.11	29000	1000	0.03	0.08	29000	1000	0.05	0.16
	<b>R0.75</b>	<b>0.5°</b>	<b>10</b>	30000	1800	0.11	0.34	28000	1500	0.1	0.3	28000	1500	0.19
<b>16</b>			27000	1600	0.09	0.27	24000	1100	0.08	0.24	24000	1100	0.15	0.48
<b>20</b>			26000	1500	0.08	0.24	24000	1100	0.07	0.21	24000	1100	0.13	0.42
<b>30</b>			25000	1400	0.07	0.21	22000	1000	0.06	0.18	22000	1000	0.11	0.35
<b>1°</b>		<b>10</b>	30000	1900	0.11	0.34	28000	1600	0.1	0.3	28000	1600	0.19	0.61
		<b>16</b>	26000	1600	0.09	0.27	24000	1200	0.08	0.24	24000	1200	0.15	0.48
		<b>20</b>	27000	1700	0.08	0.24	24000	1200	0.07	0.21	24000	1200	0.13	0.42
		<b>30</b>	25000	1500	0.07	0.21	22000	1100	0.06	0.18	22000	1100	0.11	0.35
<b>1.5°</b>		<b>10</b>	30000	1900	0.11	0.34	28000	1700	0.1	0.3	28000	1700	0.19	0.61
		<b>16</b>	27500	1700	0.09	0.27	24000	1300	0.08	0.24	24000	1300	0.15	0.48
		<b>20</b>	26500	1700	0.08	0.24	24000	1300	0.07	0.21	24000	1300	0.13	0.42
		<b>25</b>	26000	1600	0.07	0.22	23000	1200	0.06	0.19	23000	1200	0.12	0.38
<b>3°</b>		<b>30</b>	25000	1500	0.07	0.21	22000	1100	0.06	0.18	22000	1100	0.11	0.35
		<b>46</b>	15000	450	0.05	0.16	14000	800	0.04	0.13	14000	800	0.08	0.26

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## MP3XB

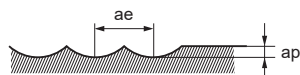
Ball nose, 3 flute, Taper neck

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Work Material			Carbon steel, Alloy steel (180—280HB) Alloy Tool Steel ( $\leq 350\text{HB}$ ) Pre-hardened steel (35—45HRC) AISI 1045, AISI 4140, SKD, SKT, AISI 4140, AISI P21				Hardened steel (45—52HRC) AISI H13, AISI L6				Copper, Copper alloys				
R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	
<b>R1.0</b>	<b>0.5°</b>	<b>16</b>	25000	1500	0.14	0.45	22000	1600	0.13	0.42	22000	1600	0.26	0.83	
		<b>20</b>	23000	1400	0.1	0.3	20000	1400	0.09	0.27	20000	1400	0.17	0.54	
		<b>30</b>	20000	1200	0.05	0.17	18000	1100	0.06	0.18	18000	1100	0.13	0.42	
		<b>35</b>	19000	1100	0.05	0.15	17000	1000	0.05	0.16	17000	1000	0.12	0.38	
		<b>40</b>	19000	1100	0.04	0.14	16000	900	0.05	0.14	16000	900	0.11	0.35	
	<b>1°</b>	<b>16</b>	25000	2300	0.14	0.45	22000	1700	0.13	0.42	22000	1700	0.26	0.83	
		<b>20</b>	23000	2100	0.1	0.3	20000	1500	0.09	0.27	20000	1500	0.17	0.54	
		<b>25</b>	23000	1400	0.06	0.19	20000	1300	0.07	0.21	20000	1300	0.16	0.5	
		<b>30</b>	20000	1200	0.05	0.17	18000	1200	0.06	0.18	18000	1200	0.13	0.42	
		<b>35</b>	19000	1100	0.05	0.15	17000	1100	0.05	0.15	17000	1100	0.12	0.37	
		<b>40</b>	19000	1100	0.04	0.14	16000	1000	0.05	0.14	16000	1000	0.11	0.35	
		<b>50</b>	17000	900	0.03	0.09	15000	900	0.03	0.08	15000	900	0.06	0.19	
	<b>70</b>	13000	700	0.02	0.06	11000	650	0.02	0.05	11000	650	0.04	0.12		
	<b>1.5°</b>	<b>16</b>	25000	2300	0.14	0.45	22000	1800	0.13	0.42	22000	1800	0.26	0.83	
		<b>20</b>	23000	2100	0.1	0.3	20000	1600	0.09	0.27	20000	1600	0.17	0.54	
		<b>25</b>	23000	1600	0.06	0.19	20000	1400	0.07	0.21	20000	1400	0.16	0.5	
		<b>30</b>	20000	1200	0.05	0.17	18000	1300	0.06	0.18	18000	1300	0.13	0.42	
		<b>35</b>	19000	1100	0.05	0.15	16000	1100	0.05	0.16	17000	1100	0.12	0.38	
	<b>3°</b>	<b>20</b>	23000	2100	0.1	0.3	20000	1700	0.09	0.27	20000	1700	0.17	0.54	
		<b>30</b>	18000	1600	0.08	0.26	16000	1300	0.07	0.22	16500	1300	0.14	0.45	
		<b>42</b>	16000	1400	0.07	0.21	13000	1000	0.06	0.18	13000	1000	0.11	0.35	
	<b>5°</b>	<b>27</b>	18000	2200	0.09	0.29	17000	1900	0.08	0.26	17000	1900	0.16	0.51	
	<b>R1.5</b>	<b>0.5°</b>	<b>10</b>	20000	2400	0.22	0.7	17000	1900	0.21	0.67	17000	1900	0.42	1.34
			<b>20</b>	17000	2000	0.2	0.64	15000	1600	0.19	0.61	15000	1600	0.38	1.22
			<b>30</b>	16000	1700	0.14	0.45	13000	1400	0.13	0.42	13000	1400	0.26	0.83
			<b>40</b>	16000	1400	0.08	0.24	12000	1200	0.09	0.27	12000	1200	0.2	0.65
			<b>50</b>	13000	1100	0.06	0.2	11000	1100	0.07	0.22	11000	1100	0.17	0.54
		<b>1°</b>	<b>20</b>	17000	2000	0.2	0.64	15000	1800	0.19	0.61	15000	1800	0.38	1.22
<b>30</b>			17000	1900	0.14	0.45	13000	1500	0.13	0.42	13000	1500	0.26	0.83	
<b>35</b>			16000	1700	0.08	0.26	13000	1500	0.09	0.29	13000	1500	0.22	0.69	
<b>40</b>			16000	1500	0.08	0.24	13000	1300	0.09	0.27	13000	1300	0.2	0.65	
<b>50</b>			13000	1200	0.06	0.2	11000	1100	0.07	0.22	11000	1100	0.17	0.54	
<b>60</b>			13000	1100	0.06	0.19	11000	1000	0.07	0.21	11000	1000	0.16	0.5	
<b>70</b>			10000	800	0.05	0.17	9000	700	0.06	0.18	9000	700	0.13	0.42	
<b>1.5°</b>		<b>20</b>	17000	2000	0.2	0.64	15000	1900	0.19	0.61	15000	1900	0.38	1.22	
		<b>30</b>	16000	1800	0.14	0.45	13000	1600	0.13	0.42	13000	1600	0.26	0.83	
		<b>35</b>	15000	1700	0.08	0.26	12000	1400	0.09	0.29	12000	1400	0.22	0.69	
		<b>40</b>	15000	1600	0.08	0.24	12000	1300	0.09	0.27	12000	1300	0.2	0.65	
		<b>45</b>	13000	1400	0.07	0.22	11000	1300	0.08	0.24	11000	1300	0.18	0.58	
		<b>52</b>	13000	1300	0.06	0.2	11000	1100	0.07	0.22	11000	1100	0.17	0.54	
		<b>64</b>	10000	900	0.06	0.18	9000	900	0.06	0.19	9000	900	0.14	0.46	
<b>3°</b>		<b>25</b>	16000	2400	0.16	0.51	13000	1900	0.15	0.48	13000	1900	0.3	0.96	
		<b>34</b>	14000	2100	0.13	0.4	11000	1600	0.12	0.37	11000	1600	0.23	0.74	
		<b>40</b>	14000	1700	0.12	0.37	11000	1400	0.11	0.34	11000	1400	0.21	0.67	
		<b>40</b>	14000	1700	0.12	0.37	11000	1400	0.11	0.34	11000	1400	0.21	0.67	
		<b>54</b>	12000	1400	0.1	0.3	10000	1200	0.09	0.27	10000	1200	0.17	0.54	

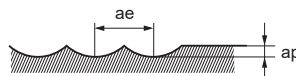
Depth of cut





Work Material			Carbon steel, Alloy steel (180—280HB) Alloy Tool Steel (≤350HB) Pre-hardened steel (35—45HRC) AISI 1045, AISI 4140, SKD, SKT, AISI 4140, AISI P21				Hardened steel (45—52HRC) AISI H13, AISI L6				Copper, Copper alloys			
R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
R2.0	0.5°	30	14000	2100	0.23	0.74	11000	1800	0.22	0.7	11000	1800	0.44	1.41
		40	12000	1800	0.19	0.61	10000	1600	0.18	0.58	10000	1600	0.36	1.15
		60	9000	1300	0.06	0.19	8500	1400	0.07	0.21	8500	1400	0.16	0.5
	1°	20	15000	2700	0.31	0.99	12000	2200	0.3	0.96	12000	2200	0.72	2.3
		30	14000	2100	0.23	0.74	11000	1800	0.22	0.7	11000	1800	0.53	1.69
		35	12000	1800	0.21	0.67	10000	1700	0.2	0.64	10000	1700	0.48	1.54
		40	12000	1700	0.19	0.61	10000	1600	0.18	0.58	10000	1600	0.43	1.38
		45	12000	1500	0.13	0.42	10000	1600	0.12	0.38	10000	1600	0.29	0.92
		66	9000	1100	0.08	0.24	8500	1300	0.07	0.21	8500	1300	0.16	0.5
	1.5°	50	12000	2200	0.11	0.35	10000	1700	0.1	0.32	10000	1700	0.24	0.77
		84	8000	1400	0.04	0.13	6500	900	0.03	0.1	6500	900	0.07	0.23
	3°	30	14000	2500	0.23	0.74	11000	2000	0.22	0.7	11000	2000	0.53	1.69
		45	11000	1900	0.16	0.51	9000	1600	0.15	0.48	9000	1600	0.36	1.15
	R2.5	1°	38	10000	2200	0.28	0.9	8500	2000	0.27	0.86	8500	2000	0.65
50			9000	1900	0.24	0.77	8000	1800	0.23	0.74	8000	1800	0.55	1.77
65			8000	1600	0.16	0.51	6500	1400	0.15	0.48	6500	1400	0.36	1.15
1.5°		66	8000	1600	0.16	0.51	6500	1500	0.15	0.48	6500	1500	0.36	1.15
3°		36	10000	2700	0.31	0.99	8500	2300	0.3	0.96	8500	2300	0.72	2.3
R3.0	1°	40	8000	2200	0.28	0.9	7500	2100	0.27	0.86	7500	2100	0.65	2.07
		50	8000	2000	0.23	0.74	6500	1800	0.22	0.7	6500	1800	0.53	1.69
		73	7000	1700	0.15	0.48	6500	1700	0.14	0.45	6500	1700	0.34	1.07
		90	6500	1500	0.09	0.29	6000	1300	0.08	0.26	6000	1300	0.19	0.61
	1.5°	53	7000	2100	0.22	0.7	6500	1900	0.21	0.67	6500	1900	0.5	1.61
	3°	32	9000	2400	0.35	1.12	8000	2200	0.34	1.09	8000	2200	0.82	2.61
R4.0	1°	50	6000	2200	0.41	1.31	5500	2000	0.4	1.28	5500	2000	0.96	3.07
		65	6000	2000	0.36	1.15	5200	1700	0.35	1.12	5200	1700	0.84	2.69
		76	6000	1800	0.29	0.93	5000	1500	0.28	0.9	5000	1500	0.67	2.15
		90	5000	1400	0.19	0.61	4700	1200	0.18	0.58	4700	1200	0.43	1.38
	1.5°	40	6000	2300	0.46	1.47	5800	2200	0.45	1.44	5800	2200	1.08	3.46
		56	6000	2200	0.38	1.22	5500	2000	0.37	1.18	5500	2000	0.9	2.84
	3°	35	7000	2700	0.49	1.57	6000	2400	0.48	1.54	6000	2400	1.15	3.69
R5.0	1°	60	5500	2600	0.51	1.63	4500	2300	0.5	1.6	4500	2300	1.2	3.84
		70	5500	2600	0.46	1.47	4500	2200	0.45	1.44	4500	2200	1.08	3.46
		100	5000	2400	0.36	1.15	4000	1900	0.35	1.12	4000	1900	0.84	2.69
	1.5°	50	5000	2400	0.56	1.79	4600	2400	0.55	1.76	4600	2400	1.32	4.22
		68	5000	2400	0.49	1.57	4600	2300	0.48	1.54	4600	2300	1.15	3.69
	3°	46	5000	2400	0.69	2.21	4800	2500	0.68	2.18	4800	2500	1.63	5.22
R6.0	1°	70	4500	2600	0.81	2.59	4000	2100	0.8	2.56	4000	2100	1.92	6.14
		100	4000	2200	0.61	1.95	3500	1800	0.6	1.92	3500	1800	1.44	4.61
	1.5°	80	5000	2300	0.71	2.27	4000	2000	0.7	2.24	4000	2000	1.68	5.38
	3°	69	5000	2700	0.81	2.59	4000	2200	0.8	2.56	4000	2200	1.92	6.14

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.

# SOLID END MILLS

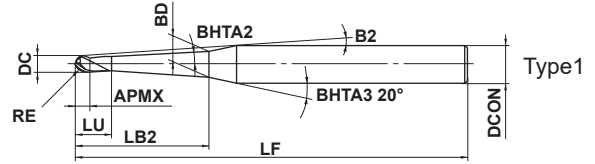
## VF3XB

Ball nose, Medium cut length, 3 flute, Taper neck

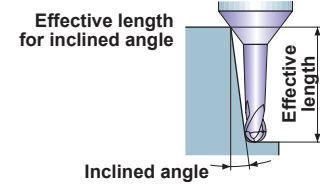


TOOL NEWS

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	Aluminium Alloy
○	◎	◎	◎				



	$0.4 \leq RE \leq 2.5$				
	$\pm 0.01$				
	$0.8 \leq DC \leq 5$				
	$0$ $- 0.02$				
	$4 \leq DCON \leq 6$	$DCON=8$			
	$0$ $- 0.008$	$0$ $- 0.009$			



● 3 flute ball end mill, high rigidity taper neck type.

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle (mm)			
														0.5°	1°	2°	3°
														VF3XBR0040T0024L006	0.4	0.8	0.4°
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
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

\* No interference

● : Inventory maintained in Japan.

(mm)

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
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
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	*

\* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



# SOLID END MILLS

## VF3XB

Ball nose, Medium cut length, 3 flute, Taper neck

(mm)

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

←

SOLID END MILLS

● : Inventory maintained in Japan.

## 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)		
Work Material			AISI 1050, AISI No 35 B, AISI P20			AISI H13, AISI W1-10, AISI P21			AISI H13			AISI D2		
R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>R0.4</b>	<b>0.4°</b>	<b>6</b>	34000	2700	0.03	31000	2200	0.025	24000	1700	0.02	19000	1400	0.015
		<b>8</b>	31000	2100	0.02	29000	1700	0.02	22000	1300	0.015	18000	1000	0.01
		<b>12</b>	28000	2000	0.015	26000	1600	0.01	20000	1200	0.01	16000	960	0.007
	<b>0.9°</b>	<b>8</b>	31000	2200	0.02	29000	1800	0.02	22000	1400	0.015	18000	1100	0.01
		<b>12</b>	28000	2100	0.015	26000	1700	0.01	20000	1300	0.01	16000	1000	0.007
		<b>16</b>	25000	1100	0.01	23000	910	0.01	18000	700	0.008	14000	560	0.006
<b>R0.5</b>	<b>0.4°</b>	<b>8</b>	27000	2700	0.04	25000	2200	0.04	19000	1700	0.03	15000	1400	0.02
		<b>10</b>	24000	2200	0.03	22000	1800	0.025	17000	1400	0.02	14000	1100	0.015
		<b>12</b>	24000	2200	0.03	22000	1800	0.025	17000	1400	0.02	14000	1100	0.015
		<b>16</b>	22000	2100	0.03	21000	1700	0.025	16000	1300	0.02	13000	1000	0.015
		<b>20</b>	20000	1400	0.015	18000	1200	0.01	14000	900	0.01	11000	720	0.007
		<b>25</b>	18000	1300	0.015	17000	1000	0.01	13000	800	0.009	10000	640	0.006
		<b>30</b>	15000	960	0.01	14000	780	0.01	11000	600	0.008	8800	480	0.006
		<b>35</b>	14000	800	0.008	13000	650	0.007	10000	500	0.006	8000	400	0.004
	<b>0.9°</b>	<b>8</b>	27000	2900	0.04	25000	2300	0.04	19000	1800	0.03	15000	1400	0.02
		<b>12</b>	24000	2400	0.03	22000	2000	0.025	17000	1500	0.02	14000	1200	0.015
		<b>16</b>	22000	2200	0.03	21000	1800	0.025	16000	1400	0.02	13000	1100	0.015
		<b>20</b>	20000	1600	0.015	18000	1300	0.01	14000	1000	0.01	11000	800	0.007
		<b>25</b>	18000	1400	0.015	17000	1200	0.01	13000	900	0.009	10000	720	0.006
		<b>30</b>	15000	1100	0.01	14000	910	0.009	11000	700	0.008	8800	560	0.006
		<b>35</b>	14000	960	0.008	13000	780	0.007	10000	600	0.006	8000	480	0.004
		<b>40</b>	11000	800	0.007	11000	650	0.006	8000	500	0.005	6400	400	0.003
		<b>50</b>	8400	610	0.006	7800	490	0.005	6000	380	0.004	4800	300	0.003
		<b>60</b>	7000	510	0.004	6500	400	0.004	5000	320	0.003	4000	260	0.002
		<b>70</b>	7000	480	0.003	6500	390	0.002	5000	300	0.002	4000	240	0.001
		<b>1.5°</b>	<b>12</b>	24000	2600	0.03	22000	2100	0.025	17000	1600	0.02	14000	1300
	<b>16</b>		22000	2400	0.03	21000	2000	0.025	16000	1500	0.02	13000	1200	0.015
	<b>20</b>		20000	1800	0.015	18000	1400	0.01	14000	1100	0.01	11000	880	0.007
	<b>25</b>		18000	1600	0.015	17000	1300	0.01	13000	1000	0.009	11000	800	0.006
	<b>30</b>		15000	1300	0.01	14000	1000	0.01	11000	800	0.008	8800	640	0.006
	<b>35</b>		14000	1100	0.008	13000	910	0.007	10000	700	0.006	8000	560	0.004

SQUARE

BALL

RADIUS

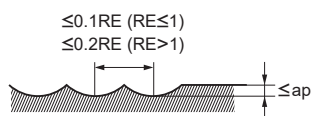
TAPER

BARREL

ROUGHING

SOLID END MILLS

Depth of cut



RE:Radius

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.

# SOLID END MILLS

## VF3XB

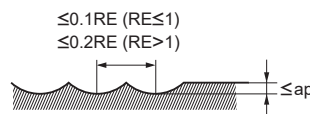
Ball nose, Medium cut length, 3 flute, Taper neck

CARBIDE

### 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 No 35 B, AISI P20			AISI H13, AISI W1-10, AISI P21			AISI H13			AISI D2		
R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
R0.75	0.4°	10	18000	2700	0.06	17000	2200	0.05	13000	1700	0.04	10000	1400	0.03
		15	17000	2200	0.04	16000	1800	0.04	12000	1400	0.03	9600	1100	0.02
		20	17000	2100	0.03	16000	1700	0.025	12000	1300	0.02	9600	1000	0.015
		30	14000	1600	0.015	13000	1300	0.01	10000	1000	0.01	8000	800	0.007
	0.9°	15	17000	2400	0.04	16000	2000	0.04	12000	1500	0.03	9600	1200	0.02
		20	17000	2200	0.03	16000	1800	0.025	12000	1400	0.02	9600	1100	0.015
		30	14000	1800	0.015	13000	1400	0.01	10000	1100	0.01	8000	880	0.007
		40	13000	1300	0.01	12000	1000	0.01	9000	800	0.008	7200	640	0.006
	1.5°	15	17000	2600	0.04	16000	2100	0.04	12000	1600	0.03	9600	1300	0.02
		20	17000	2400	0.03	16000	2000	0.025	12000	1500	0.02	9600	1200	0.015
		30	14000	2000	0.015	13000	1600	0.01	10000	1200	0.01	8000	960	0.007
	R1	0.4°	16	15000	3200	0.07	14000	2600	0.06	11000	2000	0.05	8800	1600
20			14000	2400	0.06	13000	2000	0.05	10000	1500	0.04	8000	1200	0.03
25			14000	2100	0.04	13000	1700	0.04	10000	1300	0.03	8000	1000	0.02
30			13000	1800	0.03	12000	1400	0.03	9000	1100	0.025	7200	880	0.02
35			13000	1600	0.03	12000	1300	0.025	9000	1000	0.02	7200	800	0.015
40			12000	1400	0.015	11000	1200	0.01	8500	900	0.01	6800	720	0.007
0.9°		20	14000	2600	0.06	13000	2100	0.05	10000	1600	0.04	8000	1300	0.03
		25	14000	2200	0.05	13000	1800	0.04	10000	1400	0.03	8000	1100	0.025
		30	13000	1900	0.04	12000	1600	0.04	9000	1200	0.03	7200	960	0.02
		35	13000	1800	0.04	12000	1400	0.03	9000	1100	0.025	7200	880	0.02
		40	12000	1600	0.03	11000	1300	0.025	8500	1000	0.02	6800	800	0.015
		50	11000	1400	0.015	10000	1200	0.01	8000	900	0.01	6400	720	0.007
1.5°		60	9800	1100	0.007	9100	910	0.006	7000	700	0.005	5600	560	0.003
		70	8400	960	0.004	7800	780	0.004	6000	600	0.003	4800	480	0.002
		25	14000	2400	0.05	13000	2000	0.04	10000	1500	0.03	8000	1200	0.025
		30	12600	2100	0.04	12000	1700	0.04	9000	1300	0.03	7200	1000	0.02
		35	13000	1900	0.04	12000	1600	0.03	9000	1200	0.025	7200	960	0.02
		40	12000	1800	0.03	11000	1400	0.025	8500	1100	0.02	6800	880	0.015

Depth of cut



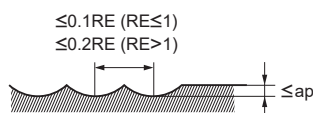
RE:Radius

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.

Work Material			Carbon steel, Cast iron, Alloy steel (-30HRC)			Alloy steel, Tool steel, Pre-hardened steel			Hardened steel (45-55HRC)			Hardened steel (55-62HRC)		
Work Material			AISI 1050, AISI No 35 B, AISI P20			AISI H13, AISI W1-10, AISI P21			AISI H13			AISI D2		
R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
R1.25	0.9°	20	13000	2900	0.06	12000	2300	0.05	9000	1800	0.04	7200	1400	0.03
		30	12000	2600	0.05	11000	2100	0.04	8500	1600	0.03	6800	1300	0.025
		40	11000	2200	0.04	9800	1800	0.04	7500	1400	0.03	6000	1100	0.02
	1.5°	20	13000	3000	0.06	12000	2500	0.05	9000	1900	0.04	7200	1500	0.03
		30	12000	2700	0.05	11050	2200	0.04	8500	1700	0.03	6800	1400	0.025
		40	11000	2400	0.04	9800	2000	0.04	7500	1500	0.03	6000	1200	0.02
R1.5	0.4°	20	12000	3700	0.13	11000	3000	0.1	8500	2300	0.09	6800	1800	0.06
		30	11000	2900	0.07	10000	2300	0.06	8000	1800	0.05	6400	1400	0.03
		40	11000	2400	0.06	10000	2000	0.05	8000	1500	0.04	6400	1200	0.03
		50	11000	2000	0.04	9800	1600	0.04	7500	1200	0.03	6000	960	0.02
	0.9°	20	12000	3800	0.13	11000	3100	0.1	8500	2400	0.09	6800	1900	0.06
		30	11000	3000	0.07	10000	2500	0.06	8000	1900	0.05	6400	1500	0.03
		40	11000	2600	0.06	10000	2100	0.05	8000	1600	0.04	6400	1300	0.03
		50	11000	2100	0.04	9800	1700	0.04	7500	1300	0.03	6000	1000	0.02
		60	9800	2000	0.03	9100	1600	0.025	7000	1200	0.02	5600	960	0.015
		70	9800	1800	0.015	9100	1400	0.01	7000	1100	0.01	5600	880	0.007
		50	11000	2200	0.04	9800	1800	0.04	7500	1400	0.03	6000	1100	0.02
	1.5°	60	9800	2100	0.03	9100	1700	0.025	7000	1300	0.02	5600	1000	0.015
		70	9800	2000	0.015	9100	1600	0.01	7000	1200	0.01	5600	960	0.007
		30	10000	3200	0.3	9400	2600	0.25	7200	2000	0.2	5800	1600	0.15
	R2	0.9°	40	9500	2400	0.15	8800	2000	0.12	6800	1500	0.1	5400	1200
50			9500	2100	0.1	8800	1700	0.1	6800	1300	0.08	5400	1000	0.06
60			9000	1900	0.07	8300	1600	0.06	6400	1200	0.05	5100	960	0.03
35			8000	3500	0.3	7400	2900	0.25	5700	2200	0.2	4600	1800	0.15
R2.5	0.9°	40	8000	3200	0.2	7400	2600	0.18	5700	2000	0.15	4600	1600	0.1
		60	7600	2400	0.15	7000	2000	0.12	5400	1500	0.1	4300	1200	0.07

Depth of cut



RE:Radius

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.

# SOLID END MILLS

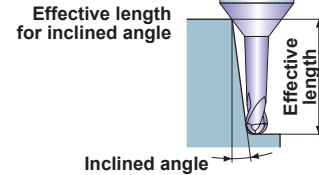
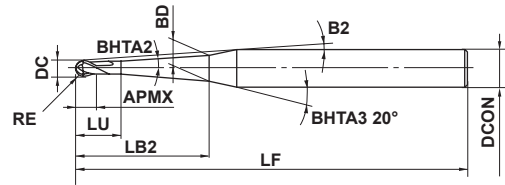
## DF3XB

Ball nose, Medium cut length, 3 flute, Taper neck, For graphite



TOOL NEWS

Aluminium Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



	$0.5 \leq RE \leq 2$				
	$\pm 0.01$				
	DCON=6				
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$				

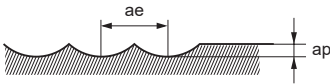
● Ball nose taper end mill with Mitsubishi's unique diamond coating for graphite machining.

Order Number	RE	DC	BHTA2	APMX	LU	LB2	B2	BD	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle (mm)			
														0.5°	1°	2°	3°
														DF3XBR0050L030	0.5	1	0.5°
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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Graphite				Copper, Copper alloys			
R RE (mm)	Neck length LB2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R0.5</b>	<b>30</b>	20000	1100	0.05	0.13	16000	700	0.04	0.13
	<b>40</b>	15000	750	0.04	0.11	12000	480	0.03	0.11
	<b>50</b>	12000	500	0.03	0.10	9600	320	0.02	0.10
<b>R1</b>	<b>40</b>	20000	1800	0.13	0.40	16000	1100	0.10	0.40
	<b>60</b>	15000	900	0.09	0.27	12000	580	0.07	0.27
	<b>80</b>	12000	600	0.07	0.20	9600	380	0.06	0.20
<b>R1.5</b>	<b>60</b>	14000	1700	0.15	0.45	11000	1100	0.12	0.45
	<b>80</b>	12000	1200	0.12	0.35	9600	770	0.10	0.35
<b>R2</b>	<b>100</b>	10000	1100	0.20	0.50	8000	700	0.16	0.50
Depth of cut									

Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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.

# SOLID END MILLS

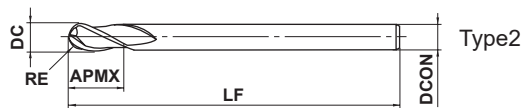
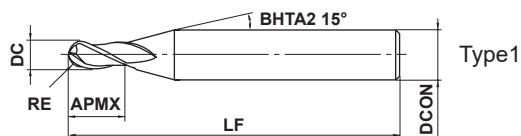
## VC3MB

Ball nose end mill, Medium cut length, 3 flute



TOOL NEWS

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	Aluminium Alloy
○	◎	○		○	○		



	RE ≤ 6	RE > 6			
	±0.01	±0.02			
	DC ≤ 12	DC > 12			
	<sup>0</sup> / <sub>-0.020</sub>	<sup>0</sup> / <sub>-0.030</sub>			
	D CON = 6	8 ≤ D CON ≤ 10	12 ≤ D CON ≤ 16	D CON = 20	
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>	<sup>0</sup> / <sub>-0.013</sub>	

● 3 flute ball nose end mill for efficient machining.

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
								Type	
VC3MBR0100	1	2	6	60	6	3	●	1	
VC3MBR0150	1.5	3	8	70	6	3	●	1	
VC3MBR0200	2	4	8	70	6	3	●	1	
VC3MBR0250	2.5	5	12	80	6	3	●	1	
VC3MBR0300	3	6	12	80	6	3	●	2	
VC3MBR0400	4	8	14	90	8	3	●	2	
VC3MBR0500	5	10	18	100	10	3	●	2	
VC3MBR0600	6	12	22	110	12	3	●	2	
VC3MBR0800	8	16	30	140	16	3	●	2	
VC3MBR1000	10	20	38	160	20	3	●	2	

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

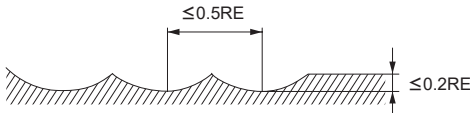


## RECOMMENDED CUTTING CONDITIONS

### ■ Roughing

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21				Hardened steel (45–55HRC) AISI H13			
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		$\alpha \leq 15^\circ$		$\alpha > 15^\circ$	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>R 1</b>	32000	3000	25000	1170	18000	1440	16000	640
<b>R 2</b>	18500	3700	14500	1460	11000	1760	9200	740
<b>R 3</b>	13000	4000	10000	1500	7700	1920	6400	800
<b>R 4</b>	10000	5000	8000	2000	6000	2300	4800	920
<b>R 5</b>	8000	5000	6500	2000	4800	2200	3800	870
<b>R 6</b>	6600	4600	5300	1800	4000	2100	3200	840
<b>R 8</b>	5000	4000	4000	1600	3000	1700	2400	680
<b>R 10</b>	4000	3600	3200	1440	2400	1400	1900	550

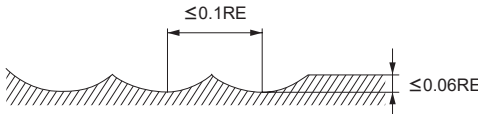
  

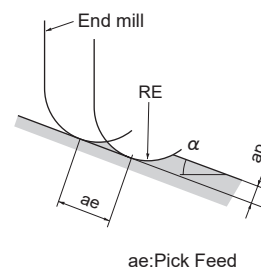
Depth of cut								
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### ■ Finishing

Work Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21				Hardened steel (45–55HRC) AISI H13			
	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		$\alpha \leq 15^\circ$		$\alpha > 15^\circ$	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>R 1</b>	32000	3200	32000	1500	25000	2000	20000	800
<b>R 2</b>	25500	5000	20000	2000	17000	2700	13000	1000
<b>R 3</b>	20000	6100	15000	2200	13000	3200	10000	1200
<b>R 4</b>	15000	7500	11000	2700	10000	3800	7500	1400
<b>R 5</b>	12000	7500	9000	2700	8000	3700	6000	1400
<b>R 6</b>	10000	7000	7500	2500	6600	3500	5000	1300
<b>R 8</b>	7500	6000	5600	2200	5000	2800	3700	1000
<b>R 10</b>	6000	5400	4500	2000	4000	2300	3000	900

Depth of cut								
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Note 1)  $\alpha$  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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS



# SOLID END MILLS

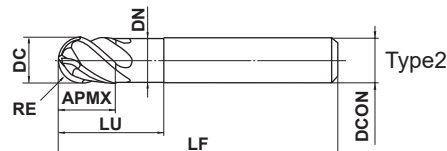
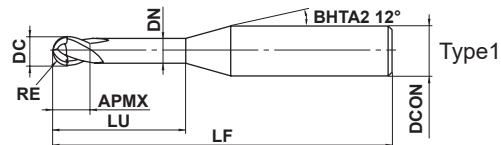
## VQ4SVB

Ball nose, Medium cutting length, 4 flute



TOOL NEWS

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	Aluminium Alloy
○	○			○	○	○	



	1 ≤ RE ≤ 6 ±0.01				
	DC ≤ 12 0 - 0.02				
	DCON = 6 0 - 0.008	8 ≤ DCON ≤ 10 0 - 0.009	DCON = 12 0 - 0.011		

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

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 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.

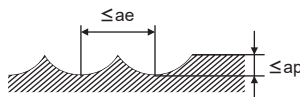
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### Shoulder milling(Slotting)

R RE (mm)	Carbon steel, Alloy steel, Mild steel, Pre-hardened steel						Austenitic stainless steel, Titanium alloy, Precipitation hardening stainless steel, Cobalt chromium alloy, Ferritic, Precipitation hardening stainless steel									
	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			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 <sup>-1</sup> )	Feed rate (mm/min)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)			Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)		
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															
<b>R 1</b>	250	40000	8000	200	32000	3800	0.17	0.5	230	36000	6500	150	24000	2900	0.17	0.5
<b>R 1.5</b>	300	32000	7700	200	21000	3200	0.25	0.75	230	24000	4800	150	16000	1900	0.25	0.75
<b>R 2</b>	300	24000	5800	200	16000	2800	0.33	1	230	18000	4000	150	12000	1700	0.33	1
<b>R 2.5</b>	300	19000	5300	200	12700	2600	0.42	1.25	230	14400	3500	150	9600	1500	0.42	1.25
<b>R 3</b>	300	16000	4800	200	10600	2100	0.5	1.5	230	12000	3200	150	8000	1400	0.5	1.5
<b>R 4</b>	300	12000	4300	200	8000	1900	0.8	2	230	9000	3200	150	6000	1400	0.8	2
<b>R 5</b>	300	9600	4100	200	6400	1800	1	2.5	230	7200	3000	150	4800	1300	1	2.5
<b>R 6</b>	300	8000	4000	200	5300	1800	1.2	3	230	6000	3000	150	4000	1300	1.2	3

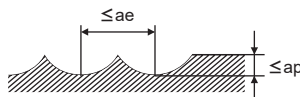
Depth of cut



RE:Radius

R RE (mm)	Copper, Copper alloy						Heat Resistant Alloy  Inconel718									
	$\alpha \leq 15^\circ$			$\alpha > 15^\circ$			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 <sup>-1</sup> )	Feed rate (mm/min)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)			Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)		
<b>R 1</b>	250	40000	8000	240	38000	4500	0.17	0.5	60	9600	960	40	6400	510	0.08	0.2
<b>R 1.5</b>	360	38000	9100	240	25000	3800	0.25	0.7	60	6400	640	40	4200	340	0.13	0.3
<b>R 2</b>	360	29000	7000	240	19000	3300	0.33	1	60	4800	580	40	3200	260	0.17	0.4
<b>R 2.5</b>	360	23000	6400	240	15000	3100	0.42	1.2	60	3800	530	39	2500	250	0.21	0.5
<b>R 3</b>	360	19000	5700	240	13000	2600	0.5	1.5	60	3200	500	40	2100	210	0.25	0.6
<b>R 4</b>	360	14000	5000	240	9600	2300	0.8	2	60	2400	430	40	1600	190	0.4	0.8
<b>R 5</b>	360	12000	5100	240	7700	2200	1	2.5	63	2000	420	41	1300	180	0.5	1
<b>R 6</b>	360	9600	4800	240	6400	2200	1.2	3	64	1700	350	41	1100	150	0.6	1.2

Depth of cut



RE:Radius

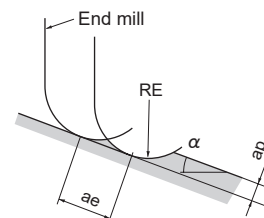
Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.

Note 2) For stainless steel, titanium alloy and heat resistant alloy, the use of water-soluble coolant 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 workpiece 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.

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

Note 5)  $\alpha$  is the inclination angle of the machined surface.



ae:Pick Feed

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VF4MB

Ball nose, Medium cut length, 4 flute

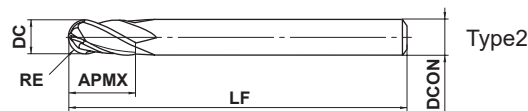
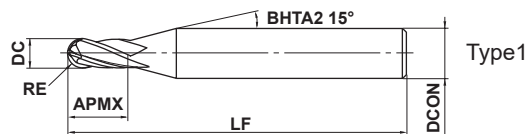


30°



TOOL NEWS

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	Aluminium Alloy
	○	◎	◎				



	$0.5 \leq RE \leq 6$				
	$\pm 0.01$				
	$1 \leq DC \leq 12$				
	$0$ $- 0.020$				
	$DCON=6$	$8 \leq DCON \leq 10$	$DCON=12$		
	$0$ $- 0.008$	$0$ $- 0.009$	$0$ $- 0.011$		

● 4 flute ball nose end mill for high-speed machining of hardened steel.

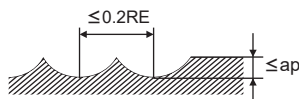
									(mm)
Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type	
VF4MBR0050	0.5	1	2.5	50	6	4	●	1	
VF4MBR0100	1	2	6	60	6	4	●	1	
VF4MBR0150	1.5	3	8	70	6	4	●	1	
VF4MBR0200	2	4	8	70	6	4	●	1	
VF4MBR0250	2.5	5	12	80	6	4	●	1	
VF4MBR0300	3	6	12	80	6	4	●	2	
VF4MBR0400	4	8	14	90	8	4	●	2	
VF4MBR0500	5	10	18	100	10	4	●	2	
VF4MBR0600	6	12	22	110	12	4	●	2	

● : Inventory maintained in Japan.

## 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 $a_p$ (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut $a_p$ (mm)	$\alpha \leq 15^\circ$		$\alpha > 15^\circ$		Depth of cut $a_p$ (mm)
Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )		Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )		Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	
<b>R0.5</b>	40000	8000	40000	3800	0.06	40000	5600	40000	3100	0.05	40000	4700	32000	1700	0.03
<b>R1</b>	40000	9600	40000	5600	0.11	40000	8000	28000	3100	0.10	24000	5000	16000	1200	0.06
<b>R1.5</b>	40000	12000	32000	5600	0.13	32000	7700	19000	2900	0.12	16000	4200	11000	1100	0.07
<b>R2</b>	32000	11000	24000	4700	0.15	24000	6200	14000	2500	0.13	12000	3100	8000	1000	0.08
<b>R2.5</b>	25000	9000	19000	3800	0.20	19000	5300	12000	2200	0.15	9600	2700	6000	780	0.08
<b>R3</b>	21000	8400	15000	3400	0.25	16000	4800	9600	2000	0.20	8000	2300	5000	780	0.09
<b>R4</b>	16000	6400	12000	2600	0.30	12000	3600	7200	1600	0.20	6000	1900	4000	620	0.09
<b>R5</b>	13000	5200	9600	2200	0.50	10000	3200	5800	1300	0.20	4800	1500	3000	550	0.10
<b>R6</b>	9000	3600	7200	1700	0.50	7000	2200	4300	940	0.30	3600	1100	2200	400	0.10

Depth of cut

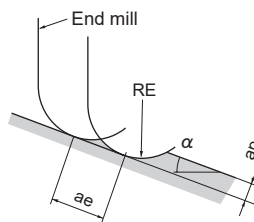


RE:Radius

Note 1)  $\alpha$  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.



ae:Pick Feed

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↳

SOLID END MILLS

# SOLID END MILLS

## MS2MRB

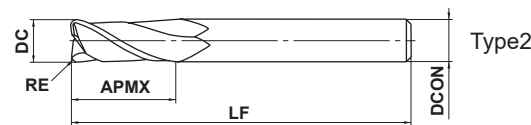
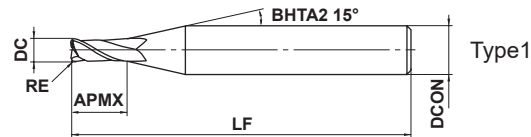
Corner radius end mill, Medium cut length, 2 flute



DC<3

DC≥3

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	Aluminium 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.

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
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

● : Inventory maintained in Japan.

(mm)

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

SQUARE

BALL

RADIUS

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ROUGHING

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SOLID END MILLS

# SOLID END MILLS

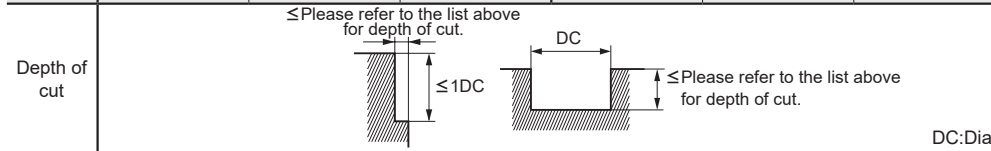
## MS2MRB

Corner radius end mill, Medium cut length, 2 flute

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21			Hardened steel (45—55HRC) AISI H13		
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>0.1</b>	40000	40	0.001	40000	40	0.001
<b>0.2</b>	40000	100	0.002	40000	100	0.002
<b>0.3</b>	40000	200	0.005	40000	200	0.005
<b>0.4</b>	40000	600	0.01	40000	600	0.01
<b>0.5</b>	40000	1000	0.015	40000	960	0.015
<b>0.6</b>	40000	1200	0.02	40000	1200	0.02
<b>0.7</b>	40000	1400	0.02	40000	1400	0.02
<b>0.8</b>	40000	1600	0.03	40000	1600	0.03
<b>0.9</b>	40000	1800	0.04	40000	1600	0.04
<b>1</b>	40000	2000	0.06	32000	1600	0.06
<b>1.5</b>	40000	3000	0.12	32000	1900	0.08
<b>2</b>	30000	3000	0.18	24000	1900	0.10
<b>2.5</b>	24000	2600	0.25	19000	1600	0.13
<b>3</b>	20000	2300	0.30	16000	1400	0.15
<b>4</b>	15000	2000	0.40	12000	1200	0.20
<b>5</b>	12000	1600	0.50	9000	900	0.25
<b>6</b>	10000	1400	0.60	7000	700	0.30
<b>8</b>	8000	1000	0.80	5600	550	0.40
<b>10</b>	6400	900	1.00	4500	500	0.50
<b>12</b>	5400	820	1.00	3800	450	0.50
<b>16</b>	2400	380	3.00	1200	100	0.80
<b>20</b>	1900	320	4.00	1000	80	1.00



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

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SOLID END MILLS

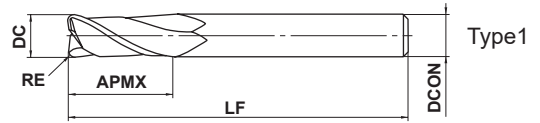
# CRN2MRB

Corner radius, Medium cut length, 2 flute, For copper electrodes



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	Aluminium Alloy
						○	○



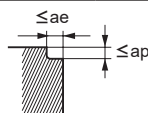
	6 ≤ DC ≤ 12			
	0 - 0.02			
	DCON=6	8 ≤ DCON ≤ 10	DCON=12	
	0 - 0.008	0 - 0.009	0 - 0.011	

● 2 flute corner radius end mill with CRN coating for copper electrode machining.

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
CRN2MRBD0600R020	6	0.2	13	50	6	2	●	1
CRN2MRBD0600R030	6	0.3	13	50	6	2	●	1
CRN2MRBD0600R050	6	0.5	13	50	6	2	●	1
CRN2MRBD0600R100	6	1	13	50	6	2	●	1
CRN2MRBD0800R030	8	0.3	19	60	8	2	●	1
CRN2MRBD0800R050	8	0.5	19	60	8	2	●	1
CRN2MRBD0800R100	8	1	19	60	8	2	●	1
CRN2MRBD1000R030	10	0.3	22	70	10	2	●	1
CRN2MRBD1000R050	10	0.5	22	70	10	2	●	1
CRN2MRBD1000R100	10	1	22	70	10	2	●	1
CRN2MRBD1200R030	12	0.3	26	75	12	2	●	1
CRN2MRBD1200R050	12	0.5	26	75	12	2	●	1
CRN2MRBD1200R100	12	1	26	75	12	2	●	1

## RECOMMENDED CUTTING CONDITIONS

Work Material		Copper, Copper alloys			
Dia. DC (mm)	Corner radius RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut	
				ap (mm)	ae (mm)
6	R0.2, R0.3, R0.5	10000	1400	6	0.6
	R1	10000	1700	6	0.6
8	R0.3, R0.5	8000	1000	8	0.8
	R1	8000	1200	8	0.8
10	R0.3, R0.5	6400	900	10	1.0
	R1	6400	1100	10	1.0
12	R0.3, R0.5	5400	800	12	1.0
	R1	5400	1000	12	1.0



DC: Dia.

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

Note 2) Water-soluble cutting fluid is recommended.

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.

● : Inventory maintained in Japan.

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SOLID END MILLS



# SOLID END MILLS

## CRN2XLRB

Corner radius, Medium cut length, 2 flute, For copper electrodes

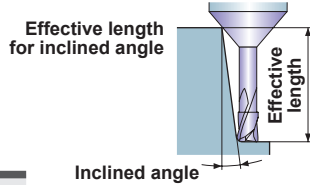
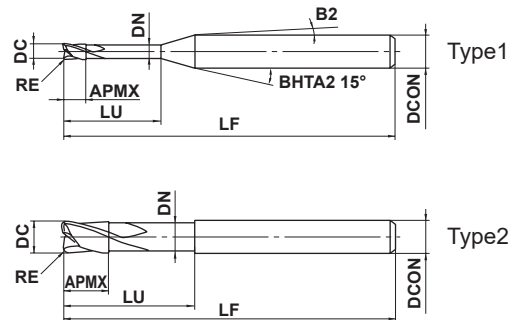


TOOL NEWS

DC<3

DC≥3

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	Aluminium Alloy
						○	○



	0.5 ≤ DC ≤ 6		
	0 - 0.02		
	4 ≤ DCON ≤ 6		
	0 - 0.008		

● 2 flute long neck corner radius end mill with CRN coating for copper electrode 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°
CRN2XLRBD0050R005N04	0.5	0.05	0.5	4	0.46	9.5°	50	4	2	●	1	4.1	4.3	4.6	5
CRN2XLRBD0050R010N04	0.5	0.1	0.5	4	0.46	9.5°	50	4	2	●	1	4.1	4.3	4.6	5
CRN2XLRBD0050R005N06	0.5	0.05	0.5	6	0.46	8°	50	4	2	●	1	6.2	6.4	6.9	7.5
CRN2XLRBD0050R010N06	0.5	0.1	0.5	6	0.46	8°	50	4	2	●	1	6.2	6.4	6.9	7.5
CRN2XLRBD0080R005N06	0.8	0.05	0.8	6	0.76	7.6°	50	4	2	●	1	6.3	6.5	7	7.6
CRN2XLRBD0080R010N06	0.8	0.1	0.8	6	0.76	7.6°	50	4	2	●	1	6.3	6.5	7	7.5
CRN2XLRBD0080R005N08	0.8	0.05	0.8	8	0.76	6.5°	50	4	2	●	1	8.3	8.6	9.3	10
CRN2XLRBD0080R010N08	0.8	0.1	0.8	8	0.76	6.6°	50	4	2	●	1	8.3	8.6	9.3	10
CRN2XLRBD0100R010N08	1	0.1	1	8	0.94	6.3°	50	4	2	●	1	8.5	8.8	9.5	10.2
CRN2XLRBD0100R030N08	1	0.3	1	8	0.94	6.3°	50	4	2	●	1	8.5	8.8	9.5	10.2
CRN2XLRBD0100R010N10	1	0.1	1	10	0.94	5.5°	55	4	2	●	1	10.6	11	11.8	12.7
CRN2XLRBD0100R030N10	1	0.3	1	10	0.94	5.5°	55	4	2	●	1	10.5	10.9	11.8	12.7
CRN2XLRBD0100R010N12	1	0.1	1	12	0.94	4.9°	55	4	2	●	1	12.6	13.1	14.1	15.2
CRN2XLRBD0100R030N12	1	0.3	1	12	0.94	4.9°	55	4	2	●	1	12.6	13.1	14.1	15.2
CRN2XLRBD0150R010N12	1.5	0.1	1.5	12	1.44	4.3°	55	4	2	●	1	12.6	13.1	14.1	15.2
CRN2XLRBD0150R020N12	1.5	0.2	1.5	12	1.44	4.3°	55	4	2	●	1	12.6	13.1	14.1	15.2
CRN2XLRBD0150R030N12	1.5	0.3	1.5	12	1.44	4.3°	55	4	2	●	1	12.6	13.1	14.1	15.2
CRN2XLRBD0150R010N20	1.5	0.1	1.5	20	1.44	2.9°	60	4	2	●	1	20.9	21.7	23.3	*
CRN2XLRBD0150R020N20	1.5	0.2	1.5	20	1.44	2.9°	60	4	2	●	1	20.9	21.7	23.3	*
CRN2XLRBD0150R030N20	1.5	0.3	1.5	20	1.44	3°	60	4	2	●	1	20.9	21.6	23.3	*
CRN2XLRBD0200R010N12	2	0.1	2	12	1.9	3.7°	55	4	2	●	1	12.5	13	14	15.1
CRN2XLRBD0200R020N12	2	0.2	2	12	1.9	3.7°	55	4	2	●	1	12.5	13	14	15.1
CRN2XLRBD0200R030N12	2	0.3	2	12	1.9	3.7°	55	4	2	●	1	12.5	13	13.9	15
CRN2XLRBD0200R050N12	2	0.5	2	12	1.9	3.8°	55	4	2	●	1	12.5	13	13.9	15
CRN2XLRBD0200R010N16	2	0.1	2	16	1.9	2.9°	55	4	2	●	1	16.7	17.3	18.6	*
CRN2XLRBD0200R020N16	2	0.2	2	16	1.9	2.9°	55	4	2	●	1	16.7	17.3	18.6	*
CRN2XLRBD0200R030N16	2	0.3	2	16	1.9	3°	55	4	2	●	1	16.7	17.3	18.5	*
CRN2XLRBD0200R050N16	2	0.5	2	16	1.9	3°	55	4	2	●	1	16.7	17.2	18.5	*
CRN2XLRBD0200R010N20	2	0.1	2	20	1.9	2.5°	60	4	2	●	1	20.8	21.6	23.2	*
CRN2XLRBD0200R020N20	2	0.2	2	20	1.9	2.5°	60	4	2	●	1	20.8	21.5	23.2	*
CRN2XLRBD0200R030N20	2	0.3	2	20	1.9	2.5°	60	4	2	●	1	20.8	21.5	23.1	*
CRN2XLRBD0200R050N20	2	0.5	2	20	1.9	2.5°	60	4	2	●	1	20.8	21.5	23.1	*
CRN2XLRBD0300R020N20	3	0.2	3	20	2.9	3.4°	65	6	2	●	1	20.8	21.5	23.2	25
CRN2XLRBD0300R030N20	3	0.3	3	20	2.9	3.4°	65	6	2	●	1	20.8	21.5	23.1	25

\* No interference

● : Inventory maintained in Japan.

(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°
												CRN2XLRBD0300R050N20	3	0.5	3
CRN2XLRBD0400R020N20	4	0.2	4	20	3.9	2.5°	65	6	2	●	1	20.8	21.5	23.2	*
CRN2XLRBD0400R030N20	4	0.3	4	20	3.9	2.5°	65	6	2	●	1	20.8	21.5	23.1	*
CRN2XLRBD0400R050N20	4	0.5	4	20	3.9	2.5°	65	6	2	●	1	20.8	21.5	23.1	*
CRN2XLRBD0500R020N25	5	0.2	5	25	4.9	1.1°	65	6	2	●	1	26	26.9	*	*
CRN2XLRBD0500R030N25	5	0.3	5	25	4.9	1.1°	65	6	2	●	1	26	26.9	*	*
CRN2XLRBD0500R050N25	5	0.5	5	25	4.9	1.1°	65	6	2	●	1	26	26.9	*	*
CRN2XLRBD0600R020N30	6	0.2	6	30	5.85	—	70	6	2	●	2	*	*	*	*
CRN2XLRBD0600R030N30	6	0.3	6	30	5.85	—	70	6	2	●	2	*	*	*	*
CRN2XLRBD0600R050N30	6	0.5	6	30	5.85	—	70	6	2	●	2	*	*	*	*
CRN2XLRBD0600R100N30	6	1	6	30	5.85	—	70	6	2	●	2	*	*	*	*

\* No interference

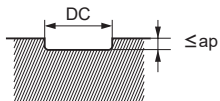
## RECOMMENDED CUTTING CONDITIONS

### ■ Slotting

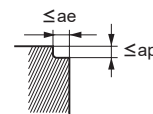
### ■ Contour Cutting

Work Material			Copper, Copper alloys			Copper, Copper alloys			
Dia. DC (mm)	Corner radius RE (mm)	Neck length (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut	
								ap (mm)	ae (mm)
<b>0.5</b>	<b>R0.05, R0.1</b>	<b>4</b>	40000	800	0.005	40000	1500	0.01	0.1
		<b>6</b>	40000	700	0.003	40000	1000	0.005	0.1
<b>0.8</b>	<b>R0.05, R0.1</b>	<b>6</b>	40000	1200	0.02	40000	2500	0.02	0.15
		<b>8</b>	40000	1200	0.015	40000	1600	0.01	0.15
<b>1</b>	<b>R0.1, R0.3</b>	<b>8</b>	40000	2000	0.03	40000	3000	0.03	0.2
		<b>10</b>	35000	1600	0.025	35000	2000	0.025	0.2
		<b>12</b>	30000	1200	0.02	30000	1800	0.02	0.2
<b>1.5</b>	<b>R0.1, R0.2, R0.3</b>	<b>12</b>	30000	1500	0.05	40000	4500	0.04	0.3
		<b>20</b>	20000	1000	0.02	20000	2000	0.02	0.3
<b>2</b>	<b>R0.1, R0.2 R0.3, R0.5</b>	<b>12</b>	30000	1500	0.1	40000	4500	0.08	0.4
		<b>16</b>	30000	1000	0.06	30000	3000	0.05	0.4
		<b>20</b>	20000	600	0.04	20000	2000	0.04	0.4
<b>3</b>	<b>R0.2, R0.3 R0.5</b>	<b>20</b>	20000	2000	0.12	35000	6000	0.1	0.6
		<b>20</b>	20000	2200	0.12	35000	8000	0.1	0.6
<b>4</b>	<b>R0.2, R0.3 R0.5</b>	<b>20</b>	15000	2000	0.25	32000	5000	0.15	0.8
		<b>20</b>	15000	2200	0.25	32000	7000	0.15	0.8
<b>5</b>	<b>R0.2, R0.3 R0.5</b>	<b>25</b>	12000	1500	0.3	22000	5000	0.2	1.0
		<b>25</b>	12000	1700	0.3	22000	7000	0.2	1.0
<b>6</b>	<b>R0.2, R0.3, R0.5 R1</b>	<b>30</b>	10000	1200	0.4	20000	5000	0.25	1.2
		<b>30</b>	10000	1500	0.4	20000	7000	0.25	1.2

Depth of cut



DC: Dia.



DC: Dia.

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

Note 2) Water-soluble cutting fluid is recommended.

Note 3) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

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SOLID END MILLS

# SOLID END MILLS

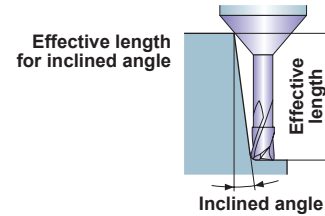
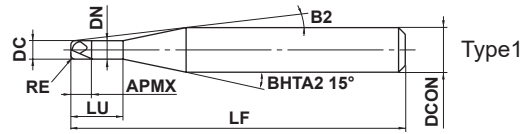
## CBN2XLRB

Corner radius end mill, Medium cut length, 2 flute, Long neck



TOOL NEWS

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	Aluminium Alloy
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	0.05 ≤ RE ≤ 0.5				
	±0.005				
	0.5 ≤ DC ≤ 2				
	0 - 0.010				
	DCON=4				
	0 - 0.005				

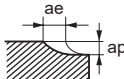
● CBN long neck radius end mill. A wide variation of neck lengths available.

(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

● : Inventory maintained in Japan.

## 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			
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.5</b>	50000	750	0.01	0.2	50000	600	0.01	0.1	40000	400	0.005	0.06
<b>1</b>	38000	1100	0.02	0.3	38000	760	0.01	0.2	25000	400	0.01	0.1
<b>1.5</b>	25000	900	0.03	0.5	25000	700	0.02	0.4	17000	340	0.02	0.2
<b>2</b>	20000	800	0.04	0.7	20000	600	0.03	0.6	12000	300	0.02	0.3
Depth of cut												

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

Note 2) Oil mist coolant is recommended.

Note 3) Cutting condition may be considerably different due to the overhang (milling depth), depth of cut, and machine tools. Please see the above table as a standard.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

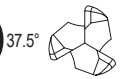
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SOLID END MILLS

# SOLID END MILLS

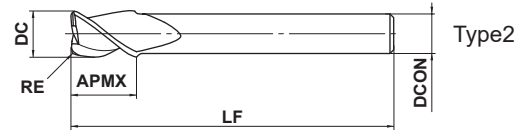
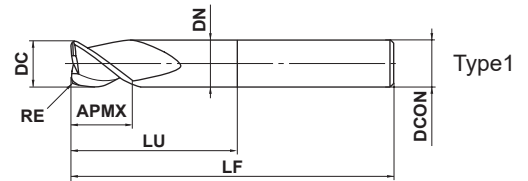
## C3SARB

Corner radius, Short cut length, 3 flute, For aluminium alloy



TOOL NEWS

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	Aluminium Alloy
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	DC ≤ 12	DC > 12			
	0 - 0.020	0 - 0.030			
	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25			
	0 - 0.011	0 - 0.013			

● High efficiency machining for aluminium alloys.

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
C3SARBD1200N0300R100	12	1	15	30	11.4	75	12	3	●	1
C3SARBD1200N0300R320	12	3.2	15	30	11.4	75	12	3	●	1
C3SARBD1200N0400R100	12	1	15	40	11.4	125	12	3	●	1
C3SARBD1200N0400R320	12	3.2	15	40	11.4	125	12	3	●	1
C3SARBD1600N0450R100	16	1	15	45	15.4	125	16	3	●	1
C3SARBD1600N0450R320	16	3.2	15	45	15.4	125	16	3	●	1
C3SARBD1600N0700R100	16	1	15	70	15.4	150	16	3	●	1
C3SARBD1600N0700R320	16	3.2	15	70	15.4	150	16	3	●	1
C3SARBD1800R100	18	1	18	—	—	150	16	3	●	2
C3SARBD1800R320	18	3.2	18	—	—	150	16	3	●	2
C3SARBD2000N0600R100	20	1	20	60	18.0	125	20	3	●	1
C3SARBD2000N0600R320	20	3.2	20	60	18.0	125	20	3	●	1
C3SARBD2000N0600R400	20	4	20	60	18.0	125	20	3	●	1
C3SARBD2000N0850R100	20	1	20	85	18.0	150	20	3	●	1
C3SARBD2000N0850R320	20	3.2	20	85	18.0	150	20	3	●	1
C3SARBD2000N0850R400	20	4	20	85	18.0	150	20	3	●	1
C3SARBD2500N0650R320	25	3.2	20	65	23.0	125	25	3	●	1
C3SARBD2500N0650R400	25	4	20	65	23.0	125	25	3	●	1
C3SARBD2500N0650R500	25	5	20	65	23.0	125	25	3	●	1
C3SARBD2500N0900R320	25	3.2	20	90	23.0	150	25	3	●	1
C3SARBD2500N0900R400	25	4	20	90	23.0	150	25	3	●	1
C3SARBD2500N0900R500	25	5	20	90	23.0	150	25	3	●	1

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>12</b>	13000	5400
<b>16</b>	10000	5400
<b>18</b>	9000	5000
<b>20</b>	8000	5000
<b>25</b>	6000	4500

Depth of cut		
	DC: Dia.	

### ■ Slotting

Work Material	Aluminium alloy	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>12</b>	13000	3200
<b>16</b>	10000	3200
<b>18</b>	9000	3000
<b>20</b>	8000	3000
<b>25</b>	6000	2800

Depth of cut		
	DC: Dia.	

Note 1) Water-soluble cutting fluid is recommended.

Note 2) Climb cutting is recommended for side milling.

Note 3) This table shows the cutting condition with less than 4D overhang length. If more than 4D, spindle speed, feed rate and depth of cut should be reduced.

Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↵

SOLID END MILLS

# SOLID END MILLS

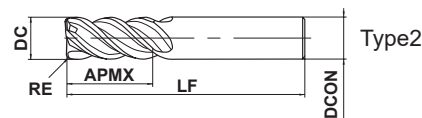
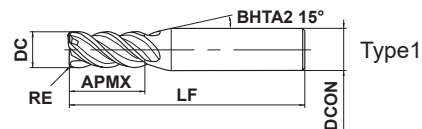
## MPMHVRB

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



TOOL NEWS

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	Aluminium Alloy
○	○	○		○	○	○	



0.1 ≤ RE ≤ 5				
±0.015				
DC ≤ 12	DC > 12			
0 - 0.02	0 - 0.03			
DCON = 4	DCON = 6	DCON = 8		
h5 0 - 0.005	0 - 0.005	0 - 0.006		
h6 DCON = 8 (DC = 10)	DCON = 10 (DC = 12)	DCON = 10	12 ≤ DCON ≤ 16	DCON = 20
0 - 0.009	0 - 0.009	0 - 0.009	0 - 0.011	0 - 0.013

● Irregular helix flutes end mill for reduced vibration when machining stainless steels and carbon steels.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MPMHVRBD0100R010	1	0.1	2.5	45	4	4	●	1
MPMHVRBD0100R020	1	0.2	2.5	45	4	4	●	1
MPMHVRBD0200R010	2	0.1	5	45	4	4	●	1
MPMHVRBD0200R020	2	0.2	5	45	4	4	●	1
MPMHVRBD0200R030	2	0.3	5	45	4	4	●	1
MPMHVRBD0200R050	2	0.5	5	45	4	4	●	1
MPMHVRBD0300R010	3	0.1	7.5	45	6	4	●	1
MPMHVRBD0300R020	3	0.2	7.5	45	6	4	●	1
MPMHVRBD0300R030	3	0.3	7.5	45	6	4	●	1
MPMHVRBD0300R050	3	0.5	7.5	45	6	4	●	1
MPMHVRBD0400R010	4	0.1	10	45	6	4	●	1
MPMHVRBD0400R020	4	0.2	10	45	6	4	●	1
MPMHVRBD0400R030	4	0.3	10	45	6	4	●	1
MPMHVRBD0400R050	4	0.5	10	45	6	4	●	1
MPMHVRBD0400R100	4	1	10	45	6	4	●	1
MPMHVRBD0500R010	5	0.1	12.5	50	6	4	●	1
MPMHVRBD0500R020	5	0.2	12.5	50	6	4	●	1
MPMHVRBD0500R030	5	0.3	12.5	50	6	4	●	1
MPMHVRBD0500R050	5	0.5	12.5	50	6	4	●	1
MPMHVRBD0500R100	5	1	12.5	50	6	4	●	1
MPMHVRBD0600R010	6	0.1	15	60	6	4	●	2
MPMHVRBD0600R020	6	0.2	15	60	6	4	●	2
MPMHVRBD0600R030	6	0.3	15	60	6	4	●	2
MPMHVRBD0600R050	6	0.5	15	60	6	4	●	2
MPMHVRBD0600R100	6	1	15	60	6	4	●	2
MPMHVRBD0800R020	8	0.2	20	70	8	4	●	2
MPMHVRBD0800R030	8	0.3	20	70	8	4	●	2
MPMHVRBD0800R050	8	0.5	20	70	8	4	●	2
MPMHVRBD0800R100	8	1	20	70	8	4	●	2
MPMHVRBD0800R150	8	1.5	20	70	8	4	●	2
MPMHVRBD0800R200	8	2	20	70	8	4	●	2
MPMHVRBD0800R250	8	2.5	20	70	8	4	●	2

● : Inventory maintained in Japan.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MPMHVRBD0800R300	8	3	20	70	8	4	●	2
MPMHVRBD1000R020	10	0.2	25	80	10	4	●	2
MPMHVRBD1000R030	10	0.3	25	80	10	4	●	2
MPMHVRBD1000R050	10	0.5	25	80	10	4	●	2
MPMHVRBD1000R100	10	1	25	80	10	4	●	2
MPMHVRBD1000R150	10	1.5	25	80	10	4	●	2
MPMHVRBD1000R200	10	2	25	80	10	4	●	2
MPMHVRBD1000R250	10	2.5	25	80	10	4	●	2
MPMHVRBD1000R300	10	3	25	80	10	4	●	2
MPMHVRBD1200R030	12	0.3	30	100	12	4	●	2
MPMHVRBD1200R050	12	0.5	30	100	12	4	●	2
MPMHVRBD1200R100	12	1	30	100	12	4	●	2
MPMHVRBD1200R150	12	1.5	30	100	12	4	●	2
MPMHVRBD1200R200	12	2	30	100	12	4	●	2
MPMHVRBD1200R300	12	3	30	100	12	4	●	2
MPMHVRBD1600R030	16	0.3	40	110	16	4	●	2
MPMHVRBD1600R050	16	0.5	40	110	16	4	●	2
MPMHVRBD1600R100	16	1	40	110	16	4	●	2
MPMHVRBD1600R200	16	2	40	110	16	4	●	2
MPMHVRBD1600R300	16	3	40	110	16	4	●	2
MPMHVRBD1600R500	16	5	40	110	16	4	●	2
MPMHVRBD2000R030	20	0.3	50	125	20	4	●	2
MPMHVRBD2000R050	20	0.5	50	125	20	4	●	2
MPMHVRBD2000R100	20	1	50	125	20	4	●	2
MPMHVRBD2000R200	20	2	50	125	20	4	●	2
MPMHVRBD2000R300	20	3	50	125	20	4	●	2
MPMHVRBD2000R500	20	5	50	125	20	4	●	2

SQUARE

BALL

RADIUS

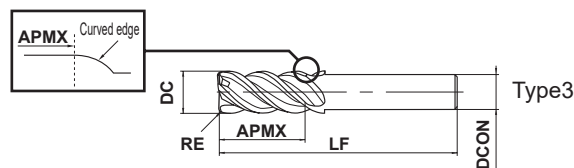
TAPER

BARREL

ROUGHING



SOLID END MILLS



■ Slim Shank

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
MPMHVRBD1000R030S08	10	0.3	25	100	8	4	●	3
MPMHVRBD1000R050S08	10	0.5	25	100	8	4	●	3
MPMHVRBD1000R100S08	10	1	25	100	8	4	●	3
MPMHVRBD1000R200S08	10	2	25	100	8	4	●	3
MPMHVRBD1200R030S10	12	0.3	30	110	10	4	●	3
MPMHVRBD1200R050S10	12	0.5	30	110	10	4	●	3
MPMHVRBD1200R100S10	12	1	30	110	10	4	●	3
MPMHVRBD1200R200S10	12	2	30	110	10	4	●	3
MPMHVRBD1200R300S10	12	3	30	110	10	4	●	3



# SOLID END MILLS

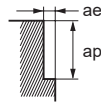
## MPMHVRB

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

### RECOMMENDED CUTTING CONDITIONS

#### ■ Side milling

Work Material	Carbon steel, Alloy steel (180—280HB) Ductile cast iron				Carbon steel, Alloy steel (280—350HB) Pre-hardened steel, Alloy tool steel				Austenitic stainless steel (≤200HB) Titanium alloy				Hardened steel (45—55HRC)			
	AISI 1045, AISI 4140, FCD450				AISI 4340, AISI P21, AISI P20, SKD, SKT				AISI 304, AISI 306, Ti-6Al-4V				AISI H13, AISI L6			
Dia. DC	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>1</b>	38000	910	1.7	0.2	31000	500	1.7	0.2	25000	500	1.7	0.2	18000	290	1.7	0.05
<b>2</b>	21000	1500	3.5	0.4	17000	820	3.5	0.4	14000	640	3.5	0.4	10000	320	3.5	0.1
<b>3</b>	16000	1800	5	0.6	13000	940	5	0.6	11000	880	5	0.6	7400	380	5	0.15
<b>4</b>	12000	1700	7	0.8	9500	950	7	0.8	8000	900	7	0.8	5600	400	7	0.2
<b>5</b>	9500	1800	8.5	1	7600	1100	8.5	1	6400	900	8.5	1	4500	430	8.5	0.25
<b>6</b>	8000	2100	10	1.2	6400	1300	10	1.2	5300	1100	10	1.2	3700	440	10	0.3
<b>8</b>	6000	2000	13.5	1.6	4800	1400	13.5	1.6	4000	1200	13.5	1.6	2800	450	13.5	0.4
<b>10</b>	4800	2100	17	2	3800	1500	17	2	3200	1100	17	2	2200	440	17	0.5
<b>12</b>	4000	1900	20.5	2.4	3200	1400	20.5	2.4	2700	1100	20.5	2.4	1900	380	20.5	0.6
<b>16</b>	3000	1400	27.2	3.2	2400	1100	27.2	3.2	2000	840	27.2	3.2	1400	340	27.2	0.8
<b>20</b>	2400	1200	34	4	1900	840	34	4	1600	670	34	4	1100	260	34	1



Note 1) When using a slim shank with DC=10 or 12, reduce the cutting speed by 60%, the feed rate by 80%, and the depth of cutting ae by 50% from the above conditions.

Note 2) Wet cutting mode is recommended for cutting stainless steels and titanium alloys, and air blow is recommended for carbon steels.

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 workpiece 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

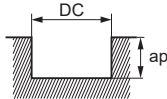


SOLID END MILLS

■ Slotting

Work Material	Carbon steel, Alloy steel (180–280HB) Ductile cast iron			Carbon steel, Alloy steel (280–350HB) Pre-hardened steel, Alloy tool steel			Austenitic stainless steel (≤200HB) Titanium alloy			Hardened steel (45–55HRC)		
	AISI 1045, AISI 4140, FCD450			AISI 4340, AISI P21, AISI P20, SKD, SKT			AISI 304, AISI 306, Ti-6Al-4V			AISI H13, AISI L6		
Dia. DC	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>1</b>	31000	620	0.5	24000	380	0.5	20000	320	0.5	9500	110	0.2
<b>2</b>	17000	650	2	14000	450	2	11000	350	2	4800	130	0.4
<b>3</b>	13000	940	3	10000	660	3	8500	510	3	3200	140	0.6
<b>4</b>	9500	820	4	7600	600	4	6400	460	4	2400	150	0.8
<b>5</b>	7600	910	5	6100	670	5	5100	510	5	1900	170	1
<b>6</b>	6400	860	6	5100	630	6	4200	470	6	1600	190	1.2
<b>8</b>	4800	1000	8	3800	750	8	3200	580	8	1200	190	1.6
<b>10</b>	3800	910	10	3100	680	10	2500	500	10	950	150	2
<b>12</b>	3200	920	12	2500	660	12	2100	500	12	800	160	2.4
<b>16</b>	2400	690	16	1900	500	16	1600	380	16	600	120	3.2
<b>20</b>	1900	550	20	1500	400	20	1300	310	20	480	96	4

Depth of cut		DC: Dia.
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Note 4) Slim shank type is not recommended for slotting.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

# SOLID END MILLS

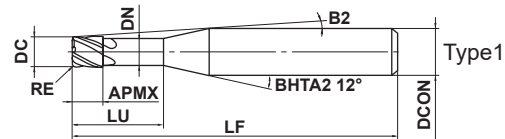
## MPXLRB

Corner radius, short cut length, long neck

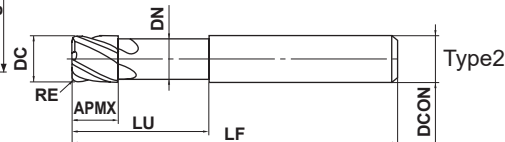
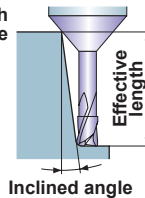


DC ≤ 0.3 DC ≥ 0.4

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	Aluminium Alloy
○	○	○		○	○	○	



Effective length for inclined angle



	0.05 ≤ RE ≤ 0.5				
	±0.005				
	0.2 ≤ DC ≤ 6				
	0 - 0.01				
	4 ≤ DCON ≤ 6				
	0 - 0.005				

● Suitable for high precision and high efficient machining of die & mold.

(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°
MPXLRBD0020R005N005	0.2	0.05	0.2	0.5	0.18	11.4°	50	4	2	●	1	0.5	0.5	0.6	0.7
MPXLRBD0020R005N010	0.2	0.05	0.2	1	0.18	10.8°	50	4	2	●	1	1.0	1.1	1.2	1.3
MPXLRBD0030R005N010	0.3	0.05	0.3	1	0.28	10.8°	50	4	2	●	1	1.0	1.1	1.2	1.3
MPXLRBD0030R005N020	0.3	0.05	0.3	2	0.28	9.8°	50	4	2	●	1	2.1	2.2	2.4	2.7
MPXLRBD0040R005N020	0.4	0.05	0.4	2	0.37	9.8°	50	4	4	●	1	2.1	2.2	2.4	2.6
MPXLRBD0040R005N030	0.4	0.05	0.4	3	0.37	8.9°	50	4	4	●	1	3.1	3.3	3.6	4.0
MPXLRBD0040R005N040	0.4	0.05	0.4	4	0.37	8.2°	50	4	4	●	1	4.2	4.3	4.8	5.3
MPXLRBD0050R005N020	0.5	0.05	0.5	2	0.47	9.7°	50	4	4	●	1	2.1	2.2	2.4	2.6
MPXLRBD0050R005N030	0.5	0.05	0.5	3	0.47	8.9°	50	4	4	●	1	3.1	3.3	3.6	4.0
MPXLRBD0050R005N040	0.5	0.05	0.5	4	0.47	8.1°	50	4	4	●	1	4.2	4.3	4.8	5.3
MPXLRBD0050R005N050	0.5	0.05	0.5	5	0.47	7.5°	50	4	4	●	1	5.2	5.4	6.0	6.6
MPXLRBD0060R005N020	0.6	0.05	0.6	2	0.57	9.7°	50	4	4	●	1	2.1	2.2	2.4	2.6
MPXLRBD0060R005N040	0.6	0.05	0.6	4	0.57	8.1°	50	4	4	●	1	4.2	4.3	4.8	5.3
MPXLRBD0060R005N060	0.6	0.05	0.6	6	0.57	6.9°	50	4	4	●	1	6.2	6.5	7.2	7.9
MPXLRBD0080R005N040	0.8	0.05	0.8	4	0.77	7.9°	50	4	4	●	1	4.2	4.3	4.8	5.3
MPXLRBD0080R005N060	0.8	0.05	0.8	6	0.77	6.8°	50	4	4	●	1	6.2	6.5	7.2	7.9
MPXLRBD0100R005N030	1	0.05	1	3	0.96	8.3°	50	4	4	●	1	3.2	3.4	3.8	4.2
MPXLRBD0100R005N040	1	0.05	1	4	0.96	7.6°	50	4	4	●	1	4.3	4.5	5.0	5.6
MPXLRBD0100R005N050	1	0.05	1	5	0.96	7.0°	50	4	4	●	1	5.4	5.6	6.2	6.9
MPXLRBD0100R005N060	1	0.05	1	6	0.96	6.5°	50	4	4	●	1	6.4	6.7	7.4	8.2
MPXLRBD0100R005N080	1	0.05	1	8	0.96	5.6°	50	4	4	●	1	8.5	8.9	9.8	10.9
MPXLRBD0100R005N100	1	0.05	1	10	0.96	5.0°	50	4	4	●	1	10.6	11.1	12.2	13.5
MPXLRBD0100R005N120	1	0.05	1	12	0.96	4.5°	50	4	4	●	1	12.7	13.3	14.6	16.2
MPXLRBD0100R010N030	1	0.1	1	3	0.96	8.4°	50	4	4	●	1	3.2	3.4	3.8	4.2
MPXLRBD0100R010N040	1	0.1	1	4	0.96	7.6°	50	4	4	●	1	4.3	4.5	5.0	5.5
MPXLRBD0100R010N050	1	0.1	1	5	0.96	7.0°	50	4	4	●	1	5.3	5.6	6.2	6.9
MPXLRBD0100R010N060	1	0.1	1	6	0.96	6.5°	50	4	4	●	1	6.4	6.7	7.4	8.2
MPXLRBD0100R010N080	1	0.1	1	8	0.96	5.6°	50	4	4	●	1	8.5	8.9	9.8	10.8
MPXLRBD0100R010N100	1	0.1	1	10	0.96	5.0°	50	4	4	●	1	10.6	11.1	12.2	13.5
MPXLRBD0100R010N120	1	0.1	1	12	0.96	4.5°	50	4	4	●	1	12.7	13.3	14.6	16.2
MPXLRBD0120R010N100	1.2	0.1	1.2	10	1.16	4.8°	50	4	4	●	1	10.6	11.1	12.2	13.5
MPXLRBD0120R020N100	1.2	0.2	1.2	10	1.16	4.8°	50	4	4	●	1	10.6	11.1	12.2	13.5
MPXLRBD0150R010N060	1.5	0.1	1.5	6	1.44	6.0°	50	4	4	●	1	6.4	6.7	7.3	8.1
MPXLRBD0150R010N120	1.5	0.1	1.5	12	1.44	4.0°	50	4	4	●	1	12.6	13.2	14.5	16.1

● : Inventory maintained in Japan.

(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°
MPXLRBD0150R010N180	1.5	0.1	1.5	18	1.44	3.0°	60	4	4	●	1	18.9	19.7	21.7	24.0
MPXLRBD0150R020N060	1.5	0.2	1.5	6	1.44	6.0°	50	4	4	●	1	6.4	6.7	7.3	8.1
MPXLRBD0150R020N120	1.5	0.2	1.5	12	1.44	4.0°	50	4	4	●	1	12.6	13.2	14.5	16.0
MPXLRBD0150R020N180	1.5	0.2	1.5	18	1.44	3.0°	60	4	4	●	1	18.9	19.7	21.7	*
MPXLRBD0150R030N060	1.5	0.3	1.5	6	1.44	6.1°	50	4	4	●	1	6.3	6.6	7.3	8.0
MPXLRBD0150R030N120	1.5	0.3	1.5	12	1.44	4.0°	50	4	4	●	1	12.6	13.2	14.5	16.0
MPXLRBD0150R030N180	1.5	0.3	1.5	18	1.44	3.0°	60	4	4	●	1	18.9	19.7	21.6	*
MPXLRBD0200R010N080	2	0.1	2	8	1.94	4.5°	50	4	4	●	1	8.5	8.8	9.7	10.8
MPXLRBD0200R010N120	2	0.1	2	12	1.94	3.4°	50	4	4	●	1	12.6	13.2	14.5	16.1
MPXLRBD0200R010N160	2	0.1	2	16	1.94	2.8°	60	4	4	●	1	16.8	17.6	19.3	*
MPXLRBD0200R010N200	2	0.1	2	20	1.94	2.3°	60	4	4	●	1	21.0	21.9	24.1	*
MPXLRBD0200R010N240	2	0.1	2	24	1.94	2.0°	70	4	4	●	1	25.2	26.3	*	*
MPXLRBD0200R020N080	2	0.2	2	8	1.94	4.5°	50	4	4	●	1	8.5	8.8	9.7	10.7
MPXLRBD0200R020N120	2	0.2	2	12	1.94	3.4°	50	4	4	●	1	12.6	13.2	14.5	*
MPXLRBD0200R020N160	2	0.2	2	16	1.94	2.8°	60	4	4	●	1	16.8	17.6	19.3	*
MPXLRBD0200R020N200	2	0.2	2	20	1.94	2.3°	60	4	4	●	1	21.0	21.9	24.0	*
MPXLRBD0200R020N240	2	0.2	2	24	1.94	2.0°	70	4	4	●	1	25.1	26.3	*	*
MPXLRBD0200R030N080	2	0.3	2	8	1.94	4.5°	50	4	4	●	1	8.5	8.8	9.7	10.7
MPXLRBD0200R030N120	2	0.3	2	12	1.94	3.5°	50	4	4	●	1	12.6	13.2	14.5	16.0
MPXLRBD0200R030N160	2	0.3	2	16	1.94	2.8°	60	4	4	●	1	16.8	17.5	19.2	*
MPXLRBD0200R030N200	2	0.3	2	20	1.94	2.3°	60	4	4	●	1	21.0	21.9	24.0	*
MPXLRBD0200R030N240	2	0.3	2	24	1.94	2.0°	70	4	4	●	1	25.1	26.3	*	*
MPXLRBD0300R010N080	3	0.1	3	8	2.9	5.7°	60	6	4	●	1	8.4	8.8	9.6	10.7
MPXLRBD0300R010N120	3	0.1	3	12	2.9	4.5°	60	6	4	●	1	12.6	13.1	14.4	16.0
MPXLRBD0300R010N180	3	0.1	3	18	2.9	3.4°	70	6	4	●	1	18.8	19.7	21.6	23.9
MPXLRBD0300R010N240	3	0.1	3	24	2.9	2.8°	70	6	4	●	1	25.1	26.2	28.8	*
MPXLRBD0300R010N300	3	0.1	3	30	2.9	2.3°	70	6	4	●	1	31.3	32.7	35.9	*
MPXLRBD0300R010N360	3	0.1	3	36	2.9	2.0°	90	6	4	●	1	37.6	39.3	*	*
MPXLRBD0300R020N120	3	0.2	3	12	2.9	4.5°	60	6	4	●	1	12.6	13.1	14.4	15.9
MPXLRBD0300R020N180	3	0.2	3	18	2.9	3.4°	60	6	4	●	1	18.8	19.6	21.6	23.9
MPXLRBD0300R020N240	3	0.2	3	24	2.9	2.8°	70	6	4	●	1	25.1	26.2	28.7	*
MPXLRBD0300R020N300	3	0.2	3	30	2.9	2.3°	70	6	4	●	1	31.3	32.7	35.9	*
MPXLRBD0300R020N360	3	0.2	3	36	2.9	2.0°	90	6	4	●	1	37.6	39.3	43.1	*
MPXLRBD0300R030N120	3	0.3	3	12	2.9	4.5°	60	6	4	●	1	12.5	13.1	14.4	15.9
MPXLRBD0300R030N180	3	0.3	3	18	2.9	3.5°	60	6	4	●	1	18.8	19.6	21.5	23.9
MPXLRBD0300R030N240	3	0.3	3	24	2.9	2.8°	70	6	4	●	1	25.1	26.2	28.7	*
MPXLRBD0300R030N300	3	0.3	3	30	2.9	2.3°	70	6	4	●	1	31.3	32.7	35.9	*
MPXLRBD0300R030N360	3	0.3	3	36	2.9	2.0°	90	6	4	●	1	37.6	39.2	*	*
MPXLRBD0300R050N120	3	0.5	3	12	2.9	4.6°	60	6	4	●	1	12.5	13.1	14.3	15.8
MPXLRBD0300R050N180	3	0.5	3	18	2.9	3.5°	60	6	4	●	1	18.8	19.6	21.5	23.8
MPXLRBD0300R050N240	3	0.5	3	24	2.9	2.8°	70	6	4	●	1	25.1	26.2	28.7	*
MPXLRBD0300R050N300	3	0.5	3	30	2.9	2.3°	70	6	4	●	1	31.3	32.7	35.9	*
MPXLRBD0300R050N360	3	0.5	3	36	2.9	2.0°	90	6	4	●	1	37.6	39.2	*	*
MPXLRBD0400R010N160	4	0.1	4	16	3.9	2.8°	70	6	4	●	1	16.7	17.5	19.2	*
MPXLRBD0400R010N240	4	0.1	4	24	3.9	2.0°	70	6	4	●	1	25.1	26.2	*	*
MPXLRBD0400R010N320	4	0.1	4	32	3.9	1.6°	70	6	4	●	1	33.4	34.9	*	*
MPXLRBD0400R010N480	4	0.1	4	48	3.9	1.1°	90	6	4	●	1	50.1	52.3	*	*
MPXLRBD0400R020N160	4	0.2	4	16	3.9	2.8°	70	6	4	●	1	16.7	17.5	19.2	*
MPXLRBD0400R020N240	4	0.2	4	24	3.9	2.0°	70	6	4	●	1	25.1	26.2	*	*
MPXLRBD0400R020N320	4	0.2	4	32	3.9	1.6°	70	6	4	●	1	33.4	34.9	*	*
MPXLRBD0400R020N480	4	0.2	4	48	3.9	1.1°	90	6	4	●	1	50.1	52.3	*	*
MPXLRBD0400R030N160	4	0.3	4	16	3.9	2.8°	70	6	4	●	1	16.7	17.5	19.1	*

\* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## MPXLRB

Corner radius, short cut length, long neck

(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°
MPXLRBD0400R030N240	4	0.3	4	24	3.9	2.0°	70	6	4	●	1	25.1	26.2	*	*
MPXLRBD0400R030N320	4	0.3	4	32	3.9	1.6°	70	6	4	●	1	33.4	34.9	*	*
MPXLRBD0400R030N480	4	0.3	4	48	3.9	1.1°	90	6	4	●	1	50.1	52.3	*	*
MPXLRBD0400R050N160	4	0.5	4	16	3.9	2.8°	70	6	4	●	1	16.7	17.4	19.1	*
MPXLRBD0400R050N240	4	0.5	4	24	3.9	2.0°	70	6	4	●	1	25.1	26.2	*	*
MPXLRBD0400R050N320	4	0.5	4	32	3.9	1.6°	70	6	4	●	1	33.4	34.9	*	*
MPXLRBD0400R050N480	4	0.5	4	48	3.9	1.1°	90	6	4	●	1	50.1	52.3	*	*
MPXLRBD0600R010N240	6	0.1	6	24	5.85	—	70	6	4	●	2	*	*	*	*
MPXLRBD0600R010N480	6	0.1	6	48	5.85	—	100	6	4	●	2	*	*	*	*
MPXLRBD0600R020N240	6	0.2	6	24	5.85	—	70	6	4	●	2	*	*	*	*
MPXLRBD0600R020N480	6	0.2	6	48	5.85	—	100	6	4	●	2	*	*	*	*
MPXLRBD0600R030N240	6	0.3	6	24	5.85	—	70	6	4	●	2	*	*	*	*
MPXLRBD0600R030N480	6	0.3	6	48	5.85	—	100	6	4	●	2	*	*	*	*
MPXLRBD0600R050N240	6	0.5	6	24	5.85	—	70	6	4	●	2	*	*	*	*
MPXLRBD0600R050N480	6	0.5	6	48	5.85	—	100	6	4	●	2	*	*	*	*

\* No interference

- CARBIDE
- SQUARE
- BALL
- RADIUS
- TAPER
- BARREL
- ROUGHING
- ← SOLID END MILLS

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Carbon steel, Alloy steel (180—280HB) Pre-hardened steel, Alloy Tool Steel, Precipitation hardeningstainless steel (<450HB)				Hardened steel (45—52HRC)			
		AISI 1045, AISI 4140, AISI P21, AISI P20, SKD, SKT, AISI 431, AISI 420				AISI H13, AISI L6			
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	0.5	30000	180	0.003	0.04	30000	150	0.003	0.04
	1	30000	120	0.003	0.04	30000	100	0.003	0.04
0.3	1	30000	210	0.003	0.08	30000	180	0.003	0.08
	2	30000	120	0.003	0.08	30000	100	0.003	0.08
0.4	2	31000	970	0.005	0.10	31000	810	0.005	0.10
	3	31000	790	0.004	0.10	31000	660	0.004	0.10
	4	31000	540	0.003	0.10	31000	450	0.003	0.10
0.5	2	31000	1500	0.006	0.12	31000	1300	0.006	0.12
	3	31000	1300	0.005	0.12	31000	1100	0.005	0.12
	4	31000	970	0.004	0.12	31000	810	0.004	0.12
	5	25000	790	0.004	0.12	25000	660	0.004	0.12
0.6	2	31000	2100	0.020	0.13	31000	1800	0.020	0.13
	4	25000	1300	0.015	0.13	25000	1100	0.015	0.13
	6	20000	790	0.008	0.13	20000	660	0.008	0.13
0.8	4	25000	3200	0.025	0.20	25000	2700	0.025	0.20
	6	20000	2100	0.020	0.20	20000	1800	0.020	0.20
1	3	24000	2400	0.045	0.30	20000	2000	0.045	0.30
	4	24000	1900	0.040	0.30	20000	1600	0.040	0.30
	5	24000	1800	0.035	0.25	20000	1500	0.035	0.25
	6	20000	1400	0.030	0.25	17000	1200	0.030	0.25
	8	20000	1000	0.020	0.20	17000	880	0.020	0.20
	10	15000	800	0.015	0.10	13000	670	0.015	0.10
	12	15000	370	0.010	0.01	13000	310	0.010	0.01
1.2	10	18000	1500	0.030	0.25	15000	1300	0.030	0.25
1.5	6	20000	2400	0.050	0.40	17000	2000	0.050	0.40
	12	15000	1400	0.040	0.30	13000	1200	0.040	0.30
	18	12000	670	0.010	0.15	10000	560	0.010	0.15
2	8	15000	2600	0.050	0.50	13000	2200	0.050	0.50
	12	15000	2100	0.045	0.50	13000	1800	0.045	0.50
	16	14000	1900	0.040	0.35	12000	1600	0.040	0.35
	20	14000	1100	0.015	0.25	12000	960	0.015	0.25
	24	9300	930	0.010	0.20	7800	780	0.010	0.20
3	8	12000	3300	0.100	0.80	10000	2800	0.100	0.80
	12	12000	3100	0.080	0.80	10000	2600	0.080	0.80
	18	11000	3100	0.070	0.70	9600	2600	0.070	0.70
	24	11000	2600	0.060	0.50	9300	2200	0.060	0.50
	30	9000	1300	0.030	0.40	7500	1100	0.030	0.40
	36	6200	910	0.010	0.30	5200	760	0.010	0.30
4	16	9000	3200	0.100	1.00	7500	2700	0.100	1.00
	24	7900	2500	0.085	0.80	6600	2100	0.085	0.80
	32	6900	1600	0.040	0.70	5800	1400	0.040	0.70
	48	4800	740	0.010	0.35	4000	620	0.010	0.35
6	24	5500	2700	0.120	1.50	4600	2263	0.120	1.50
	48	3800	1200	0.050	1.20	3200	1000	0.050	1.20

SQUARE

BALL

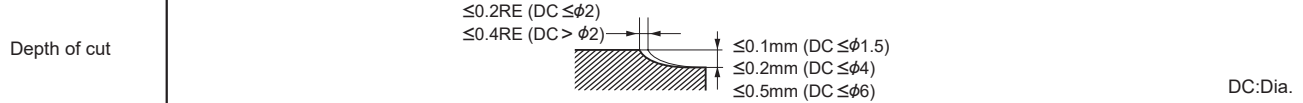
RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS



- 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 shallow, the revolution and feed rate can be increased.
- Note 3) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.
- Note 4) 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.

# SOLID END MILLS

## MPXLRB

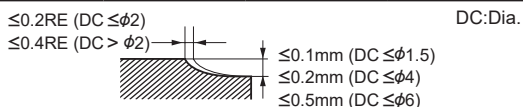
Corner radius, short cut length, long neck

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Work Material		Austenitic stainless steel ( $\leq 200\text{HB}$ ) Titanium alloy ( $< 450\text{HB}$ ) AISI 304, AISI 306, Ti-6Al-4V			
Dia. DC (mm)	Neck length LU (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Depth of cut $a_e$ (mm)
0.2	0.5	33000	170	0.003	0.04
	1	30000	110	0.003	0.04
0.3	1	30000	200	0.003	0.08
	2	30000	110	0.003	0.08
0.4	2	31000	930	0.005	0.10
	3	31000	750	0.004	0.10
	4	31000	510	0.003	0.10
0.5	2	31000	1400	0.006	0.12
	3	31000	1200	0.005	0.12
	4	31000	930	0.004	0.12
	5	25000	750	0.004	0.12
0.6	2	31000	2000	0.020	0.13
	4	25000	1200	0.015	0.13
	6	20000	750	0.008	0.13
0.8	4	25000	3100	0.025	0.20
	6	20000	2000	0.020	0.20
1	3	23000	2300	0.045	0.30
	4	23000	1800	0.040	0.30
	5	23000	1700	0.035	0.25
	6	19000	1300	0.030	0.25
	8	19000	1000	0.020	0.20
	10	14000	770	0.015	0.10
	12	14000	350	0.010	0.01
1.2	10	17000	1400	0.030	0.25
1.5	6	19000	2300	0.050	0.40
	12	14000	1300	0.040	0.30
	18	11000	640	0.010	0.15
2	8	14000	2500	0.050	0.50
	12	14000	2000	0.045	0.50
	16	13000	1800	0.040	0.35
	20	13000	1100	0.015	0.25
	24	8900	890	0.010	0.20
3	8	11000	3200	0.100	0.80
	12	11000	2900	0.080	0.80
	18	11000	2900	0.070	0.70
	24	10000	2500	0.060	0.50
	30	8600	1200	0.030	0.40
	36	5900	870	0.010	0.30
4	16	8600	3100	0.100	1.00
	24	7500	2400	0.085	0.80
	32	6600	1600	0.040	0.70
	48	4600	710	0.010	0.35
6	24	5200	2600	0.120	1.50
	48	3600	1100	0.050	1.20

Depth of cut



Work Material		Copper, Copper alloys			
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	0.5	30000	150	0.003	0.08
	1	30000	100	0.003	0.08
0.3	1	30000	180	0.003	0.16
	2	30000	100	0.003	0.16
0.4	2	31000	810	0.005	0.20
	3	31000	660	0.004	0.20
	4	31000	450	0.003	0.20
0.5	2	31000	1300	0.006	0.24
	3	31000	1100	0.005	0.24
	4	31000	810	0.004	0.24
	5	25000	660	0.004	0.24
0.6	2	31000	1800	0.020	0.26
	4	25000	1100	0.015	0.26
	6	20000	660	0.008	0.26
0.8	4	25000	2700	0.025	0.40
	6	20000	1800	0.020	0.40
1	3	20000	2000	0.045	0.60
	4	20000	1600	0.040	0.60
	5	20000	1500	0.035	0.50
	6	17000	1200	0.030	0.50
	8	17000	880	0.020	0.40
	10	13000	670	0.015	0.20
	12	13000	310	0.010	0.02
1.2	10	15000	1300	0.030	0.50
1.5	6	14700	1700	0.050	0.80
	12	11000	1000	0.040	0.60
	18	8600	480	0.010	0.30
2	8	11000	1900	0.050	1.00
	12	11000	1500	0.045	1.00
	16	10000	1300	0.040	0.70
	20	10000	830	0.015	0.50
	24	6700	670	0.010	0.40
3	8	8600	2400	0.100	1.60
	12	8600	2200	0.080	1.60
	18	8300	2200	0.070	1.40
	24	8000	1900	0.060	1.00
	30	6500	950	0.030	0.80
	36	4500	660	0.010	0.60
4	16	6500	2300	0.100	2.00
	24	5700	1800	0.085	1.60
	32	5000	1200	0.040	1.40
	48	3400	530	0.010	0.70
6	24	4000	1900	0.120	3.00
	48	2700	870	0.050	2.40
Depth of cut	<div style="display: flex; justify-content: space-between;"> <div> <p>≤0.2RE (DC ≤φ2)</p> <p>≤0.4RE (DC &gt; φ2)</p> </div> <div style="text-align: center;"> </div> <div> <p>DC: Dia.</p> <p>≤0.1mm (DC ≤φ1.5)</p> <p>≤0.2mm (DC ≤φ4)</p> <p>≤0.5mm (DC ≤φ6)</p> </div> </div>				



# SOLID END MILLS

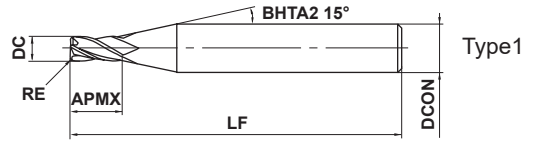
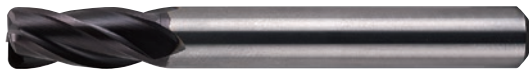
## MS4MRB

Corner radius end mill, Medium cut length, 4 flute



TOOL NEWS

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	Aluminium Alloy
○	○	○	○	○	○	○	○



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

● 4 flute corner radius end mill for general use.

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
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

● : Inventory maintained in Japan.

(mm)

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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

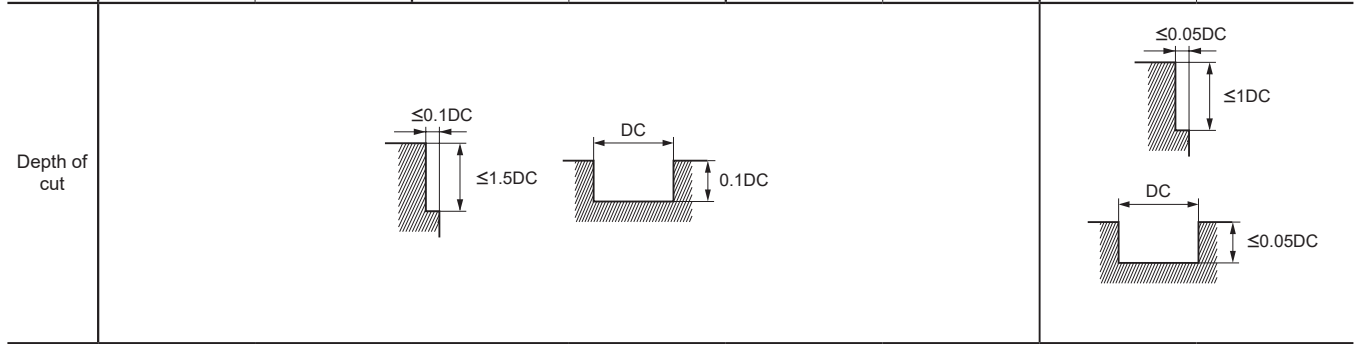
## MS4MRB

Corner radius end mill, Medium cut length, 4 flute

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

Dia. DC (mm)	Carbon steel, Cast iron, Alloy steel (-30HRC)		Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Hardened steel (45-55HRC)	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	16000	1500	10000	800	7400	480	8000	240
<b>4</b>	12000	1800	8000	1000	5600	600	6000	240
<b>5</b>	9600	1800	6400	1000	4400	600	4800	240
<b>6</b>	8000	1800	5300	1000	3700	600	4000	240
<b>8</b>	6000	1600	4000	900	2800	560	3000	240
<b>10</b>	4800	1400	3200	800	2200	500	2400	240
<b>12</b>	4000	1200	2700	700	1800	430	2000	230
<b>16</b>	3000	960	2000	560	1400	360	1500	190
<b>20</b>	2400	800	1600	480	1100	300	1200	170



DC: Dia.

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

Note 2) If the depth of cut is shallow, the revolution and 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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SOLID END MILLS

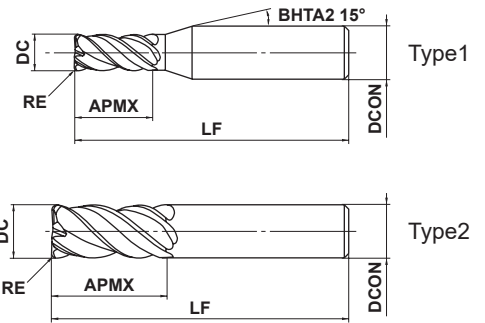
# VQMHV RB

Corner radius end mill, 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	Aluminium Alloy
○	○			○	○	○	



	0.2 ≤ RE ≤ 6.35			
	±0.015			
	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

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

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
VQMHV RBD1600R100	16	1	35	90	16	4	●	2
VQMHV RBD1600R150	16	1.5	35	90	16	4	●	2

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.

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VQMHVRB

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

(mm)

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

● : Inventory maintained in Japan.

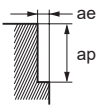
## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
 The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

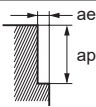
#### High efficiency conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth 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



#### General-purpose conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, Cobalt chromium alloy				
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth 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



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 alloys and heat-resistant alloys 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

↪

SOLID END MILLS

# SOLID END MILLS

## VQMHV RB

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

### RECOMMENDED CUTTING CONDITIONS

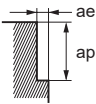
#### Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

#### High efficiency conditions

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

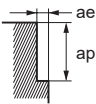
Depth of cut



#### General-purpose conditions

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

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 alloys and heat-resistant alloys 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.

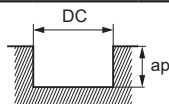
Note 4) When the depth of cut is smaller than shown the revolution and feed rate can be increased.

### Slotting

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

#### High efficiency conditions

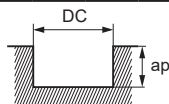
Work Material	Carbon steel, Alloy steel, Mild steel				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	AISI 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			
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



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 steels, Titanium alloys				Hardened stainless steels, Cobalt chromium alloy				Copper, Copper alloy				Heat resistant alloys			
	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			
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



DC:Dia.

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Note 2) Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.



# SOLID END MILLS

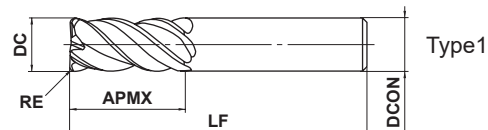
## VQMHRBF

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



TOOL NEWS

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	Aluminium Alloy
○	○			○	○	○	



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

←

SOLID END MILLS

	$0.3 \leq RE \leq 3$				
	$\pm 0.015$				
	$DC \leq 12$	$DC > 12$			
	$0$	$0$			
	$- 0.02$	$- 0.03$			
	$DCON = 6$	$8 \leq DCON \leq 10$	$12 \leq DCON \leq 16$		
	$0$	$0$	$0$		
	$- 0.008$	$- 0.009$	$- 0.011$		

- 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.

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHRBFD0600R030	6	0.3	13	50	6	4	●	1
VQMHRBFD0600R050	6	0.5	13	50	6	4	●	1
VQMHRBFD0600R100	6	1	13	50	6	4	●	1
VQMHRBFD0800R050	8	0.5	19	60	8	4	●	1
VQMHRBFD0800R100	8	1	19	60	8	4	●	1
VQMHRBFD1000R030	10	0.3	22	70	10	4	●	1
VQMHRBFD1000R050	10	0.5	22	70	10	4	●	1
VQMHRBFD1000R100	10	1	22	70	10	4	●	1
VQMHRBFD1000R200	10	2	22	70	10	4	●	1
VQMHRBFD1200R100	12	1	26	75	12	4	●	1
VQMHRBFD1200R200	12	2	26	75	12	4	●	1
VQMHRBFD1200R300	12	3	26	75	12	4	●	1
VQMHRBFD1600R100	16	1	35	90	16	4	●	1
VQMHRBFD1600R200	16	2	35	90	16	4	●	1

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.


● : Inventory maintained in Japan.

# RECOMMENDED CUTTING CONDITIONS

## ■ Side milling

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Hardened stainless steels, Cobalt chromium alloy					Copper, Copper alloy					Heat resistant alloys				
	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				
Dia. DC (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth 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

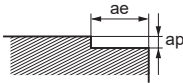
Depth of cut



## ■ Bottom face milling

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Hardened stainless steels, Cobalt chromium alloy					Copper, Copper alloy					Heat resistant alloys				
	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				
Dia. DC (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting speed (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth 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



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Note 2) Effective cutting of stainless steel, titanium alloys and heat-resistant alloys 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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## VFMHVRBCH

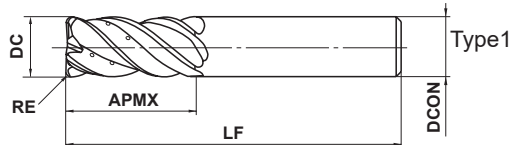
Corner radius end mill, Medium cut length, 4 flute, Irregular helix flutes, with multiple internal through coolant holes



TOOL NEWS

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	Aluminium Alloy
○	○			◎	◎		

### CoolStar END MILLS



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

	$1 \leq RE \leq 3$ $\pm 0.015$				
	$16 \leq DC \leq 20$ $0$ $- 0.03$				
	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.

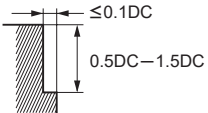
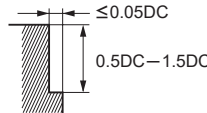
(mm)

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

● : Inventory maintained in Japan.

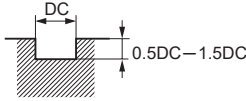
## RECOMMENDED CUTTING CONDITIONS

### Side milling

Dia. DC (mm)	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 alloys Inconel718	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>16</b>	3000	1140	2000	560	800	110
<b>20</b>	2400	860	1600	510	600	100
Depth of cut						

DC: Dia.

### Slotting

Dia. DC (mm)	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	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>16</b>	2400	670	1400	380	1400	170
<b>20</b>	1900	610	1100	350	1100	130
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 workpiece 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.

# SOLID END MILLS

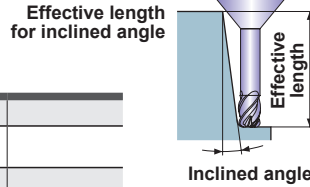
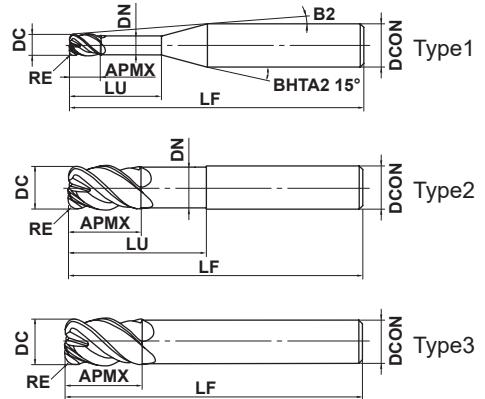
## VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes



TOOL NEWS

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	Aluminium Alloy
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	DC ≤ 10	DC > 10		
	±0.007	±0.01		
	DC ≤ 12	DC > 12		
	<sup>0</sup> / <sub>-0.02</sub>	<sup>0</sup> / <sub>-0.03</sub>		
	DCON=6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>	

● 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
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	*	*

\* No interference

● : Inventory maintained in Japan.

(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°
												VFHVRBD0400R05N048	4	0.5	4
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

# SOLID END MILLS

## VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes

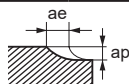
CARBIDE

### RECOMMENDED CUTTING CONDITIONS

#### High speed milling

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							
Dia. DC (mm)	Corner R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	0.2	4	40000	7200	0.04	0.45	33000	5100	0.03	0.45	27000	4100	0.025	0.45	20000	1800	0.013	0.45
1	0.2	6	40000	6500	0.03	0.45	33000	4600	0.022	0.45	27000	3700	0.018	0.45	20000	1600	0.01	0.45
1	0.2	8	32000	4500	0.022	0.45	27000	3200	0.018	0.45	21000	2600	0.012	0.45	16000	1100	0.008	0.45
1	0.2	10	24000	2700	0.015	0.45	20000	1900	0.01	0.45	16000	1500	0.008	0.45	12000	700	0.006	0.45
1	0.2	15	16000	1200	0.008	0.45	14000	700	0.005	0.45	12000	500	0.003	0.45	10000	400	0.003	0.45
1	0.2	20	14000	1000	0.005	0.45	12000	600	0.004	0.45	10000	400	0.002	0.45	9000	300	0.002	0.45
1.5	0.3	4	32000	10000	0.1	0.65	27000	7100	0.08	0.65	21000	5700	0.06	0.65	16000	2500	0.03	0.65
1.5	0.3	6	32000	7800	0.08	0.65	27000	5500	0.06	0.65	21000	4200	0.05	0.65	16000	2000	0.025	0.65
1.5	0.3	10	27000	5700	0.05	0.65	22000	4000	0.035	0.65	18000	3000	0.03	0.65	14000	1400	0.014	0.65
1.5	0.3	15	22000	3200	0.03	0.65	18000	2300	0.025	0.65	15000	1700	0.018	0.65	11000	1000	0.009	0.65
1.5	0.3	20	16000	1400	0.02	0.65	14000	1200	0.016	0.65	13000	1000	0.012	0.65	9000	700	0.007	0.65
1.5	0.3	25	13000	1000	0.015	0.65	11000	800	0.012	0.65	10000	700	0.009	0.65	7500	500	0.005	0.65
1.5	0.3	30	13000	900	0.01	0.65	11000	700	0.008	0.65	10000	600	0.006	0.65	7500	400	0.004	0.65
2	0.5	6	24000	10000	0.1	0.75	20000	7100	0.08	0.75	16000	5700	0.06	0.75	12000	2500	0.03	0.75
2	0.5	10	24000	10000	0.08	0.75	20000	7100	0.06	0.75	16000	5700	0.05	0.75	12000	2500	0.025	0.75
2	0.5	15	20000	7000	0.05	0.75	17000	5000	0.04	0.75	13000	3200	0.03	0.75	10000	1800	0.016	0.75
2	0.5	20	20000	3600	0.04	0.75	17000	2600	0.03	0.75	13000	1800	0.025	0.75	10000	900	0.012	0.75
2	0.5	25	16000	1800	0.03	0.75	14000	1400	0.025	0.75	12000	1100	0.02	0.75	9000	720	0.01	0.75
2	0.5	30	16000	1400	0.025	0.75	14000	1200	0.02	0.75	12000	900	0.016	0.75	9000	650	0.008	0.75
2	0.5	35	13000	1100	0.02	0.75	11000	800	0.018	0.75	10000	700	0.014	0.75	7000	500	0.007	0.75
2	0.5	40	13000	1000	0.02	0.75	11000	700	0.015	0.75	10000	600	0.012	0.75	7000	400	0.006	0.75
3	0.5	10	16000	11000	0.12	1.5	13000	7800	0.09	1.5	11000	6300	0.07	1.5	8000	2800	0.04	1.5
3	0.5	15	16000	9000	0.11	1.5	13000	6400	0.08	1.5	11000	5100	0.06	1.5	8000	2300	0.04	1.5
3	0.5	20	13000	7200	0.09	1.5	11000	5100	0.07	1.5	8700	4000	0.05	1.5	6500	1800	0.03	1.5
3	0.5	30	13000	5700	0.06	1.5	11000	4000	0.05	1.5	8700	3000	0.04	1.5	6500	1400	0.02	1.5
3	0.8	10	16000	11000	0.24	1	13000	7800	0.19	1	11000	6300	0.14	1	8000	2800	0.07	1
3	0.8	15	16000	9000	0.22	1	13000	6400	0.17	1	11000	5100	0.13	1	8000	2300	0.07	1
3	0.8	20	13000	7200	0.19	1	11000	5100	0.15	1	8700	4000	0.11	1	6500	1800	0.06	1
3	0.8	30	13000	5700	0.12	1	11000	4000	0.09	1	8700	3000	0.07	1	6500	1400	0.04	1
3	0.8	40	11000	3600	0.08	1	9100	2600	0.06	1	7400	2000	0.05	1	5500	1000	0.025	1
3	0.8	50	8000	2600	0.07	1	6600	1800	0.05	1	5800	1500	0.04	1	4600	800	0.02	1
4	0.5	12	8400	6000	0.15	2	7000	4300	0.12	2	5600	3400	0.09	2	4200	1500	0.05	2
4	0.5	20	8400	6000	0.14	2	7000	4300	0.11	2	5600	3400	0.08	2	4200	1500	0.04	2
4	0.5	30	6900	4900	0.12	2	5700	3500	0.09	2	4600	2800	0.07	2	3500	1200	0.03	2
4	0.5	48	5600	2000	0.07	2	4600	1400	0.05	2	3800	1100	0.04	2	2800	500	0.02	2
4	1	12	12000	12000	0.3	1.5	10000	8500	0.23	1.5	8000	6800	0.18	1.5	6000	3000	0.1	1.5
4	1	20	12000	12000	0.27	1.5	10000	8500	0.21	1.5	8000	6800	0.16	1.5	6000	3000	0.08	1.5
4	1	30	10000	9900	0.24	1.5	8300	7000	0.19	1.5	6700	5600	0.14	1.5	5000	2500	0.07	1.5
6	0.5	18	4000	3900	0.15	3.5	3300	2800	0.12	3.5	2700	2200	0.09	3.5	2000	1000	0.05	3.5
6	0.5	30	4000	3900	0.14	3.5	3300	2800	0.11	3.5	2700	2200	0.08	3.5	2000	1000	0.04	3.5
6	1	18	8000	13000	0.5	3	6600	9200	0.4	3	5400	7400	0.3	3	4000	3300	0.15	3
6	1	30	8000	13000	0.45	3	6600	9200	0.35	3	5400	7400	0.27	3	4000	3300	0.14	3
6	1	54	6600	11000	0.25	3	5500	7800	0.2	3	4400	6300	0.15	3	3300	2800	0.08	3
6	1.5	18	8000	13000	0.5	2	6600	9200	0.4	2	5400	7400	0.3	2	4000	3300	0.15	2
6	1.5	30	8000	13000	0.45	2	6600	9200	0.35	2	5400	7400	0.27	2	4000	3300	0.14	2
6	1.5	42	6600	11000	0.4	2	5500	7800	0.3	2	4400	6300	0.24	2	3300	2800	0.12	2
6	1.5	54	6600	11000	0.25	2	5500	7800	0.2	2	4400	6300	0.15	2	3300	2800	0.08	2
6	2	18	8000	13000	0.5	1.5	6600	9200	0.4	1.5	5400	7400	0.3	1.5	4000	3300	0.15	1.5
6	2	30	8000	13000	0.45	1.5	6600	9200	0.35	1.5	5400	7400	0.27	1.5	4000	3300	0.14	1.5

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.

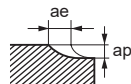
Note 3) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

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 workpiece 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.



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			
Dia. DC (mm)	Corner R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>7</b>	<b>1.5</b>	–	6800	13000	0.5	3	5600	9200	0.4	3	4600	7400	0.3	3	3400	3300	0.15	3
<b>8</b>	<b>0.5</b>	<b>24</b>	3000	3900	0.18	5	2500	2800	0.14	5	2000	2200	0.11	5	1500	1000	0.05	5
<b>8</b>	<b>0.5</b>	<b>40</b>	3000	3900	0.16	5	2500	2800	0.12	5	2000	2200	0.1	5	1500	1000	0.05	5
<b>8</b>	<b>1</b>	<b>24</b>	4200	6500	0.3	4.5	3500	4600	0.23	4.5	2800	3700	0.18	4.5	2100	1600	0.09	4.5
<b>8</b>	<b>1</b>	<b>40</b>	4200	6500	0.27	4.5	3500	4600	0.21	4.5	2800	3700	0.16	4.5	2100	1600	0.08	4.5
<b>8</b>	<b>2</b>	<b>24</b>	6000	13000	0.6	3	5000	9200	0.46	3	4000	7400	0.36	3	3000	3300	0.18	3
<b>8</b>	<b>2</b>	<b>40</b>	6000	13000	0.54	3	5000	9200	0.42	3	4000	7400	0.32	3	3000	3300	0.16	3
<b>8</b>	<b>2</b>	<b>56</b>	5000	11000	0.48	3	4200	7800	0.37	3	3400	6300	0.3	3	2500	2800	0.14	3
<b>8</b>	<b>2</b>	<b>72</b>	5000	11000	0.3	3	4200	7800	0.23	3	3400	6300	0.2	3	2500	2800	0.09	3
<b>9</b>	<b>2</b>	–	5300	13000	0.6	3.5	4400	9200	0.46	3.5	3600	7400	0.36	3.5	2700	3300	0.18	3.5
<b>10</b>	<b>0.5</b>	<b>30</b>	2400	3900	0.18	6.5	2000	2800	0.14	6.5	1600	2200	0.11	6.5	1200	1000	0.05	6.5
<b>10</b>	<b>0.5</b>	<b>50</b>	2400	3900	0.16	6.5	2000	2800	0.12	6.5	1600	2200	0.1	6.5	1200	1000	0.05	6.5
<b>10</b>	<b>1</b>	<b>30</b>	3300	6500	0.3	6	2700	4600	0.23	6	2200	3700	0.18	6	1700	1600	0.09	6
<b>10</b>	<b>1</b>	<b>50</b>	3300	6500	0.27	6	2700	4600	0.21	6	2200	3700	0.16	6	1700	1600	0.08	6
<b>10</b>	<b>2</b>	<b>30</b>	4800	13000	0.6	4.5	4000	9200	0.46	4.5	3200	7400	0.36	4.5	2400	3300	0.18	4.5
<b>10</b>	<b>2</b>	<b>50</b>	4800	13000	0.54	4.5	4000	9200	0.42	4.5	3200	7400	0.32	4.5	2400	3300	0.16	4.5
<b>10</b>	<b>2</b>	<b>70</b>	4000	11000	0.48	4.5	3300	7800	0.37	4.5	2700	6300	0.3	4.5	2000	2800	0.14	4.5
<b>10</b>	<b>2</b>	<b>90</b>	4000	11000	0.48	4.5	3300	7800	0.37	4.5	2700	6300	0.3	4.5	2000	2800	0.14	4.5
<b>11</b>	<b>2</b>	–	4300	12000	0.6	5	3600	8500	0.46	5	2900	6800	0.36	5	2200	3000	0.18	5
<b>12</b>	<b>0.5</b>	<b>36</b>	2000	3600	0.27	8	1700	2600	0.21	8	1300	2100	0.14	8	1000	900	0.07	8
<b>12</b>	<b>0.5</b>	<b>60</b>	2000	3600	0.24	8	1700	2600	0.18	8	1300	2100	0.12	8	1000	900	0.06	8
<b>12</b>	<b>1</b>	<b>36</b>	2400	4800	0.36	7.5	2000	3400	0.28	7.5	1600	2700	0.18	7.5	1200	1200	0.09	7.5
<b>12</b>	<b>1</b>	<b>60</b>	2400	4800	0.32	7.5	2000	3400	0.25	7.5	1600	2700	0.16	7.5	1200	1200	0.08	7.5
<b>12</b>	<b>2</b>	<b>36</b>	4000	12000	0.9	6	3300	8500	0.7	6	2700	6800	0.45	6	2000	3000	0.23	6
<b>12</b>	<b>2</b>	<b>60</b>	4000	12000	0.8	6	3300	8500	0.6	6	2700	6800	0.4	6	2000	3000	0.2	6
<b>12</b>	<b>2</b>	<b>84</b>	3300	9900	0.7	6	2700	7000	0.55	6	2200	5600	0.36	6	1700	2500	0.18	6
<b>12</b>	<b>2</b>	<b>108</b>	3300	9900	0.45	6	2700	7000	0.35	6	2200	5600	0.23	6	1700	2500	0.11	6
<b>12</b>	<b>3</b>	<b>36</b>	4000	12000	0.9	4.5	3300	8500	0.7	4.5	2700	6800	0.45	4.5	2000	3000	0.23	4.5
<b>12</b>	<b>3</b>	<b>60</b>	4000	12000	0.8	4.5	3300	8500	0.6	4.5	2700	6800	0.4	4.5	2000	3000	0.2	4.5
<b>13</b>	<b>3</b>	–	3700	12000	0.9	5	3100	8500	0.7	5	2500	6800	0.45	5	1900	3000	0.23	5
<b>16</b>	<b>0.5</b>	<b>42</b>	1500	3000	0.27	11	1200	2100	0.21	11	1000	1700	0.12	11	750	750	0.05	11
<b>16</b>	<b>2</b>	<b>42</b>	2100	5000	0.45	9	1700	3600	0.35	9	1400	2900	0.2	9	1100	1300	0.08	9
<b>16</b>	<b>3</b>	<b>42</b>	3000	10000	0.9	7.5	2500	7100	0.7	7.5	2000	5700	0.4	7.5	1500	2500	0.15	7.5
<b>16</b>	<b>3</b>	<b>80</b>	3000	10000	0.8	7.5	2500	7100	0.6	7.5	2000	5700	0.37	7.5	1500	2500	0.14	7.5
<b>16</b>	<b>3</b>	<b>120</b>	2500	8300	0.7	7.5	2100	5900	0.55	7.5	1700	4700	0.32	7.5	1300	2100	0.12	7.5

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 moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

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# SOLID END MILLS

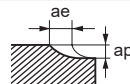
## VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes

### 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 No 35 B, AISI P20				AISI H13, AISI W1-10, AISI P21				AISI H13				AISI D2			
Dia. DC (mm)	Corner R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	0.2	4	24000	2200	0.08	0.45	20000	1500	0.07	0.45	16000	1200	0.05	0.45	12000	550	0.025	0.45
1	0.2	6	24000	2000	0.07	0.45	20000	1400	0.05	0.45	16000	1100	0.04	0.45	12000	500	0.02	0.45
1	0.2	8	19000	1400	0.05	0.45	16000	1000	0.04	0.45	13000	800	0.03	0.45	9500	350	0.016	0.45
1	0.2	10	14000	800	0.04	0.45	12000	600	0.03	0.45	9000	400	0.025	0.45	7000	200	0.012	0.45
1	0.2	15	16000	1200	0.008	0.45	14000	700	0.005	0.45	12000	500	0.003	0.45	10000	400	0.003	0.45
1	0.2	20	14000	1000	0.005	0.45	12000	600	0.004	0.45	10000	400	0.002	0.45	9000	300	0.002	0.45
1.5	0.3	4	19000	3000	0.2	0.65	16000	2100	0.16	0.65	13000	1700	0.12	0.65	9500	750	0.06	0.65
1.5	0.3	6	19000	2300	0.16	0.65	16000	1600	0.13	0.65	13000	1300	0.1	0.65	9500	580	0.05	0.65
1.5	0.3	10	16000	1700	0.1	0.65	13000	1200	0.07	0.65	11000	1000	0.05	0.65	8000	430	0.03	0.65
1.5	0.3	15	13000	1000	0.06	0.65	11000	700	0.05	0.65	9000	600	0.04	0.65	6500	250	0.018	0.65
1.5	0.3	20	16000	1400	0.02	0.65	14000	1200	0.016	0.65	13000	1000	0.012	0.65	9000	700	0.007	0.65
1.5	0.3	25	13000	1000	0.015	0.65	11000	800	0.012	0.65	10000	700	0.009	0.65	7500	500	0.005	0.65
1.5	0.3	30	13000	900	0.01	0.65	11000	700	0.008	0.65	10000	600	0.006	0.65	7500	400	0.004	0.65
2	0.5	6	14000	3000	0.2	0.75	12000	2100	0.16	0.75	9400	1700	0.12	0.75	7000	750	0.06	0.75
2	0.5	10	14000	3000	0.16	0.75	12000	2100	0.13	0.75	9400	1700	0.1	0.75	7000	750	0.05	0.75
2	0.5	15	12000	2100	0.1	0.75	10000	1500	0.08	0.75	8000	1200	0.06	0.75	6000	530	0.03	0.75
2	0.5	20	12000	1100	0.08	0.75	10000	800	0.06	0.75	8000	600	0.05	0.75	6000	280	0.025	0.75
2	0.5	25	16000	1800	0.03	0.75	14000	1400	0.025	0.75	12000	1100	0.02	0.75	9000	720	0.01	0.75
2	0.5	30	16000	1400	0.025	0.75	14000	1200	0.02	0.75	12000	900	0.016	0.75	9000	650	0.008	0.75
2	0.5	35	13000	1100	0.02	0.75	11000	800	0.018	0.75	10000	700	0.014	0.75	7000	500	0.007	0.75
2	0.5	40	13000	1000	0.02	0.75	11000	700	0.015	0.75	10000	600	0.012	0.75	7000	400	0.006	0.75
3	0.5	10	9600	3300	0.24	1.5	8000	2300	0.2	1.5	6400	1800	0.14	1.5	4800	830	0.07	1.5
3	0.5	15	9600	2700	0.22	1.5	8000	1900	0.17	1.5	6400	1500	0.13	1.5	4800	680	0.06	1.5
3	0.5	20	7800	2200	0.18	1.5	6500	1500	0.14	1.5	5200	1200	0.11	1.5	3900	550	0.05	1.5
3	0.5	30	7800	1700	0.12	1.5	6500	1200	0.1	1.5	5200	1000	0.07	1.5	3900	430	0.04	1.5
3	0.8	10	9600	3300	0.5	1	8000	2300	0.4	1	6400	1800	0.3	1	4800	830	0.14	1
3	0.8	15	9600	2700	0.5	1	8000	1900	0.35	1	6400	1500	0.25	1	4800	680	0.13	1
3	0.8	20	7800	2200	0.4	1	6500	1500	0.3	1	5200	1200	0.23	1	3900	550	0.11	1
3	0.8	30	7800	1700	0.24	1	6500	1200	0.2	1	5200	1000	0.14	1	3900	430	0.05	1
3	0.8	40	11000	3600	0.08	1	9100	2600	0.06	1	7400	2000	0.05	1	5500	1000	0.025	1
3	0.8	50	8000	2600	0.07	1	6600	1800	0.05	1	5800	1500	0.04	1	4600	800	0.02	1
4	0.5	12	5000	1800	0.3	2	4200	1300	0.24	2	3400	1000	0.18	2	2500	450	0.06	2
4	0.5	20	5000	1800	0.3	2	4200	1300	0.22	2	3400	1000	0.17	2	2500	450	0.06	2
4	0.5	30	4100	1500	0.24	2	3400	1100	0.19	2	2700	840	0.14	2	2100	380	0.05	2
4	0.5	48	5600	2000	0.07	2	4600	1400	0.05	2	3800	1100	0.04	2	2800	500	0.02	2
4	1	12	7200	3600	0.6	1.5	6000	2500	0.5	1.5	4800	2000	0.36	1.5	3600	900	0.12	1.5
4	1	20	7200	3600	0.6	1.5	6000	2500	0.4	1.5	4800	2000	0.32	1.5	3600	900	0.11	1.5
4	1	30	6000	3000	0.5	1.5	5000	2100	0.4	1.5	4000	1700	0.3	1.5	3000	750	0.1	1.5
6	0.5	18	2400	1200	0.3	3.5	2000	840	0.24	3.5	1600	670	0.18	3.5	1200	300	0.06	3.5
6	0.5	30	2400	1200	0.3	3.5	2000	840	0.22	3.5	1600	670	0.17	3.5	1200	300	0.06	3.5
6	1	18	4800	3900	1	3	4000	2700	0.8	3	3200	2200	0.6	3	2400	980	0.2	3
6	1	30	4800	3900	0.9	3	4000	2700	0.7	3	3200	2200	0.5	3	2400	980	0.18	3
6	1	54	4000	3300	0.5	3	3300	2300	0.4	3	2700	1800	0.3	3	2000	830	0.1	3
6	1.5	18	4800	3900	1	2	4000	2700	0.8	2	3200	2200	0.6	2	2400	980	0.2	2
6	1.5	30	4800	3900	0.9	2	4000	2700	0.7	2	3200	2200	0.5	2	2400	980	0.18	2
6	1.5	42	4000	3300	0.8	2	3300	2300	0.6	2	2700	1800	0.5	2	2000	830	0.16	2
6	1.5	54	4000	3300	0.5	2	3300	2300	0.4	2	2700	1800	0.3	2	2000	830	0.1	2
6	2	18	4800	3900	1	1.5	4000	2700	0.8	1.5	3200	2200	0.6	1.5	2400	980	0.2	1.5
6	2	30	4800	3900	0.9	1.5	4000	2700	0.7	1.5	3200	2200	0.5	1.5	2400	980	0.18	1.5

Depth of cut



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

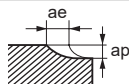
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			AISI 1050, AISI No 35 B, AISI P20				AISI H13, AISI W1-10, AISI P21				AISI H13				AISI D2			
Dia. DC (mm)	Corner R RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>7</b>	<b>1.5</b>	<b>-</b>	4100	3900	1	3	3400	2700	0.8	3	2700	2200	0.6	3	2100	980	0.2	3
<b>8</b>	<b>0.5</b>	<b>24</b>	1800	1200	0.35	5	1500	840	0.3	5	1200	670	0.2	5	900	300	0.07	5
<b>8</b>	<b>0.5</b>	<b>40</b>	1800	1200	0.3	5	1500	840	0.25	5	1200	670	0.2	5	900	300	0.06	5
<b>8</b>	<b>1</b>	<b>24</b>	2500	2000	0.6	4.5	2100	1400	0.5	4.5	1700	1100	0.4	4.5	1300	500	0.12	4.5
<b>8</b>	<b>1</b>	<b>40</b>	2500	2000	0.5	4.5	2100	1400	0.4	4.5	1700	1100	0.3	4.5	1300	500	0.11	4.5
<b>8</b>	<b>2</b>	<b>24</b>	3600	3900	1.2	3	3000	2700	1	3	2400	2200	0.7	3	1800	980	0.24	3
<b>8</b>	<b>2</b>	<b>40</b>	3600	3900	1.1	3	3000	2700	0.9	3	2400	2200	0.7	3	1800	980	0.22	3
<b>8</b>	<b>2</b>	<b>56</b>	3000	3300	1	3	2500	2300	0.8	3	2000	1800	0.6	3	1500	830	0.2	3
<b>8</b>	<b>2</b>	<b>72</b>	3000	3300	0.6	3	2500	2300	0.5	3	2000	1800	0.4	3	1500	830	0.12	3
<b>9</b>	<b>2</b>	<b>-</b>	3200	3900	1.2	3.5	2700	2700	1	3.5	2100	2200	0.7	3.5	1600	980	0.24	3.5
<b>10</b>	<b>0.5</b>	<b>30</b>	1400	1200	0.35	6.5	1200	840	0.3	6.5	940	670	0.2	6.5	700	300	0.07	6.5
<b>10</b>	<b>0.5</b>	<b>50</b>	1400	1200	0.3	6.5	1200	840	0.25	6.5	940	670	0.2	6.5	700	300	0.06	6.5
<b>10</b>	<b>1</b>	<b>30</b>	2000	2000	0.6	6	1700	1400	0.5	6	1300	1100	0.4	6	1000	500	0.12	6
<b>10</b>	<b>1</b>	<b>50</b>	2000	2000	0.5	6	1700	1400	0.4	6	1300	1100	0.3	6	1000	500	0.11	6
<b>10</b>	<b>2</b>	<b>30</b>	2900	3900	1.2	4.5	2400	2700	1	4.5	1900	2200	0.7	4.5	1500	980	0.24	4.5
<b>10</b>	<b>2</b>	<b>50</b>	2900	3900	1.1	4.5	2400	2700	0.9	4.5	1900	2200	0.7	4.5	1500	980	0.22	4.5
<b>10</b>	<b>2</b>	<b>70</b>	2400	3300	1	4.5	2000	2300	0.8	4.5	1600	1800	0.6	4.5	1200	830	0.2	4.5
<b>10</b>	<b>2</b>	<b>90</b>	2400	3300	1	4.5	2000	2300	0.8	4.5	1600	1800	0.6	4.5	1200	830	0.2	4.5
<b>11</b>	<b>2</b>	<b>-</b>	2600	3600	1.2	5	2200	2500	1	5	1700	2000	0.7	5	1300	900	0.24	5
<b>12</b>	<b>0.5</b>	<b>36</b>	1200	1100	0.5	8	1000	770	0.4	8	800	620	0.3	8	600	280	0.11	8
<b>12</b>	<b>0.5</b>	<b>60</b>	1200	1100	0.5	8	1000	770	0.4	8	800	620	0.3	8	600	280	0.1	8
<b>12</b>	<b>1</b>	<b>36</b>	1400	1400	0.7	7.5	1200	1000	0.6	7.5	940	780	0.4	7.5	700	350	0.14	7.5
<b>12</b>	<b>1</b>	<b>60</b>	1400	1400	0.6	7.5	1200	1000	0.5	7.5	940	780	0.4	7.5	700	350	0.13	7.5
<b>12</b>	<b>2</b>	<b>36</b>	2400	3600	1.8	6	2000	2500	1.4	6	1600	2000	1.1	6	1200	900	0.4	6
<b>12</b>	<b>2</b>	<b>60</b>	2400	3600	1.6	6	2000	2500	1.3	6	1600	2000	1	6	1200	900	0.3	6
<b>12</b>	<b>2</b>	<b>84</b>	2000	3000	1.4	6	1700	2100	1.1	6	1300	1700	0.8	6	1000	750	0.3	6
<b>12</b>	<b>2</b>	<b>108</b>	2000	3000	0.9	6	1700	2100	0.7	6	1300	1700	0.5	6	1000	750	0.2	6
<b>12</b>	<b>3</b>	<b>36</b>	2400	3600	1.8	4.5	2000	2500	1.4	4.5	1600	2000	1.1	4.5	1200	900	0.4	4.5
<b>12</b>	<b>3</b>	<b>60</b>	2400	3600	1.6	4.5	2000	2500	1.3	4.5	1600	2000	1	4.5	1200	900	0.3	4.5
<b>13</b>	<b>3</b>	<b>-</b>	2200	3600	1.8	5	1800	2500	1.4	5	1500	2000	1.1	5	1100	900	0.4	5
<b>16</b>	<b>0.5</b>	<b>42</b>	900	900	0.5	11	750	630	0.4	11	600	500	0.3	11	450	230	0.1	11
<b>16</b>	<b>2</b>	<b>42</b>	1300	1500	0.9	9	1100	1100	0.7	9	870	840	0.5	9	650	380	0.2	9
<b>16</b>	<b>3</b>	<b>42</b>	1800	3000	1.8	7.5	1500	2100	1.4	7.5	1200	1700	0.9	7.5	900	750	0.4	7.5
<b>16</b>	<b>3</b>	<b>80</b>	1800	3000	1.6	7.5	1500	2100	1.3	7.5	1200	1700	0.8	7.5	900	750	0.3	7.5
<b>16</b>	<b>3</b>	<b>120</b>	1500	2500	1.4	7.5	1200	1800	1.1	7.5	1000	1400	0.7	7.5	750	630	0.3	7.5

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.

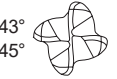
Note 3) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

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 workpiece 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.

# SOLID END MILLS

## VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes



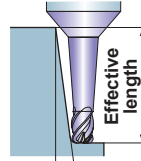
TOOL NEWS

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	Aluminium Alloy
○	○	○	○	○	○		

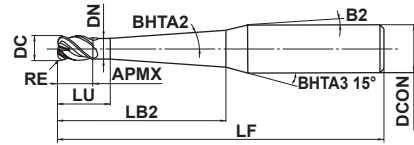
Taper neck type



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	*	*
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	*

\* No interference

● : Inventory maintained in Japan.

(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°
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



SOLID END MILLS

# SOLID END MILLS

## VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes

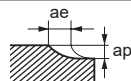
CARBIDE

### 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 No 35 B, AISI P20				AISI H13, AISI W1-10, AISI P21				AISI H13				AISI D2			
Dia. DC (mm)	Corner R RE (mm)	Taper angle one side BHTA	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
1	0.2	0.9°	6	40000	6500	0.03	0.45	33000	4600	0.022	0.45	27000	3700	0.018	0.45	20000	1600	0.01	0.45
1	0.2	0.9°	10	24000	2700	0.015	0.45	20000	1900	0.01	0.45	16000	1500	0.008	0.45	12000	700	0.006	0.45
1	0.2	0.9°	15	16000	1200	0.013	0.45	14000	700	0.008	0.45	12000	500	0.007	0.45	10000	400	0.003	0.45
1	0.2	0.9°	20	14000	1000	0.01	0.45	12000	600	0.006	0.45	10000	400	0.005	0.45	9000	300	0.002	0.45
1	0.2	0.9°	25	9500	610	0.008	0.45	8000	440	0.005	0.45	6000	320	0.004	0.45	4800	160	0.002	0.45
1	0.2	0.9°	30	4900	320	0.007	0.45	4100	220	0.004	0.45	3000	160	0.003	0.45	2500	80	0.002	0.45
1	0.2	0.9°	35	4000	260	0.006	0.45	3400	190	0.003	0.45	3000	160	0.003	0.45	2000	70	0.001	0.45
1	0.2	0.9°	40	3500	180	0.005	0.45	2900	130	0.003	0.45	2000	90	0.003	0.45	1700	50	0.001	0.45
1	0.2	0.9°	45	2900	150	0.004	0.45	2400	100	0.002	0.45	2000	90	0.002	0.45	1400	40	0.001	0.45
1	0.2	0.9°	50	2900	110	0.003	0.45	2400	80	0.002	0.45	2000	60	0.002	0.45	1400	30	0.001	0.45
1.5	0.3	0.9°	10	27000	5700	0.05	0.65	22000	4000	0.035	0.65	18000	3000	0.03	0.65	14000	1400	0.014	0.65
1.5	0.3	0.9°	15	22000	3200	0.03	0.65	18000	2300	0.025	0.65	15000	1700	0.018	0.65	11000	1000	0.009	0.65
1.5	0.3	0.9°	20	16000	1400	0.02	0.65	14000	1200	0.016	0.65	13000	1000	0.012	0.65	9000	700	0.007	0.65
1.5	0.3	0.9°	30	13000	900	0.01	0.65	11000	700	0.008	0.65	10000	600	0.006	0.65	7500	400	0.004	0.65
1.5	0.3	0.9°	40	4500	230	0.008	0.65	3700	160	0.007	0.65	3000	120	0.005	0.65	2300	70	0.003	0.65
1.5	0.3	0.9°	50	3700	190	0.007	0.65	3000	130	0.006	0.65	3000	120	0.004	0.65	1900	60	0.002	0.65
2	0.5	0.4°	15	20000	7000	0.05	0.75	17000	5000	0.04	0.75	13000	3200	0.03	0.75	10000	1800	0.016	0.75
2	0.5	0.4°	20	20000	3600	0.04	0.75	17000	2600	0.03	0.75	13000	1800	0.025	0.75	10000	900	0.012	0.75
2	0.5	0.4°	25	16000	1800	0.03	0.75	14000	1400	0.025	0.75	12000	1100	0.02	0.75	9000	720	0.01	0.75
2	0.5	0.4°	30	16000	1400	0.025	0.75	14000	1200	0.02	0.75	12000	900	0.016	0.75	9000	650	0.008	0.75
2	0.5	0.4°	35	13000	1100	0.02	0.75	11000	800	0.018	0.75	10000	700	0.014	0.75	7000	500	0.007	0.75
2	0.5	0.4°	40	13000	1000	0.02	0.75	11000	700	0.015	0.75	10000	600	0.012	0.75	7000	400	0.006	0.75
2	0.5	0.9°	20	20000	3600	0.04	0.75	17000	2600	0.03	0.75	13000	1800	0.025	0.75	10000	900	0.012	0.75
2	0.5	0.9°	25	16000	1800	0.03	0.75	14000	1400	0.025	0.75	12000	1100	0.02	0.75	9000	720	0.01	0.75
2	0.5	0.9°	30	16000	1400	0.025	0.75	14000	1200	0.02	0.75	12000	900	0.016	0.75	9000	650	0.008	0.75
2	0.5	0.9°	35	13000	1100	0.02	0.75	11000	800	0.018	0.75	10000	700	0.014	0.75	7000	500	0.007	0.75
2	0.5	0.9°	40	13000	1000	0.02	0.75	11000	700	0.015	0.75	10000	600	0.012	0.75	7000	400	0.006	0.75
2	0.5	0.9°	45	8000	500	0.016	0.75	6800	360	0.012	0.75	5200	250	0.01	0.75	4000	120	0.005	0.75
2	0.5	0.9°	50	8000	500	0.016	0.75	6800	360	0.012	0.75	5200	250	0.01	0.75	4000	120	0.005	0.75
2	0.5	0.9°	55	4100	230	0.012	0.75	3500	170	0.009	0.75	2700	120	0.008	0.75	2000	60	0.004	0.75
2	0.5	0.9°	60	4100	230	0.012	0.75	3500	170	0.009	0.75	2700	120	0.008	0.75	2000	60	0.004	0.75
3	0.8	0.9°	20	13000	7200	0.19	1	11000	5100	0.15	1	8700	4000	0.11	1	6500	1800	0.06	1
3	0.8	0.9°	25	13000	7200	0.19	1	11000	5100	0.15	1	8700	4000	0.11	1	6500	1800	0.06	1
3	0.8	0.9°	30	13000	5700	0.12	1	11000	4000	0.09	1	8700	3000	0.07	1	6500	1400	0.04	1
3	0.8	0.9°	40	11000	3600	0.08	1	9100	2600	0.06	1	7400	2000	0.05	1	5500	1000	0.025	1
3	0.8	0.9°	50	8000	2600	0.07	1	6600	1800	0.05	1	5800	1500	0.04	1	4600	800	0.02	1
3	0.8	0.9°	60	7800	2480	0.06	1	6600	1740	0.05	1	5000	1250	0.04	1	3900	610	0.02	1

Depth of cut



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

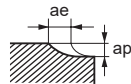
Note 2) Air blow or oil mist is recommended for good chip evacuation.

Note 3) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

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 workpiece 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.

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						
Dia. DC (mm)	Corner R RE (mm)	Taper angle one side BHTA2	Neck length LB2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
4	1	0.4°	25	10000	9900	0.24	1.5	8300	7000	0.19	1.5	6700	5600	0.14	1.5	5000	2500	0.07	1.5
4	1	0.4°	30	10000	9900	0.24	1.5	8300	7000	0.19	1.5	6700	5600	0.14	1.5	5000	2500	0.07	1.5
4	1	0.4°	35	10000	9900	0.15	1.5	8300	7000	0.12	1.5	6700	5600	0.09	1.5	5000	2500	0.04	1.5
4	1	0.4°	40	10000	9900	0.15	1.5	8300	7000	0.12	1.5	6700	5600	0.09	1.5	5000	2500	0.04	1.5
4	1	0.4°	45	10000	9900	0.15	1.5	8300	7000	0.12	1.5	6700	5600	0.09	1.5	5000	2500	0.04	1.5
4	1	0.4°	50	8100	6300	0.14	1.5	6700	4420	0.11	1.5	5400	3500	0.08	1.5	4000	1600	0.04	1.5
4	1	0.9°	25	10000	9900	0.24	1.5	8300	7000	0.19	1.5	6700	5600	0.14	1.5	5000	2500	0.07	1.5
4	1	0.9°	30	10000	9900	0.15	1.5	8300	7000	0.12	1.5	6700	5600	0.09	1.5	5000	2500	0.04	1.5
4	1	0.9°	40	10000	9900	0.15	1.5	8300	7000	0.12	1.5	6700	5600	0.09	1.5	5000	2500	0.04	1.5
4	1	0.9°	50	8100	6300	0.14	1.5	6700	4420	0.11	1.5	5400	3500	0.08	1.5	4000	1600	0.04	1.5
4	1	0.9°	60	8100	6300	0.11	1.5	6700	4420	0.08	1.5	5400	3500	0.06	1.5	4000	1600	0.03	1.5
6	1.5	0.9°	40	6600	11000	0.4	2	5500	7600	0.32	2	4500	6100	0.24	2	3300	2700	0.12	2
6	1.5	0.9°	50	6600	11000	0.4	2	5500	7600	0.32	2	4500	6100	0.24	2	3300	2700	0.12	2
6	1.5	0.9°	60	6600	11000	0.25	2	5500	7600	0.2	2	4500	6100	0.15	2	3300	2700	0.08	2
6	1.5	0.9°	70	5400	8700	0.23	2	4400	6200	0.18	2	3600	5000	0.14	2	2700	2200	0.07	2
8	2	0.9°	60	5000	11000	0.48	3	4200	7600	0.37	3	3300	6100	0.29	3	2500	2700	0.14	3
8	2	0.9°	80	5000	11000	0.3	3	4200	7600	0.23	3	3300	6100	0.18	3	2500	2700	0.09	3
10	2	0.9°	80	4000	11000	0.48	4.5	3300	7600	0.37	4.5	2700	6100	0.29	4.5	2000	2700	0.14	4.5
10	2	0.9°	120	3200	8700	0.27	4.5	2700	6200	0.21	4.5	2100	5000	0.16	4.5	1600	2200	0.08	4.5
12	2	0.9°	80	3300	10000	0.72	6	2700	7100	0.56	6	2200	5600	0.36	6	1700	2500	0.18	6
12	2	0.9°	120	3300	10000	0.45	6	2700	7100	0.35	6	2200	5600	0.23	6	1700	2500	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 moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

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 workpiece 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.



# SOLID END MILLS

## VFFDRB

Multi-task corner radius end mill for impact miracle high speed cutting

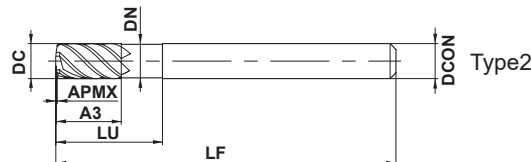
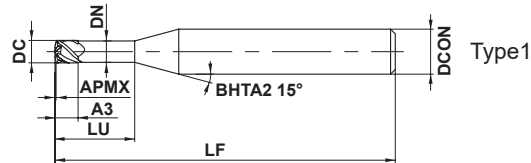
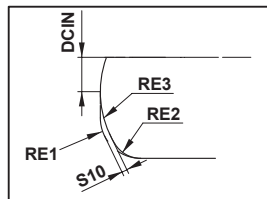


TOOL NEWS

DC≤6

DC≥8

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	Aluminium Alloy
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DC≤12				
0				
-0.020				



DCON=6	8≤DCON≤10	DCON=12		
0		0		
-0.008	-0.009	-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 <sup>*1</sup>	APMX	A3 <sup>*3</sup>	LU	DN	LF	DCON	No. of Flutes	Multi-task radius part				RMPX <sup>*2</sup>	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

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

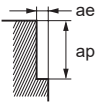
SOLID END MILLS



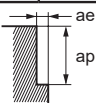
## RECOMMENDED CUTTING CONDITIONS FOR IMPACT MIRACLE END MILLS

### ■ Side milling

Work Material	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					
	Dia. DC (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min <sup>-1</sup> )	Feed per Tooth (mm/t.)	Table Feed per Min. (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min <sup>-1</sup> )	Feed per Tooth (mm/t.)	Table Feed per Min. (mm/min)	Depth of cut ap (mm)
<b>3</b>	80	8500	0.07	2400	0.12	1.5	100	11000	0.07	3100	0.12	1.5
<b>4</b>	80	6400	0.1	2600	0.16	2	100	8000	0.1	3200	0.16	2
<b>6</b>	80	4200	0.17	2900	0.24	3	100	5300	0.17	3600	0.24	3
<b>8</b>	80	3200	0.17	3300	0.32	4.8	100	4000	0.17	4100	0.32	4.8
<b>10</b>	80	2500	0.2	3000	0.4	6	100	3200	0.2	3800	0.4	6
<b>12</b>	80	2100	0.22	2800	0.48	7.2	100	2700	0.22	3600	0.48	7.2

Depth of cut 

Work Material	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.					
	Dia. DC (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min <sup>-1</sup> )	Feed per Tooth (mm/t.)	Table Feed per Min. (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min <sup>-1</sup> )	Feed per Tooth (mm/t.)	Table Feed per Min. (mm/min)	Depth of cut ap (mm)
<b>3</b>	80	8500	0.07	2400	0.12	1.5	40	4200	0.05	840	0.12	1.5
<b>4</b>	80	6400	0.1	2600	0.16	2	40	3200	0.07	960	0.16	2
<b>6</b>	80	4200	0.17	2900	0.24	3	40	2100	0.15	1300	0.24	3
<b>8</b>	80	3200	0.17	3300	0.32	4.8	40	1600	0.15	1400	0.32	4.8
<b>10</b>	80	2500	0.2	3000	0.4	6	40	1300	0.17	1300	0.4	6
<b>12</b>	80	2100	0.22	2800	0.48	7.2	40	1100	0.2	1300	0.48	7.2

Depth of cut 

Note 1) When ramping process set the feedrate at 50%. A ramping angle of 1° is recommended.

DC: Dia.

Note 2) Use at a revolution of 70% and feedrate of 50% when the tool overhang exceeds 5D.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

J

SOLID END MILLS



# SOLID END MILLS

## VCPSRB MIRACLE ORBIT

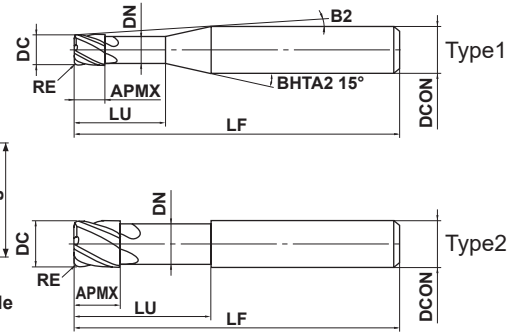
Corner radius end mill, Short cut length, 2-4 flute, High precision



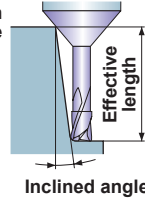
TOOL NEWS

DC ≤ 1.5 DC ≥ 2

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	Aluminium Alloy
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Effective length for inclined angle



	0.05 ≤ RE ≤ 5				
	±0.01				
	0.6 ≤ DC ≤ 12				
	0 - 0.01				
	DCON = 6	8 ≤ DCON ≤ 10	DCON = 12		
	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	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
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

● : Inventory maintained in Japan.

(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°
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
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	*

\* No interference



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## VCPSRB MIRACLE ORBIT

Corner radius end mill, Short cut length, 2-4 flute, High precision

(mm)

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

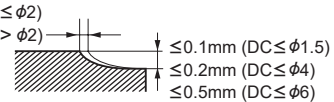
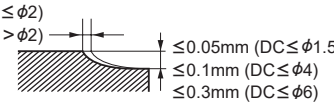
SOLID END MILLS

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°
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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material		Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		Hardened steel (45—55HRC) AISI H13		Hardened steel (55—62HRC) AISI D2	
Dia. DC (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
0.6	2	48000	200—600	40000	160—500	22000	80—250
	4	48000	160—500	40000	100—300	22000	50—150
0.8	4	48000	240—750	32000	160—500	19000	80—250
	6	38000	190—600	26000	130—400	16000	70—200
	8	29000	150—450	19000	100—300	12000	50—150
1	4	48000	270—900	32000	180—600	19000	90—300
	6	38000	220—720	26000	150—480	16000	70—240
	10	29000	160—540	19000	110—360	12000	60—180
1.2	6	48000	300—900	32000	200—600	19000	100—300
	10	38000	240—720	26000	160—480	15000	80—240
	15	29000	180—540	19000	120—360	12000	60—180
1.5	4	41000	300—900	27000	200—600	16000	100—300
	6	32000	240—720	22000	160—480	13000	80—240
	10	24000	180—540	16000	120—360	10000	60—180
2	6	36000	600—2000	24000	400—1300	14000	200—650
	10	29000	480—1600	19000	320—1000	12000	160—520
	15	22000	360—1200	14000	240—780	9000	120—390
2.5	8	33000	750—2400	22000	500—1600	13000	250—800
	15	20000	450—1400	13000	300—960	8000	150—480
3	10	30000	900—3000	20000	600—2000	12000	300—1000
	15	24000	720—2400	16000	480—1600	10000	240—800
	20	18000	540—1800	12000	360—1200	7000	180—600
4	12	26000	1200—4500	17000	800—3000	10000	400—1500
	20	20000	960—2000	14000	640—2000	8000	320—2000
	30	15000	720—1000	10000	480—1000	6000	240—1000
5	15	20000	1200—4800	13000	780—3120	10000	520—2000
	30	12000	720—1900	8000	480—1600	7000	360—1120
6	18	20000	1600—7500	13000	1100—5000	8000	550—2500
	41	15000	900—2400	12000	720—1600	10000	600—1200
	50	10000	600—1200	8000	480—800	6000	360—530
8	24	15000	1900—7500	10000	1300—5000	6000	650—2500
	50	10000	1300—2400	8000	1000—2200	3000	320—600
10	30	12000	1600—7500	8000	1100—5000	5000	550—2500
	50	10000	1300—3200	7000	950—2200	2500	280—600
12	36	10000	1500—7500	7000	1000—5000	4000	500—2500
Depth of cut		$\leq 0.2RE$ ( $DC \leq \phi 2$ ) $\leq 0.4RE$ ( $DC > \phi 2$ ) 			$\leq 0.1RE$ ( $DC \leq \phi 2$ ) $\leq 0.2RE$ ( $DC > \phi 2$ ) 		

DC: Dia.

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 shallow, the revolution and feed rate can be increased.

Note 3) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

Note 4) 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.

# SOLID END MILLS

## VCPSRB MIRACLE ORBIT

Corner radius end mill, Short cut length, 2-4 flute, High precision



TOOL NEWS

DC ≤ 1.5 DC ≥ 2

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	Aluminium Alloy
○	◎	◎	○	○	○		

SQUARE

BALL

RADIUS

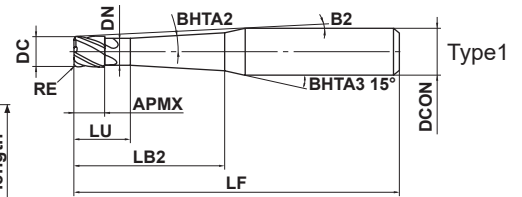
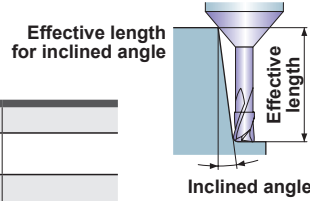
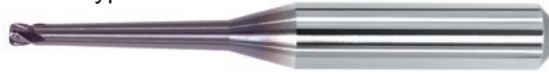
TAPER

BARREL

ROUGHING

SOLID END MILLS

Taper neck type



	$0.5 \leq RE \leq 3$				
	$\pm 0.01$				
	$1.5 \leq DC \leq 12$				
	$0 - 0.01$				
	DCON=6	$8 \leq DCON \leq 10$	$12 \leq DCON \leq 16$		
	$0 - 0.005$	$0 - 0.006$	$0 - 0.008$		

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

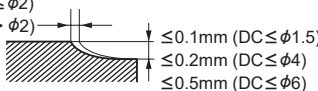
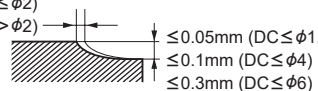
(mm)

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
VCPSRBD0300N06L15R10	3	1	1.5°	3	15	6	2.9	4.4°	60	6	4	●	1	—	17.4	18.7
VCPSRBD0300N06L20R05	3	0.5	1.5°	3	20	6	2.9	3.6°	60	6	4	●	1	—	22.1	23.8
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	*	*
VCPSRBD0500N08L40R10	5	1	1°	5	40	8	4.9	2°	90	8	4	●	1	41.7	*	*
VCPSRBD0500N08L60R05	5	0.5	1°	5	60	8	4.9	1.4°	110	8	4	●	1	61.2	*	*
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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		Hardened steel (45—55HRC) AISI H13		Hardened steel (55—62HRC) AISI D2	
Dia. DC (mm)	Taper angle one side DHTA	Neck length LU_2 (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
1.5	1.5°	6	36000	270— 810	24000	180— 540	15000	90— 270
	1.5°	10	28000	210— 630	19000	140— 420	11000	70— 210
2	1.5°	10	32000	540—1800	22000	360—1200	13000	180— 590
	1.5°	15	25000	420—1400	17000	280— 910	10000	140— 460
2.5	1.5°	12	26000	600—1900	18000	400—1300	11000	200— 640
	1.5°	20	20000	450— 140	13000	300— 960	8000	150— 480
3	1.5°	15	27000	810—2700	18000	540—1800	11000	270— 900
	1.5°	20	21000	630—2100	14000	420—1400	8000	210— 700
4	1.5°	20	23000	1080—3000	15000	720—3000	9000	360—3000
	1.5°	30	18000	840—1500	12000	560—1500	7000	280—1500
5	1°	40	10000	520—1400	7000	420— 840	5000	260— 600
	1°	60	7000	360— 840	5000	300— 500	4000	210— 400
6	1°	40	20000	1650—4500	13000	1100—3000	8000	550—1500
8	1°	53	15000	1950—4500	10000	1300—3000	6000	650—1500
10	1°	55	12000	1650—4500	8000	1100—3000	5000	550—1500
Depth of cut			$\leq 0.2RE$ ( $DC \leq \phi 2$ ) $\leq 0.4RE$ ( $DC > \phi 2$ ) 			$\leq 0.1RE$ ( $DC \leq \phi 2$ ) $\leq 0.2RE$ ( $DC > \phi 2$ ) 		

DC: Dia.

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 shallow, the revolution and feed rate can be increased.

Note 3) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

Note 4) 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.



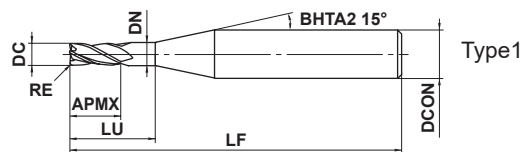
# SOLID END MILLS

## VC4SRB

Corner radius end mill, Short 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	Aluminium Alloy
○	◎	○		○	○		



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

● 4 flute corner radius end mill with relieved neck for 3×D length of reach.

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VC4SRBD0400R0050	4	0.5	4	12	3.8	45	6	4	●	1
VC4SRBD0600R0050	6	0.5	6	18	5.8	50	6	4	●	2
VC4SRBD0600R0100	6	1	6	18	5.8	50	6	4	●	2
VC4SRBD0800R0050	8	0.5	8	24	7.8	60	8	4	●	2
VC4SRBD0800R0100	8	1	8	24	7.8	60	8	4	●	2
VC4SRBD1000R0100	10	1	10	30	9.7	70	10	4	●	2
VC4SRBD1000R0200	10	2	10	30	9.7	70	10	4	●	2
VC4SRBD1200R0100	12	1	12	36	11.7	75	12	4	●	2
VC4SRBD1200R0200	12	2	12	36	11.7	75	12	4	●	2

(mm)

● : Inventory maintained in Japan.

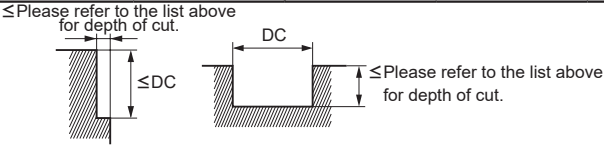
CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## 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			AISI H13		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>2</b>	30000	4500	0.18	24000	3600	0.10
<b>2.5</b>	24000	3900	0.25	19000	3000	0.13
<b>3</b>	20000	3500	0.30	16000	2700	0.15
<b>4</b>	15000	3000	0.40	12000	2400	0.20
<b>5</b>	12000	2400	0.50	9000	1800	0.25
<b>6</b>	10000	2100	0.60	7000	1470	0.30
<b>8</b>	8000	1500	0.80	5600	1050	0.40
<b>10</b>	6400	1400	1.00	4500	950	0.50
<b>12</b>	5400	1200	1.00	3800	860	0.50
<b>16</b>	2400	550	2.00	1200	120	0.80
<b>20</b>	1900	480	3.00	1000	100	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 shallow, the revolution and feed rate can be increased.

Note 2) When slotting with end mills with  $\phi 3$  or larger, reduce the revolution to 50—70% and the feed rate to 40—60%.

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 materials installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS



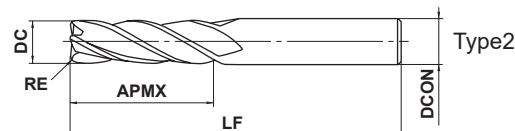
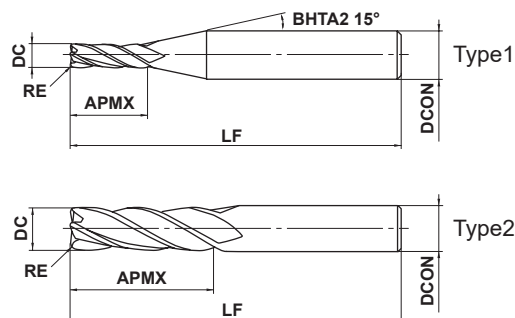
# SOLID END MILLS

## VC4JRB

Corner radius end mill, Semi long 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	Aluminium Alloy
○	◎	○	○	○	○		



	DC ≤ 12	DC > 12			
	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	$\begin{matrix} 0 \\ -0.030 \end{matrix}$			
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20	
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$	

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

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

● : Inventory maintained in Japan.

## 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 No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	4200	110	3400	95	2600	70	2100	50
<b>4</b>	3400	140	2700	110	2100	85	1700	60
<b>5</b>	2900	170	2300	140	1800	100	1500	70
<b>6</b>	2500	200	2000	170	1500	130	1300	85
<b>8</b>	1900	220	1500	170	1200	150	1000	85
<b>10</b>	1600	220	1300	170	950	130	800	85
<b>12</b>	1300	170	1100	150	800	100	670	70
<b>16</b>	1000	140	820	110	600	80	500	50
<b>20</b>	800	110	650	85	480	70	400	40
<b>25</b>	650	85	520	70	380	50	320	35

Depth of cut	Standard side milling		Slotting	

DC: Dia.

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

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

Note 3) The above table shows cutting conditions for standard side 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 steels.

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

Note 5) 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

↓

SOLID END MILLS

# SOLID END MILLS

## VCHFRB

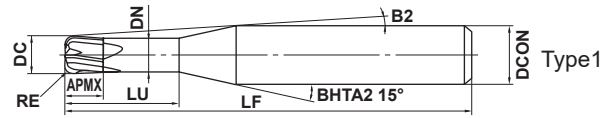
Corner radius, Short flute length, 4 flute, High feed machining



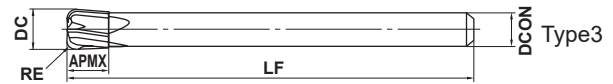
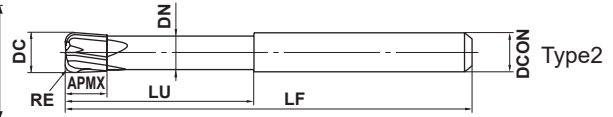
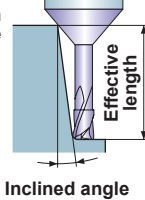
DC ≤ 5

DC ≥ 6

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	Aluminium Alloy
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Effective length for inclined angle



	0.5 ≤ RE ≤ 3		
	±0.015		
	DC ≤ 12	DC > 12	
	0	0	
	-0.02	-0.03	
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16
	0	0	0
	-0.008	-0.009	-0.011

● Suitable for high feed and efficient machining of die & mould.

(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°
VCHFRBD0200R050N06	2	0.5	2	6	1.9	8.7°	50	6	4	▲	1	6.2	6.5	6.9	7.5
VCHFRBD0200R050N10	2	0.5	2	10	1.9	6.7°	70	6	4	▲	1	10.4	10.8	11.5	12.4
VCHFRBD0300R075N09	3	0.75	3	9	2.9	6.2°	50	6	4	▲	1	9.4	9.7	10.4	11.1
VCHFRBD0300R075N15	3	0.75	3	15	2.9	4.3°	70	6	4	▲	1	15.6	16.1	17.3	18.6
VCHFRBD0400R100N12	4	1	4	12	3.9	3.9°	50	6	4	▲	1	12.4	12.8	13.7	14.7
VCHFRBD0400R100N20	4	1	4	20	3.9	2.6°	70	6	4	▲	1	20.7	21.4	22.9	*
VCHFRBD0500R120N15	5	1.2	5	15	4.9	1.9°	70	6	4	▲	1	15.5	16.0	*	*
VCHFRBD0600R150N18	6	1.5	6	18	5.85	—	50	6	4	▲	2	*	*	*	*
VCHFRBD0600R150N30	6	1.5	6	30	5.85	—	90	6	4	▲	2	*	*	*	*
VCHFRBD0700R150A050	7	1.5	7	—	—	—	50	6	4	▲	3	*	*	*	*
VCHFRBD0700R150A080	7	1.5	7	—	—	—	80	6	4	▲	3	*	*	*	*
VCHFRBD0800R200N24	8	2	8	24	7.85	—	60	8	4	▲	2	*	*	*	*
VCHFRBD0800R200N40	8	2	8	40	7.85	—	90	8	4	▲	2	*	*	*	*
VCHFRBD0900R200A065	9	2	9	—	—	—	65	8	4	▲	3	*	*	*	*
VCHFRBD0900R200A100	9	2	9	—	—	—	100	8	4	▲	3	*	*	*	*
VCHFRBD1000R200N30	10	2	10	30	9.7	—	70	10	4	▲	2	*	*	*	*
VCHFRBD1000R200N50	10	2	10	50	9.7	—	100	10	4	▲	2	*	*	*	*
VCHFRBD1100R200A070	11	2	11	—	—	—	70	10	4	▲	3	*	*	*	*
VCHFRBD1100R200A110	11	2	11	—	—	—	110	10	4	▲	3	*	*	*	*
VCHFRBD1200R300N36	12	3	12	36	11.7	—	75	12	4	▲	2	*	*	*	*
VCHFRBD1200R300N60	12	3	12	60	11.7	—	110	12	4	▲	2	*	*	*	*
VCHFRBD1300R300A075	13	3	13	—	—	—	75	12	4	▲	3	*	*	*	*
VCHFRBD1300R300A120	13	3	13	—	—	—	120	12	4	▲	3	*	*	*	*
VCHFRBD1600R300N80	16	3	16	80	15.5	—	140	16	4	▲	2	*	*	*	*

\* No interference

▲ : Product scheduled to be discontinued at the end of March 2020

VFHVRB(J306) is alternative product.

# VCHF RB

Corner radius, Short flute length, 4 flute, High feed machining



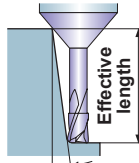
CARBIDE

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	Aluminium Alloy
○	◎	◎	○				

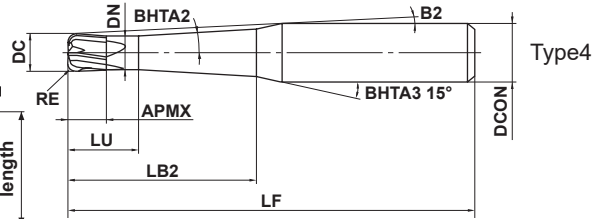
Taper neck type



Effective length for inclined angle



Inclined angle



	0.5 ≤ RE ≤ 3		
	±0.015		
	DC ≤ 12	DC > 12	
	<sup>0</sup> / <sub>-0.02</sub>	<sup>0</sup> / <sub>-0.03</sub>	
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>

● Suitable for high feed and efficient machining of die & mould.

(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°
														VCHF RBD0200R050N12	2	0.5
VCHF RBD0200R050N16	2	0.5	1°	2	16	4	1.9	5°	70	6	4	▲	4	16.9	18.2	19.6
VCHF RBD0200R050N20	2	0.5	1°	2	20	4	1.9	4.3°	70	6	4	▲	4	20.9	22.5	24.3
VCHF RBD0300R075N18	3	0.75	1°	3	18	6	2.9	3.8°	80	6	4	▲	4	19.3	20.7	22.3
VCHF RBD0300R075N24	3	0.75	1°	3	24	6	2.9	3°	80	6	4	▲	4	25.3	27.2	*
VCHF RBD0300R075N30	3	0.75	1°	3	30	6	2.9	2.6°	80	6	4	▲	4	31.3	33.6	*
VCHF RBD0400R100N24	4	1	1°	4	24	8	3.9	2.2°	90	6	4	▲	4	25.7	27.6	*
VCHF RBD0400R100N32	4	1	1°	4	32	8	3.9	1.7°	90	6	4	▲	4	33.7	*	*
VCHF RBD0400R100N40	4	1	1°	4	40	8	3.9	1.4°	90	6	4	▲	4	41.7	*	*
VCHF RBD0500R120N30	5	1.2	1°	5	30	8	4.9	1°	90	6	4	▲	4	*	*	*
VCHF RBD0500R120N40	5	1.2	1°	5	40	8	4.9	2°	90	8	4	▲	4	41.9	*	*
VCHF RBD0500R120N50	5	1.2	1°	5	50	8	4.9	1.7°	110	8	4	▲	4	51.9	*	*
VCHF RBD0600R150N50	6	1.5	1°	6	50	16	5.85	1.2°	110	8	4	▲	4	52.9	*	*
VCHF RBD0600R150N67	6	1.5	1°	6	67	16	5.85	0.9°	130	8	4	▲	4	*	*	*
VCHF RBD0800R200N70	8	2	1°	8	70	18	7.85	0.9°	120	10	4	▲	4	*	*	*
VCHF RBD0800R200N90	8	2	1°	8	90	18	7.85	1.3°	150	12	4	▲	4	93.5	*	*
VCHF RBD1000R200N80	10	2	1°	10	80	20	9.7	2°	140	16	4	▲	4	83.9	*	*
VCHF RBD1000R200N110	10	2	1°	10	110	20	9.7	1.5°	160	16	4	▲	4	113.9	*	*
VCHF RBD1200R300N110	12	3	1°	12	110	24	11.7	1.1°	160	16	4	▲	4	115.2	*	*

\* No interference

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

▲ : Product scheduled to be discontinued at the end of March 2020  
VFHVRB(J312) is alternative product.

# SOLID END MILLS

## VCHFRB

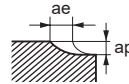
Corner radius, Short flute length, 4 flute, High feed machining

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

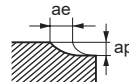
Work Material		Carbon steel, Cast iron, Alloy steel (-30HRC) AISI 1050, AISI No 35 B, AISI P20				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			
Dia. DC (mm)	Corner radius RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>2</b>	<b>R 0.5</b>	33000	10000	0.08	0.8	27000	8400	0.05	0.8
<b>3</b>	<b>R 0.75</b>	22000	11000	0.12	1.2	18000	9000	0.08	1.2
<b>4</b>	<b>R 1</b>	17000	12000	0.15	1.5	14000	9500	0.12	1.5
<b>5</b>	<b>R 1.2</b>	13000	13000	0.20	2.0	11000	11000	0.15	2.0
<b>6</b>	<b>R 1.5</b>	11000	13000	0.25	2.5	9000	11000	0.15	2.5
<b>7</b>	<b>R 1.5</b>	9400	13000	0.25	3.0	7800	11000	0.15	3.0
<b>8</b>	<b>R 2</b>	8200	13000	0.30	3.0	7000	11000	0.20	3.0
<b>9</b>	<b>R 2</b>	7300	13000	0.30	4.0	6000	11000	0.20	4.0
<b>10</b>	<b>R 2</b>	6500	13000	0.30	4.5	5500	11000	0.20	4.5
<b>11</b>	<b>R 2</b>	6000	12000	0.30	5.5	5000	10000	0.20	5.5
<b>12</b>	<b>R 3</b>	5500	12000	0.45	4.5	4600	10000	0.30	4.5
<b>13</b>	<b>R 3</b>	5000	12000	0.45	5.5	4200	10000	0.30	5.5
<b>16</b>	<b>R 3</b>	4100	10000	0.45	7.5	3400	8800	0.30	7.5

Depth of cut



Work Material		Hardened steel (45-55HRC) AISI H13				Hardened steel (55-62HRC) AISI D2			
Dia. DC (mm)	Corner radius RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>2</b>	<b>R 0.5</b>	24000	7500	0.04	0.8	16000	3000	0.03	0.8
<b>3</b>	<b>R 0.75</b>	16000	8500	0.06	1.2	11000	3300	0.05	1.2
<b>4</b>	<b>R 1</b>	12000	8800	0.08	1.5	8000	3500	0.07	1.5
<b>5</b>	<b>R 1.2</b>	9600	9500	0.10	2.0	6400	3800	0.08	2.0
<b>6</b>	<b>R 1.5</b>	8000	9600	0.10	2.5	5300	3800	0.10	2.5
<b>7</b>	<b>R 1.5</b>	6900	9600	0.10	3.0	4600	3800	0.10	3.0
<b>8</b>	<b>R 2</b>	6000	9600	0.15	3.0	4000	3800	0.13	3.0
<b>9</b>	<b>R 2</b>	5300	9500	0.15	4.0	3800	3800	0.13	4.0
<b>10</b>	<b>R 2</b>	4800	9500	0.15	4.5	3200	3800	0.13	4.5
<b>11</b>	<b>R 2</b>	4500	9000	0.15	5.5	2900	3500	0.13	5.5
<b>12</b>	<b>R 3</b>	4100	9000	0.25	4.5	2700	3500	0.20	4.5
<b>13</b>	<b>R 3</b>	3700	8900	0.25	5.5	2500	3500	0.20	5.5
<b>16</b>	<b>R 3</b>	3000	7800	0.25	7.5	2000	3200	0.20	7.5

Depth of cut



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

## ■ Coefficients respective of tool overhang

Type	Overhang	Revolution	Feed rate	Depth of cut $a_p$
Straight	$L/D \leq 5$	100%	100%	100%
	$L/D = 6$	90%	80%	80%
	$L/D = 7$	80%	70%	70%
Taper neck	$L/D = 6$	100%	100%	100%
	$L/D = 8$	90%	80%	80%
	$L/D \geq 10$	80%	70%	70%

Note 1) The above table shows cutting conditions when machining with the corner radius cutting edge.

Note 2) This table shows the cutting conditions with less than 5D overhang length.

In the case of longer overhangs, the revolution and the feed rate should be reduced proportionately.

Note 3) If the depth of cut is shallow, the revolution and feed rate can be increased.

Note 4) Air blow or oil mist is recommended for good chip evacuation.

Note 5) For profile machining such as moulds, machining conditions may differ considerably depending on the workpiece geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece.

Note 6) When machining inclinations in the Z direction, set the inclination angle at  $2^\circ$  and reduce the feed rate by 50%.

Note 7) 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.

# SOLID END MILLS

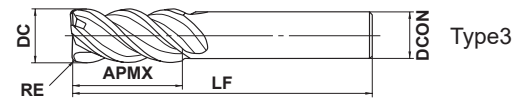
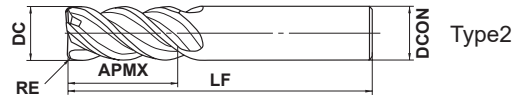
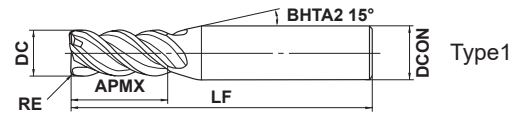
## VCMHDRB

Corner radius end mill, Medium cut length, 4 flute, High helix angle



TOOL NEWS

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	Aluminium Alloy
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	0.2 ≤ RE ≤ 6.35				
	±0.020				
	DC ≤ 12	DC > 12			
	-0.02	-0.03			
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	20 ≤ DCON ≤ 25	
	-0.008	-0.009	-0.011	-0.013	

● 4 flute corner radius end mill with high helix angle and newly designed corner radius, for milling carbon steels to stainless steels materials.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VCMHDRBD0200R020S04	2	0.2	6	40	4	4	▲	1
VCMHDRBD0200R030S04	2	0.3	6	40	4	4	▲	1
VCMHDRBD0300R020S06	3	0.2	8	50	6	4	▲	1
VCMHDRBD0300R030S06	3	0.3	8	50	6	4	▲	1
VCMHDRBD0300R050S06	3	0.5	8	50	6	4	▲	1
VCMHDRBD0400R020S06	4	0.2	11	50	6	4	▲	1
VCMHDRBD0400R030S06	4	0.3	11	50	6	4	▲	1
VCMHDRBD0400R050S06	4	0.5	11	50	6	4	▲	1
VCMHDRBD0500R020S06	5	0.2	13	60	6	4	▲	1
VCMHDRBD0500R030S06	5	0.3	13	60	6	4	▲	1
VCMHDRBD0500R050S06	5	0.5	13	60	6	4	▲	1
VCMHDRBD0500R100S06	5	1	13	60	6	4	▲	1
VCMHDRBD0600R030S06	6	0.3	13	60	6	4	▲	2
VCMHDRBD0600R050S06	6	0.5	13	60	6	4	▲	2
VCMHDRBD0600R100S06	6	1	13	60	6	4	▲	2
VCMHDRBD0800R030S08	8	0.3	19	70	8	4	▲	2
VCMHDRBD0800R050S08	8	0.5	19	70	8	4	▲	2
VCMHDRBD0800R100S08	8	1	19	70	8	4	▲	2
VCMHDRBD0800R150S08	8	1.5	19	70	8	4	▲	2
VCMHDRBD1000R030S08	10	0.3	22	90	8	4	▲	3
VCMHDRBD1000R050S08	10	0.5	22	90	8	4	▲	3
VCMHDRBD1000R100S08	10	1	22	90	8	4	▲	3
VCMHDRBD1000R150S08	10	1.5	22	90	8	4	▲	3
VCMHDRBD1000R200S08	10	2	22	90	8	4	▲	3
VCMHDRBD1000R030S10	10	0.3	22	90	10	4	▲	2
VCMHDRBD1000R050S10	10	0.5	22	90	10	4	▲	2
VCMHDRBD1000R100S10	10	1	22	90	10	4	▲	2
VCMHDRBD1000R150S10	10	1.5	22	90	10	4	▲	2
VCMHDRBD1000R200S10	10	2	22	90	10	4	▲	2
VCMHDRBD1200R050S10	12	0.5	26	90	10	4	▲	3
VCMHDRBD1200R100S10	12	1	26	90	10	4	▲	3
VCMHDRBD1200R150S10	12	1.5	26	90	10	4	▲	3
VCMHDRBD1200R200S10	12	2	26	90	10	4	▲	3
VCMHDRBD1200R300S10	12	3	26	90	10	4	▲	3

▲ : Product scheduled to be discontinued at the end of March 2020

MPMHVRB(J284) is alternative product.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VCMHDRBD1200R050S12	12	0.5	26	90	12	4	▲	2
VCMHDRBD1200R100S12	12	1	26	90	12	4	▲	2
VCMHDRBD1200R150S12	12	1.5	26	90	12	4	▲	2
VCMHDRBD1200R200S12	12	2	26	90	12	4	▲	2
VCMHDRBD1200R300S12	12	3	26	90	12	4	▲	2
VCMHDRBD1600R100S16	16	1	32	110	16	4	▲	2
VCMHDRBD1600R150S16	16	1.5	32	110	16	4	▲	2
VCMHDRBD1600R200S16	16	2	32	110	16	4	▲	2
VCMHDRBD1600R300S16	16	3	32	110	16	4	▲	2
VCMHDRBD1800R100S16	18	1	32	110	16	4	▲	3
VCMHDRBD1800R150S16	18	1.5	32	110	16	4	▲	3
VCMHDRBD1800R200S16	18	2	32	110	16	4	▲	3
VCMHDRBD1800R300S16	18	3	32	110	16	4	▲	3
VCMHDRBD2000R100S20	20	1	38	110	20	4	▲	2
VCMHDRBD2000R150S20	20	1.5	38	110	20	4	▲	2
VCMHDRBD2000R200S20	20	2	38	110	20	4	▲	2
VCMHDRBD2000R300S20	20	3	38	110	20	4	▲	2
VCMHDRBD2200R100S20	22	1	38	140	20	4	▲	3
VCMHDRBD2200R150S20	22	1.5	38	140	20	4	▲	3
VCMHDRBD2200R200S20	22	2	38	140	20	4	▲	3
VCMHDRBD2200R300S20	22	3	38	140	20	4	▲	3
VCMHDRBD2500R100S25	25	1	45	140	25	4	▲	2
VCMHDRBD2500R150S25	25	1.5	45	140	25	4	▲	2
VCMHDRBD2500R200S25	25	2	45	140	25	4	▲	2
VCMHDRBD2500R300S25	25	3	45	140	25	4	▲	2

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS



# SOLID END MILLS

## VCMHDRB

Corner radius end mill, Medium cut length, 4 flute, High helix angle

CARBIDE

### 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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
2	15000	550	10000	340	10000	320	6400	160	4800	100
3	11000	800	7400	500	7400	480	4800	250	4000	170
4	8000	900	5600	540	5600	520	3600	270	3200	240
5	6400	1000	4500	600	4500	580	2900	300	2600	240
6	5900	1100	3700	640	3700	600	2400	320	2100	230
8	4400	1100	2800	660	2800	600	1800	330	1600	220
10	3500	1000	2300	640	2300	560	1400	320	1300	200
12	2900	1000	1900	640	1900	530	1200	320	1100	170
16	2200	800	1400	500	1400	450	900	250	800	130
20	1800	750	1100	460	1100	440	720	230	640	100
25	1400	600	900	400	900	380	570	200	510	80

Depth of cut	≤0.2DC		≤0.1DC		≤0.05DC	
	≤1.5DC		≤1.5DC		≤1.5DC	

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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
2	12000	400	7000	200	7000	100	4200	80	2300	40
3	9000	600	5300	300	5300	150	3200	130	1900	70
4	7200	720	4000	360	4000	180	2400	140	1400	95
5	5800	720	3200	360	3200	180	1900	150	1100	95
6	5000	800	2700	400	2700	200	1600	160	950	95
8	3700	800	2000	400	2000	200	1200	170	720	90
10	3000	720	1600	360	1600	180	960	160	570	80
12	2500	720	1300	360	1300	180	800	160	480	70
16	2000	600	1000	280	1000	150	600	130	360	50
20	1600	540	800	250	800	130	480	120	290	40
25	1300	480	640	220	640	120	380	100	230	35

Depth of cut	DC		DC		DC	
	1DC (MAX. 12mm)		0.5DC		0.2DC	

DC:Dia.

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

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.

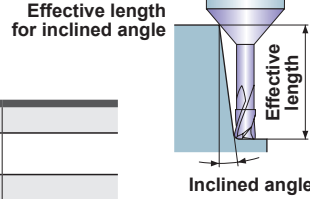
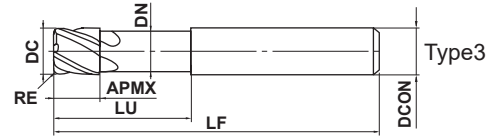
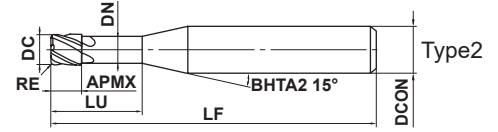
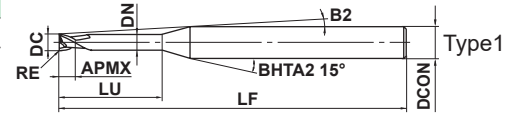
# DFPSRB

Corner radius end mill, Short cut length, 2-4 flute, High precision, For graphite



CARBIDE

Aluminium Alloy	Copper Alloy	Graphite	GFRP CFRP	Machineable Ceramics
○	◎	◎	○	○



	0.1 ≤ RE ≤ 1				
	±0.01				
	0.5 ≤ DC ≤ 12				
	0 - 0.02				
	4 ≤ DCON ≤ 6	8 ≤ DCON ≤ 10	DCON = 12		
	0 - 0.008	0 - 0.009	0 - 0.011		

● ±0.01mm corner radius tolerance, 0—-0.02mm 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
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	*	*	*	*
DFPSRBD0600R010N24	6	0.1	9	24	5.85	—	90	6	4	●	3	*	*	*	*
DFPSRBD0600R030N24	6	0.3	9	24	5.85	—	90	6	4	●	3	*	*	*	*

\* No interference



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## DFPSRB

Corner radius end mill, Short cut length, 2—4 flute, High precision, For graphite

(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°
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

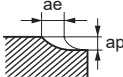
ROUGHING

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SOLID END MILLS

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material			Graphite				Copper, Copper alloys			
Dia. DC (mm)	Corner radius RE (mm)	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>0.5</b>	<b>0.1</b>	<b>4</b>	30000	1100	0.05	0.23	24000	700	0.04	0.23
	<b>0.1</b>	<b>5</b>	28000	960	0.05	0.23	22000	600	0.04	0.23
	<b>0.1</b>	<b>6</b>	25000	850	0.05	0.23	20000	540	0.04	0.23
	<b>0.1</b>	<b>10</b>	22000	600	0.04	0.21	—	—	—	—
	<b>0.1</b>	<b>15</b>	20000	500	0.03	0.18	—	—	—	—
<b>0.8</b>	<b>0.1</b>	<b>6</b>	28000	1300	0.08	0.45	22000	830	0.06	0.45
	<b>0.1</b>	<b>8</b>	22000	900	0.08	0.45	18000	580	0.06	0.45
<b>1</b>	<b>0.1</b>	<b>8</b>	25000	1500	0.1	0.6	20000	960	0.08	0.6
	<b>0.1</b>	<b>12</b>	22000	1300	0.1	0.6	18000	830	0.08	0.6
	<b>0.2</b>	<b>8</b>	25000	1500	0.1	0.45	20000	960	0.08	0.45
	<b>0.2</b>	<b>12</b>	22000	1300	0.1	0.45	18000	830	0.08	0.45
	<b>0.2</b>	<b>16</b>	18000	1000	0.08	0.4	14000	640	0.06	0.4
	<b>0.2</b>	<b>20</b>	15000	800	0.08	0.4	—	—	—	—
<b>1.5</b>	<b>0.2</b>	<b>10</b>	18000	1400	0.15	0.8	14000	900	0.12	0.8
	<b>0.2</b>	<b>20</b>	12000	900	0.12	0.65	9600	580	0.1	0.65
<b>2</b>	<b>0.1</b>	<b>8</b>	24000	3300	0.2	1.2	19000	2100	0.16	1.2
	<b>0.2</b>	<b>12</b>	22000	3000	0.2	1.2	18000	1900	0.16	1.2
	<b>0.2</b>	<b>16</b>	19000	2500	0.2	1.2	15000	1600	0.16	1.2
	<b>0.2</b>	<b>20</b>	16000	2000	0.2	1.2	13000	1300	0.16	1.2
	<b>0.2</b>	<b>30</b>	13000	1600	0.16	1.0	—	—	—	—
	<b>0.3</b>	<b>40</b>	11000	1200	0.14	0.8	—	—	—	—
<b>3</b>	<b>0.2</b>	<b>8</b>	24000	3300	0.3	1.2	19000	2100	0.24	1.2
	<b>0.2</b>	<b>20</b>	18000	3000	0.3	2.0	14000	1900	0.24	2.0
	<b>0.2</b>	<b>40</b>	12000	1800	0.25	1.7	9600	1100	0.2	1.7
	<b>0.5</b>	<b>20</b>	18000	3000	0.3	1.5	14000	1900	0.24	1.5
<b>4</b>	<b>0.3</b>	<b>12</b>	20000	4500	0.3	1.5	16000	2900	0.24	1.5
	<b>0.2</b>	<b>20</b>	18000	4200	0.4	2.7	14000	2700	0.3	2.7
	<b>0.2</b>	<b>40</b>	13000	2800	0.4	2.7	10000	1800	0.3	2.7
	<b>0.5</b>	<b>20</b>	18000	4200	0.4	2.3	14000	2700	0.3	2.3
<b>6</b>	<b>0.5</b>	<b>40</b>	13000	2800	0.4	2.3	10000	1800	0.3	2.3
	<b>0.1</b>	<b>24</b>	14000	4600	0.6	3.8	11000	2900	0.5	3.8
	<b>0.3</b>	<b>24</b>	14000	4600	0.6	3.8	11000	2900	0.5	3.8
	<b>0.5</b>	<b>24</b>	14000	4600	0.6	3.8	11000	2900	0.5	3.8
	<b>0.5</b>	<b>30</b>	14000	4600	0.6	3.8	11000	2900	0.5	3.8
<b>8</b>	<b>1</b>	<b>30</b>	14000	4600	0.6	3.0	11000	2900	0.5	3.0
	<b>0.5</b>	<b>30</b>	10500	4000	0.8	5.3	8400	2600	0.6	5.3
<b>10</b>	<b>1</b>	<b>30</b>	10500	4000	0.8	4.5	8400	2600	0.6	4.5
	<b>0.5</b>	<b>40</b>	8700	3500	1.0	6.8	7000	2200	0.8	6.8
<b>12</b>	<b>1</b>	<b>40</b>	8700	3500	1.0	6.0	7000	2200	0.8	6.0
<b>12</b>	<b>0.5</b>	<b>40</b>	7200	3000	1.2	8.0	5800	1900	1.0	8.0
Depth of cut										

Note 1) When high machining accuracy is needed, or the workpiece becomes chipped, we recommend lowering the feed rate.

Note 2) Use a milling machine dedicated for graphite.

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

J

SOLID END MILLS

# SOLID END MILLS

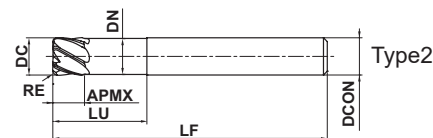
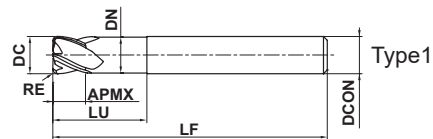
## CE4SRB/CE6SRB

Corner radius end mill, short cut length, 4-6 flute



TOOL NEWS

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	Aluminium Alloy
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	DC≤12				
	±0.02				
	DC=6	DC=8,10	DC=12		
	- 0.008 - 0.028	- 0.009 - 0.029	- 0.011 - 0.031		
	DC=6	DC=8,10	DC=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

(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
CE6SRBD0600R050	6	0.5	4.5	12	5.85	50	6	6	●	2
CE6SRBD0800R100	8	1.0	6.0	16	7.85	60	8	6	●	2
CE6SRBD1000R100	10	1.0	7.5	20	9.70	65	10	6	●	2
CE6SRBD1200R150	12	1.5	9.0	24	11.70	70	12	6	●	2

Note 1) Never use ceramic end mills to cut titanium alloys.  
Doing so will cause a risk of ignition and can be extremely dangerous.

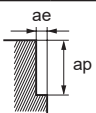
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### CE4SRB

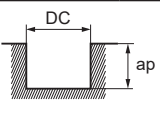
#### Side milling

Work Material	Heat resistant alloys			
	Inconel718			
Dia. DC (mm)	Cutting Speed (m/min)	Feed per Tooth (mm/t.)	Depth of cut ap (mm)	Cutting Width ae (mm)
<b>6</b>	≥350	≤0.06	≤4.5	≤1.2
<b>8</b>	≥350	≤0.06	≤6.0	≤1.6
<b>10</b>	≥350	≤0.06	≤7.5	≤2.0
<b>12</b>	≥350	≤0.06	≤9.0	≤2.4

Depth of cut  DC:Dia.

#### Slotting

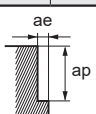
Work Material	Heat resistant alloys		
	Inconel718		
Dia. DC (mm)	Cutting Speed (m/min)	Feed per Tooth (mm/t.)	Depth of cut ap (mm)
<b>6</b>	≥350	≤0.03	≤1.0
<b>8</b>	≥350	≤0.03	≤1.5
<b>10</b>	≥350	≤0.03	≤2.0
<b>12</b>	≥350	≤0.03	≤2.5

Depth of cut  DC:Dia.

### CE6SRB

#### Side milling

Work Material	Heat resistant alloys			
	Inconel718			
Dia. DC (mm)	Cutting Speed (m/min)	Feed per Tooth (mm/t.)	Depth of cut ap (mm)	Cutting Width ae (mm)
<b>6</b>	≥350	≤0.06	≤4.5	≤1.2
<b>8</b>	≥350	≤0.06	≤6.0	≤1.6
<b>10</b>	≥350	≤0.06	≤7.5	≤2.0
<b>12</b>	≥350	≤0.06	≤9.0	≤2.4

Depth of cut  DC:Dia.

Note 1) The outermost layer of the material may be affected by heat.

Ensure a minimum of 0.3mm final machining allowance remains.

Note 2) The recommended ramping angle is 1.5 degree. By Shoulder milling=25% and Slot milling=50% from the cutting conditions shown.

Note 3) Gradually increase the depth of cut (Shoulder milling=ae and Slot milling=ap) starting from 0.05DC.

SQUARE

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TAPER

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ROUGHING

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SOLID END MILLS

# SOLID END MILLS

## VQT5MVRB

NEW

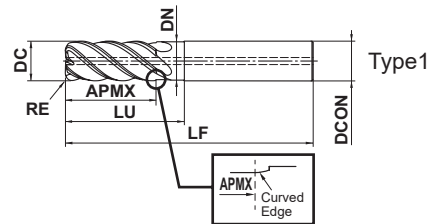
Corner radius, Medium cut length, 5 flute, Irregular helix flutes, With coolant hole



TOOL NEWS



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	Aluminium Alloy
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	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


● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Shoulder Milling

Overhang Length DC×3 (DC=Dia.)

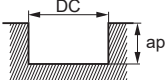
Work Material	Austenitic Stainless Steel ( $\leq 200\text{HB}$ ), Titanium Alloy AISI 304, AISI 316, Ti-6Al-4V				
Dia. DC (mm)	Cutting Speed (m/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Width of cut $a_e$ (mm)
<b>16</b>	70	1400	700	32	2.4
<b>20</b>	70	1100	550	40	3
<b>25</b>	70	890	440	50	3.8

Depth of Cut 

### ■ Slot Milling

Depth of Cut DC×1

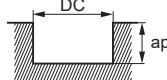
Work Material	Austenitic Stainless Steel ( $\leq 200\text{HB}$ ), Titanium Alloy AISI 304, AISI 316, Ti-6Al-4V			
Dia. DC (mm)	Cutting Speed (m/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)
<b>16</b>	60	1200	420	16
<b>20</b>	60	950	330	20
<b>25</b>	50	640	220	25

Depth of Cut 

DC:Dia.

Depth of Cut DC×2

Work Material	Austenitic Stainless Steel ( $\leq 200\text{HB}$ ), Titanium Alloy AISI 304, AISI 316, Ti-6Al-4V			
Dia. DC (mm)	Cutting Speed (m/min)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)
<b>16</b>	60	1200	240	32
<b>20</b>	60	950	190	40
<b>25</b>	50	640	130	50

Depth of Cut 

DC:Dia.

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

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

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

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

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

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

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

SQUARE

BALL

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BARREL

ROUGHING



SOLID END MILLS



# SOLID END MILLS

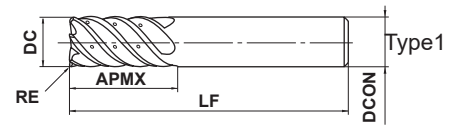
## VQ6MHVRBCH NEW

Corner radius end mill, Medium cut length, 6 flute, Irregular helix flutes, With multiple internal through 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	Aluminium Alloy
○	○			◎	◎	○	

**CoolStar**  
END MILLS



	$0.5 \leq RE \leq 4$				
	$\pm 0.015$				
	$DC \leq 12$	$DC > 12$			
	$0$ - 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 corner radius end mill with multiple internal through coolant holes ensures stable machining on difficult-to-cut materials and applications requiring long overhangs.

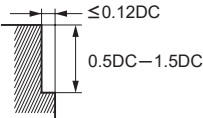
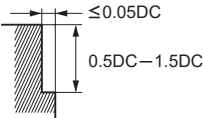
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQ6MHVRBCHD1000R050	10	0.5	22	70	10	6	●	1
VQ6MHVRBCHD1000R100	10	1	22	70	10	6	●	1
VQ6MHVRBCHD1200R050	12	0.5	26	75	12	6	●	1
VQ6MHVRBCHD1200R100	12	1	26	75	12	6	●	1
VQ6MHVRBCHD1600R100	16	1	32	90	16	6	●	1
VQ6MHVRBCHD1600R300	16	3	32	90	16	6	●	1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

● : Inventory maintained in Japan.

CARBIDE  
 SQUARE  
 BALL  
 RADIUS  
 TAPER  
 BARREL  
 ROUGHING  
 SOLID END MILLS

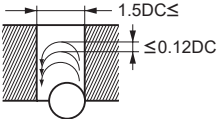
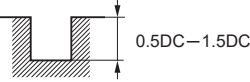
## RECOMMENDED CUTTING CONDITIONS

### Side milling

Dia. DC (mm)	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		Austenitic Stainless Steel ( $\leq 200\text{HB}$ ), Titanium Alloy AISI 304, AISI 316, Ti-6Al-4V		Copper, Copper alloy		Heat Resistant Alloys Inconel 718	
	Revolution ( $\text{min}^{-1}$ )	Feed rate ( $\text{mm/min}$ )	Revolution ( $\text{min}^{-1}$ )	Feed rate ( $\text{mm/min}$ )	Revolution ( $\text{min}^{-1}$ )	Feed rate ( $\text{mm/min}$ )	Revolution ( $\text{min}^{-1}$ )	Feed rate ( $\text{mm/min}$ )
<b>10</b>	—	—	4800	2000	—	—	1300	260
<b>12</b>	—	—	4000	2000	—	—	1100	230
<b>16</b>	4000	2200	3000	1600	2400	1400	800	180
<b>20</b>	3200	1900	2400	1400	1900	1100	640	150
Depth of Cut								

DC: Dia.

### Trochoidal slotting

Dia. DC (mm)	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21		Austenitic stainless steel ( $\leq 200\text{HB}$ ), Titanium alloy AISI 304, AISI 306, Ti-6Al-4V	
	Revolution ( $\text{min}^{-1}$ )	Feed rate ( $\text{mm/min}$ )	Revolution ( $\text{min}^{-1}$ )	Feed rate ( $\text{mm/min}$ )
<b>10</b>	—	—	4800	1400
<b>12</b>	—	—	4000	1200
<b>16</b>	4000	1600	3000	1100
<b>20</b>	3200	1400	2400	900
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 workpiece 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.

# SOLID END MILLS

## VF6MHVRB

Corner radius, Medium cut length, 6 flute, Irregular helix flutes

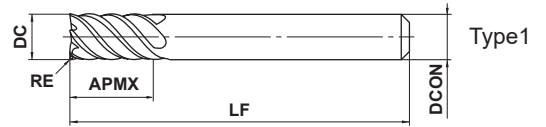


43.5°  
45°



TOOL NEWS

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	Aluminium Alloy
○	○			◎	◎		



Type1

	$0.5 \leq RE \leq 2$				
	$\pm 0.015$				
	$DC \leq 12$	$DC > 12$			
	$-0.020$	$-0.030$			
	$DCON = 6$	$8 \leq DCON \leq 10$	$12 \leq DCON \leq 16$	$DCON = 20$	
	$-0.008$	$-0.009$	$-0.011$	$-0.013$	

- 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)

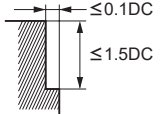
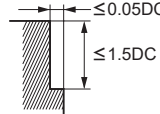
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6MHVRBD0600R050	6	0.5	13	50	6	6	●	1
VF6MHVRBD0600R100	6	1	13	50	6	6	●	1
VF6MHVRBD0800R050	8	0.5	19	60	8	6	●	1
VF6MHVRBD0800R100	8	1	19	60	8	6	●	1
VF6MHVRBD1000R050	10	0.5	22	70	10	6	●	1
VF6MHVRBD1000R100	10	1	22	70	10	6	●	1
VF6MHVRBD1200R050	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

● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Heat resistant alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>6</b>	10600	2900	8000	2000	2100	320
<b>8</b>	8000	2900	6000	2000	1600	300
<b>10</b>	6400	2700	4800	2000	1300	260
<b>12</b>	5300	2700	4000	2000	1100	230
<b>16</b>	4000	2200	3000	1600	800	180
<b>20</b>	3200	1900	2400	1400	640	150
Depth of cut						

DC: Dia.

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

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

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 workpiece 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

↩

SOLID END MILLS

# SOLID END MILLS

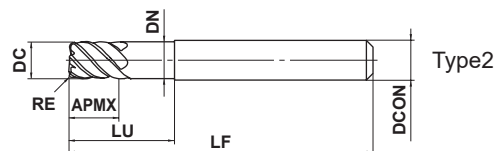
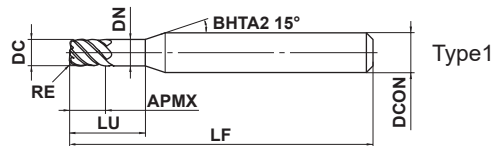
## VFSDRB

IMPACT MIRACLE Corner radius end mill, 6 flute (S)



TOOL NEWS

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	Aluminium Alloy
	○	◎	◎				



	3 ≤ DC ≤ 12				
	<sup>0</sup> / <sub>-0.02</sub>				
	DCON=6	8 ≤ DCON ≤ 10	DCON=12		
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>		

● 6 flute end mill with Impact Miracle coating for high hardened materials.

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

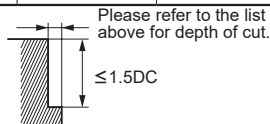
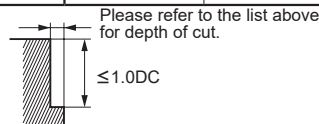
● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## 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		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	1200	0.05	40000	800	0.03	32000	500	0.02
<b>2</b>	40000	2000	0.1	24000	1000	0.05	16000	600	0.05
<b>3</b>	32000	3800	0.2	16000	1900	0.1	11000	1200	0.05
<b>4</b>	24000	4400	0.2	12000	2200	0.1	8000	1300	0.05
<b>6</b>	16000	5800	0.3	8000	2900	0.2	5300	1800	0.1
<b>8</b>	12000	5800	0.4	6000	2900	0.2	4000	1800	0.1
<b>10</b>	9600	5800	0.5	4800	2900	0.3	3200	1800	0.2
<b>12</b>	8000	4800	0.6	4000	2400	0.3	2700	1500	0.2
<b>16</b>	6000	3600	0.8	3000	1800	0.5	2000	1100	0.3
<b>20</b>	4800	2900	1.0	2400	1400	0.5	1600	880	0.3
<b>25</b>	3800	2300	1.0	1900	1100	0.5	1300	720	0.3

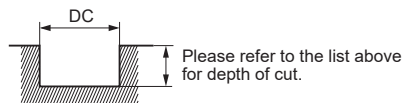
  

Depth of cut		
	DC: Dia.	

### Slot milling with small diameter tools

Work Material	Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
	AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	15000	300	0.1	9500	110	0.05
<b>2</b>	8000	320	0.2	4800	190	0.1

Depth of cut		DC: Dia.

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

Note 2) 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.

# SOLID END MILLS

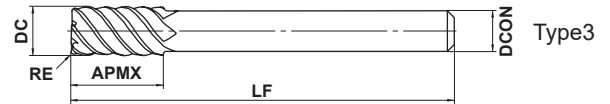
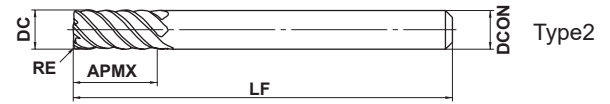
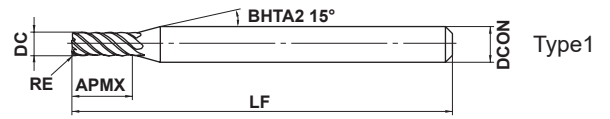
## VFMDRDB

Corner radius, Medium cut length, 6 flute, For hardened materials



TOOL NEWS

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	Aluminium Alloy
	○	◎	◎				



	DC ≤ 12	DC > 12		
	$\begin{matrix} 0 \\ -0.02 \end{matrix}$	$\begin{matrix} 0 \\ -0.03 \end{matrix}$		
	DCON = 6	8 ≤ DCON ≤ 10	12 ≤ DCON ≤ 16	DCON = 20
h6	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$

● 6 flute corner radius end mill with Impact Miracle coating for high hardened materials.

(mm)

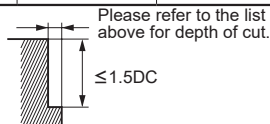
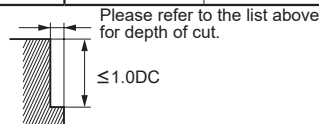
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMDRBD0300R030	3	0.3	10	60	6	6	●	1
VFMDRBD0400R030	4	0.3	12	60	6	6	●	1
VFMDRBD0500R030	5	0.3	15	60	6	6	●	1
VFMDRBD0600R030	6	0.3	15	60	6	6	●	2
VFMDRBD0600R050	6	0.5	15	60	6	6	●	2
VFMDRBD0600R100	6	1	15	60	6	6	●	2
VFMDRBD0800R030	8	0.3	20	75	8	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

● : Inventory maintained in Japan.

## 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		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	40000	1200	0.05	40000	800	0.03	32000	500	0.02
<b>2</b>	40000	2000	0.1	24000	1000	0.05	16000	600	0.05
<b>3</b>	32000	3800	0.2	16000	1900	0.1	11000	1200	0.05
<b>4</b>	24000	4400	0.2	12000	2200	0.1	8000	1300	0.05
<b>6</b>	16000	5800	0.3	8000	2900	0.2	5300	1800	0.1
<b>8</b>	12000	5800	0.4	6000	2900	0.2	4000	1800	0.1
<b>10</b>	9600	5800	0.5	4800	2900	0.3	3200	1800	0.2
<b>12</b>	8000	4800	0.6	4000	2400	0.3	2700	1500	0.2
<b>16</b>	6000	3600	0.8	3000	1800	0.5	2000	1100	0.3
<b>20</b>	4800	2900	1.0	2400	1400	0.5	1600	880	0.3
<b>25</b>	3800	2300	1.0	1900	1100	0.5	1300	720	0.3

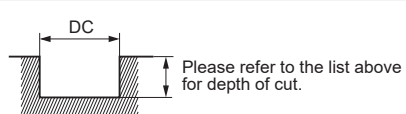
Depth of cut		
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DC:Dia.

### Slot milling with small diameter tools

Work Material	Hardened steel (45—55HRC)			Hardened steel (55—62HRC)		
	AISI H13			AISI D2		
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut (mm)
<b>1</b>	15000	300	0.1	9500	110	0.05
<b>2</b>	8000	320	0.2	4800	190	0.1

Depth of cut	
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DC:Dia.

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.



# SOLID END MILLS

## VF8MHVRBCH

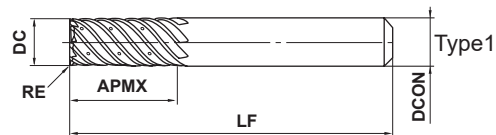
Corner radius end mill, Medium cut length, 8 flute, Irregular helix flutes, with multiple internal through coolant holes



TOOL NEWS

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	Aluminium Alloy
○	○			◎	◎		

**CoolStar**  
END MILLS



SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

←

SOLID END MILLS

	$1 \leq RE \leq 3$ ±0.015				
	$16 \leq DC \leq 20$ 0 - 0.03				
	DCON=16 0 - 0.011	DCON=20 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

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Dia. DC (mm)	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Heat resistant alloys	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>16</b>	4000	2400	3000	2100	800	240
<b>20</b>	3200	1900	2400	1900	640	200

Work Material	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Heat resistant alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Depth of cut						

DC: Dia.

### ■ Trochoidal slotting

Dia. DC (mm)	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>16</b>	4000	1900	3000	1400
<b>20</b>	3200	1500	2400	1200

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	
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 workpiece 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

↵

SOLID END MILLS

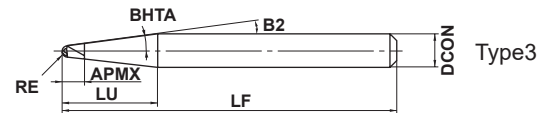
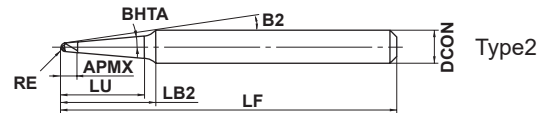
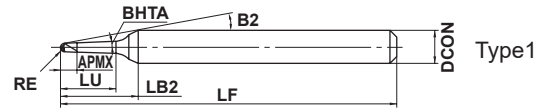
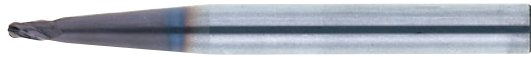
# SOLID END MILLS

## VC4STB

Ball nose taper end mill, Short 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	Aluminium Alloy
	○	◎	◎	○	○		



\*Relief Neck type.

	0.3 ≤ RE ≤ 4				
	±0.01				
	DCON = 6	8 ≤ DCON ≤ 10			
	0 - 0.008	0 - 0.009			

● 4 flute taper end mill with taper neck for maximum rigidity and high performance.

Order Number	RE	BHTA	APMX	LU	LB2	B2	LF	DCON	No. of Flutes	Stock	Type
VC4STBR0030T0130N05	0.3	1.5°	1	5	9.0	17.2°	60	6	4	●	1
VC4STBR0030T0200N05	0.3	2°	1	5	9.0	17.2°	60	6	4	●	1
VC4STBR0030T0500N05	0.3	5°	1	5	8.8	17.6°	60	6	4	●	1
VC4STBR0030T1000N15	0.3	10°	1	15	—	10.4°	60	6	4	●	3
VC4STBR0040T0130N10	0.4	1.5°	2	10	14.0	10.8°	60	6	4	●	1
VC4STBR0040T0130N15	0.4	1.5°	2	15	19.0	8.0°	60	6	4	●	1
VC4STBR0040T0200N10	0.4	2°	2	10	14.0	10.8°	60	6	4	●	1
VC4STBR0040T0500N10	0.4	5°	2	10	13.5	11.2°	60	6	4	●	1
VC4STBR0040T0700N10	0.4	7°	7	10	12.2	12.4°	60	6	4	●	2
VC4STBR0040T1000N15	0.4	10°	3	15	—	10.1°	60	6	4	●	3
VC4STBR0050T0130N10	0.5	1.5°	2	10	14.0	10.5°	60	6	4	●	1
VC4STBR0050T0130N15	0.5	1.5°	2	15	19.0	7.7°	60	6	4	●	1
VC4STBR0050T0130N20	0.5	1.5°	2	20	24.0	6.1°	60	6	4	●	1
VC4STBR0050T0200N10	0.5	2°	2	10	14.0	10.5°	60	6	4	●	1
VC4STBR0050T0200N15	0.5	2°	2	15	18.9	7.8°	60	6	4	●	1
VC4STBR0050T0200N20	0.5	2°	3	20	24.0	6.1°	60	6	4	●	1
VC4STBR0050T0500N10	0.5	5°	3	10	13.6	10.8°	60	6	4	●	1
VC4STBR0050T0500N15	0.5	5°	3	15	17.2	8.5°	60	6	4	●	2
VC4STBR0050T0500N20	0.5	5°	3	20	21.8	6.7°	60	6	4	●	2
VC4STBR0050T0700N10	0.5	7°	7	10	12.1	12.2°	60	6	4	●	2
VC4STBR0050T0700N15	0.5	7°	7	15	16.6	8.9°	60	6	4	●	2
VC4STBR0050T0700N20	0.5	7°	7	20	—	7.3°	60	6	4	●	3
VC4STBR0050T1000N14	0.5	10°	3	14	—	10.5°	60	6	4	●	3
VC4STBR0075T0200N10	0.75	2°	3	10	14.0	9.6°	60	6	4	●	1
VC4STBR0075T0500N15	0.75	5°	3	15	17.0	7.9°	60	6	4	●	2
VC4STBR0100T0130N10	1	1.5°	4	10	13.5	9.1°	60	6	4	●	1
VC4STBR0100T0130N15	1	1.5°	4	15	18.5	6.5°	60	6	4	●	1
VC4STBR0100T0130N20	1	1.5°	4	20	23.5	5.1°	60	6	4	●	1
VC4STBR0100T0200N06	1	2°	4	6	8.7	14.4°	60	6	4	●	2
VC4STBR0100T0200N10	1	2°	4	10	13.8	8.9°	60	6	4	●	1
VC4STBR0100T0200N15	1	2°	4	15	17.5	6.9°	60	6	4	●	2
VC4STBR0100T0500N10	1	5°	4	10	12.2	10.1°	60	6	4	●	2
VC4STBR0100T0500N15	1	5°	4	15	16.8	7.2°	60	6	4	●	2
VC4STBR0100T0500N23	1	5°	4	23	—	5.2°	60	6	4	●	3

● : Inventory maintained in Japan.

(mm)

Order Number	RE	BHTA	APMX	LU	LB2	B2	LF	DCON	No. of Flutes	Stock	Type
VC4STBR0100T0700N17	1	7°	7	17	—	7.1°	60	6	4	●	3
VC4STBR0100T1000N12	1	10°	4	12	—	10.3°	60	6	4	●	3
VC4STBR0125T0500N15	1.25	5°	4	15	16.5	6.6°	60	6	4	●	2
VC4STBR0150T0130N15	1.5	1.5°	4	15	17.3	5.4°	60	6	4	●	2
VC4STBR0150T0130N20	1.5	1.5°	4	20	22.2	4.2°	60	6	4	●	2
VC4STBR0150T0300N15	1.5	3°	4	15	16.9	5.6°	60	6	4	●	2
VC4STBR0150T0500N10	1.5	5°	4	10	11.7	8.3°	60	6	4	●	2
VC4STBR0150T0500N18	1.5	5°	4	18	—	5.2°	60	6	4	●	3
VC4STBR0175T0500N15	1.75	5°	4	15	—	5.4°	60	6	4	●	3
VC4STBR0200T0130N15	2	1.5°	5	15	16.8	3.9°	60	6	4	●	2
VC4STBR0200T0130N20	2	1.5°	5	20	21.6	3.0°	60	6	4	●	2
VC4STBR0200T0300N21	2	3°	4	21	—	3.1°	60	6	4	●	3
VC4STBR0200T0500N13	2	5°	4	13	—	5.2°	60	6	4	●	3
VC4STBR0200T0700N18	2	7°	7	18	—	7.1°	60	8	4	●	3
VC4STBR0300T0130N15	3	1.5°	6	15	16.8	4.2°	90	8	4	●	2
VC4STBR0300T0130N20	3	1.5°	6	20	21.7	3.1°	90	8	4	●	2
VC4STBR0300T0300N22	3	3°	6	22	—	3.1°	90	8	4	●	3
VC4STBR0400T0130N15	4	1.5°	8	15	16.9	4.4°	90	10	4	●	2
VC4STBR0400T0300N22	4	3°	8	22	—	3.2°	90	10	4	●	3

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## VC4STB

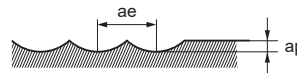
Ball nose taper end mill, Short cut length, 4 flute

CARBIDE

### RECOMMENDED CUTTING CONDITIONS

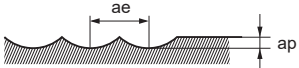
Work Material			Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
			AISI H13, AISI W1-10, AISI P21				AISI H13				AISI D2			
R RE (mm)	Taper angle one side BHTA	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
R 0.3	1.5°	5	40000	1600	0.08	0.12	40000	1200	0.06	0.10	40000	700	0.04	0.06
	2°	5	40000	1600	0.08	0.12	40000	1200	0.06	0.10	40000	700	0.04	0.06
	5°	5	40000	1600	0.08	0.12	40000	1200	0.06	0.10	40000	700	0.04	0.06
	10°	15	40000	1600	0.05	0.08	40000	1200	0.04	0.06	40000	700	0.03	0.04
R 0.4	1.5°	10	40000	2000	0.07	0.11	40000	1500	0.06	0.08	30000	700	0.04	0.05
	1.5°	15	40000	2000	0.05	0.08	40000	1500	0.04	0.06	30000	800	0.03	0.04
	2°	10	40000	2000	0.07	0.11	40000	1500	0.06	0.08	30000	800	0.04	0.05
	5°	10	40000	2000	0.07	0.11	40000	1500	0.06	0.08	30000	800	0.04	0.05
	7°	10	40000	2000	0.07	0.11	40000	1500	0.06	0.08	30000	800	0.04	0.05
	10°	15	40000	2000	0.06	0.09	40000	1500	0.05	0.07	30000	800	0.03	0.05
R 0.5	1.5°	10	38000	2500	0.11	0.16	35000	1600	0.08	0.13	25000	800	0.05	0.08
	1.5°	15	38000	2500	0.09	0.14	35000	1600	0.07	0.11	25000	800	0.05	0.07
	1.5°	20	38000	2500	0.06	0.09	35000	1600	0.05	0.07	25000	800	0.03	0.05
	2°	10	38000	2500	0.11	0.16	35000	1600	0.08	0.13	25000	800	0.05	0.08
	2°	15	38000	2500	0.09	0.14	35000	1600	0.07	0.11	25000	800	0.05	0.07
	2°	20	38000	2500	0.06	0.09	35000	1600	0.05	0.07	25000	800	0.03	0.05
	5°	10	38000	2500	0.12	0.18	35000	1600	0.10	0.14	25000	800	0.06	0.09
	5°	15	38000	2500	0.09	0.14	35000	1600	0.07	0.11	25000	800	0.05	0.07
	5°	20	38000	2500	0.08	0.11	35000	1600	0.06	0.09	25000	800	0.04	0.06
	7°	10	38000	2500	0.12	0.18	35000	1600	0.10	0.14	25000	800	0.06	0.09
	7°	15	38000	2500	0.11	0.16	35000	1600	0.08	0.13	25000	800	0.05	0.08
	7°	20	38000	2500	0.08	0.11	35000	1600	0.06	0.09	25000	800	0.04	0.06
R 0.75	2°	10	38000	2500	0.18	0.27	35000	1600	0.14	0.22	18000	800	0.09	0.14
	5°	15	38000	2500	0.16	0.24	35000	1600	0.13	0.19	18000	800	0.08	0.12
	1.5°	10	35000	2800	0.18	0.27	30000	1800	0.14	0.22	15000	1000	0.09	0.14
	1.5°	15	35000	2800	0.16	0.24	30000	1800	0.13	0.19	15000	1000	0.08	0.12
R 1	1.5°	20	35000	2800	0.14	0.21	30000	1800	0.11	0.17	15000	1000	0.07	0.11
	2°	6	35000	2800	0.20	0.30	30000	1800	0.16	0.24	15000	1000	0.10	0.15
	2°	10	35000	2800	0.18	0.27	30000	1800	0.14	0.22	15000	1000	0.09	0.14
	2°	15	35000	2800	0.16	0.24	30000	1800	0.13	0.19	15000	1000	0.08	0.12
	5°	10	35000	2800	0.18	0.27	30000	1800	0.14	0.22	15000	1000	0.09	0.14
	5°	15	35000	2800	0.18	0.27	30000	1800	0.14	0.22	15000	1000	0.09	0.14
	5°	23	35000	2800	0.14	0.21	30000	1800	0.11	0.17	15000	1000	0.07	0.11
	7°	17	35000	2800	0.16	0.24	30000	1800	0.13	0.19	15000	1000	0.08	0.12
	10°	12	35000	2800	0.18	0.27	30000	1800	0.14	0.22	15000	1000	0.09	0.14
	R 1.25	5°	15	35000	2800	0.23	0.34	30000	1800	0.18	0.27	15000	1000	0.11
R 1.5	1.5°	15	32000	3000	0.23	0.34	27000	2000	0.18	0.27	16000	1200	0.11	0.17
	1.5°	20	32000	3000	0.23	0.34	27000	2000	0.18	0.27	16000	1200	0.11	0.17
	3°	15	32000	3000	0.23	0.34	27000	2000	0.18	0.27	16000	1200	0.11	0.17
	5°	10	32000	3000	0.25	0.38	27000	2000	0.20	0.30	16000	1200	0.13	0.19
	5°	18	32000	3000	0.23	0.34	27000	2000	0.18	0.27	16000	1200	0.11	0.17
R 1.75	5°	15	27500	3500	0.23	0.34	23000	2500	0.18	0.27	14000	1500	0.11	0.17

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.

Work Material			Alloy steel, Tool steel, Pre-hardened steel				Hardened steel (45—55HRC)				Hardened steel (55—62HRC)			
			AISI H13, AISI W1-10, AISI P21				AISI H13				AISI D2			
R RE (mm)	Taper angle one side BHTA	Neck length LU (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R 2</b>	<b>1.5°</b>	<b>15</b>	24000	3500	0.23	0.34	20000	2500	0.18	0.27	12000	1500	0.11	0.17
	<b>1.5°</b>	<b>20</b>	24000	3500	0.23	0.34	20000	2500	0.18	0.27	12000	1500	0.11	0.17
	<b>3°</b>	<b>21</b>	24000	3500	0.23	0.34	20000	2500	0.18	0.27	12000	1500	0.11	0.17
	<b>5°</b>	<b>13</b>	24000	3500	0.25	0.38	20000	2500	0.20	0.30	12000	1500	0.13	0.19
	<b>7°</b>	<b>18</b>	24000	3500	0.23	0.34	20000	2500	0.18	0.27	12000	1500	0.11	0.17
<b>R 3</b>	<b>1.5°</b>	<b>15</b>	16000	3500	0.30	0.45	13500	2500	0.24	0.36	8000	1500	0.15	0.23
	<b>1.5°</b>	<b>20</b>	16000	3500	0.30	0.45	13500	2500	0.24	0.36	8000	1500	0.15	0.23
	<b>3°</b>	<b>22</b>	16000	3500	0.30	0.45	13500	2500	0.24	0.36	8000	1500	0.15	0.23
<b>R 4</b>	<b>1.5°</b>	<b>15</b>	12000	3500	0.30	0.45	10000	2500	0.24	0.36	6000	1500	0.15	0.23
	<b>3°</b>	<b>22</b>	12000	3500	0.30	0.45	10000	2500	0.24	0.36	6000	1500	0.15	0.23
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.

# SOLID END MILLS

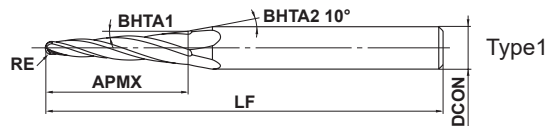
## C4LATB

Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers



TOOL NEWS

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	Aluminium Alloy
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	RE ≤ 2				
	± 0.010				
	± 5'				
	DCON=6	DCON=8			
	$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$			

● 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.

● : Inventory maintained in Japan.

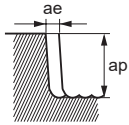
CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy			
R RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R0.5</b>	20000	2000	15	0.75
<b>R1</b>	20000	4000	15	1.5
<b>R1.5</b>	20000	5200	15	2.25
<b>R2</b>	20000	5200	23	3


Depth of cut



### ■ Slotting

Work Material	Aluminium alloy		
R RE	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)
<b>R0.5</b>	20000	600	10
<b>R1</b>	20000	2800	10
<b>R1.5</b>	20000	4000	10
<b>R2</b>	20000	4000	15

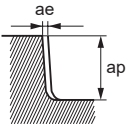
Depth of cut



### ■ Side milling (Finishing)

Work Material	Aluminium alloy			
R RE (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Depth of cut ae (mm)
<b>R0.5</b>	20000	800	18	0.1
<b>R1</b>	20000	2000	18	0.2
<b>R1.5</b>	20000	2400	18	0.3
<b>R2</b>	20000	2400	27	0.3

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS



CARBIDE

# VQT6UR

Nose radius suitable for fillet milling, also tangential form radius fit composite blade surface machining.

## Radial Accuracy

RE1 and RE2 ±0.010mm

## Optimum Cutting Edge Design

### 6-flute Peripheral Cutting Edge (Irregular pitch)

Multi cutting edge design achieve high efficiency machining. Irregular pitch design prevents chattering.

### 3-flute End Cutting Edge

A wide flute improves chip evacuation.

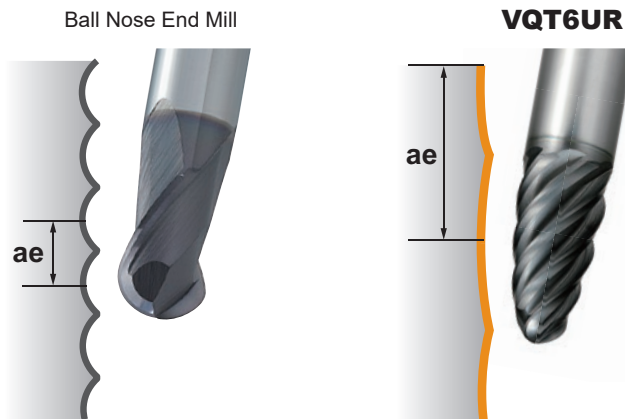


## Ideal Shape

Compared with ball nose end mill, an tangential form radius is larger and cusp height is controllable. This design makes highly efficient machining with larger pick feed.



Nose and tangential form part has two different radius.



Shorter cutting distance contribute to longer tool life.

SOLID END MILLS

ROUGHING

BARREL

TAPER

RADIUS

BALL

SQUARE

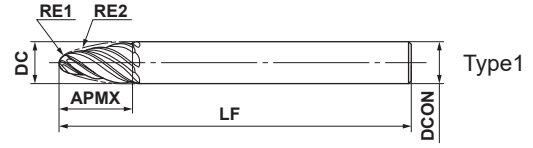
# VQT6UR NEW

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	Aluminium Alloy
				○	◎		○



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

- Nose and tangential form part has two different radius.
- Irregular pitch design prevents chattering and achieves high efficiency and high quality machining surface. (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, please use an internal contact type (non-electricity type) or a laser tool setter.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS

● : Inventory maintained in Japan.

# SOLID END MILLS

## VQT6UR NEW

Barrel, Medium cut length, 6 flute

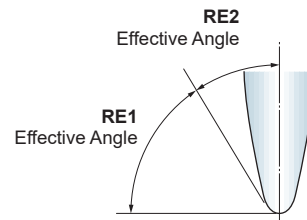
CARBIDE

### RECOMMENDED CUTTING CONDITIONS

#### Effective Angle

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

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



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

Work Material		Mild Steels ( $\leq 180\text{HB}$ ) Carbon Steels, Cast Irons (180–280HB)			Austenitic Stainless Steels ( $\leq 200\text{HB}$ ) Titanium Alloys			Aluminum Alloys (Si < 5%)		
DC (mm)	RE2 (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)
8	75	8000	2400	0.05–0.3	3200	770	0.05–0.3	16000	4800	0.05–0.3
10	85	6400	1900	0.05–0.3	2500	600	0.05–0.3	13000	3900	0.05–0.3
10	75	6400	1900	0.05–0.3	2500	600	0.05–0.3	13000	3900	0.05–0.3
12	100	5300	1600	0.05–0.3	2100	500	0.05–0.3	11000	3300	0.05–0.3

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

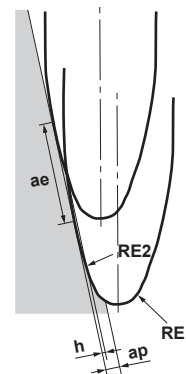
Work Material	RE2	Cusp Height h	0.0001	0.0003	0.0005	0.0008	0.001	0.003	0.005	0.008
VQT6URR020R075S08	75	Depth of Cut $a_p$	0.245	0.424	0.548	0.693	0.775	1.342	1.732	2.191
VQT6URR030R075S10	75		0.245	0.424	0.548	0.693	0.775	1.342	1.732	2.191
VQT6URR020R085S10	85		0.261	0.452	0.583	0.738	0.825	1.428	1.844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

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) It is recommended to use this tool only for finish cutting.

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.



## ■ Milling with the Use of the Nose Radius (RE1)

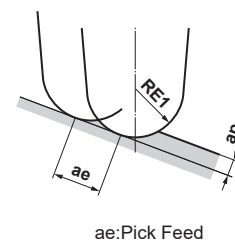
Work Material		Mild Steels ( $\leq 180\text{HB}$ ) Carbon Steels, Cast Irons (180—280HB)				Austenitic Stainless Steels ( $\leq 200\text{HB}$ ) Titanium Alloys				Aluminum Alloys (Si < 5%)			
DC (mm)	RE1 (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Depth of cut $a_e$ (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Depth of cut $a_e$ (mm)	Revolution ( $\text{min}^{-1}$ )	Feed rate (mm/min)	Depth of cut $a_p$ (mm)	Depth of cut $a_e$ (mm)
8	2	16000	2400	0.4	1	6400	580	0.4	1	32000	4800	0.4	1
10	2	16000	2400	0.4	1	6400	580	0.4	1	32000	4800	0.4	1
10	3	11000	1700	0.6	1.5	4200	380	0.6	1.5	21000	3200	0.6	1.5
12	4	8000	1200	0.8	2	3200	290	0.8	2	16000	2400	0.8	2

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) It is recommended to use this tool only for finish cutting.

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.



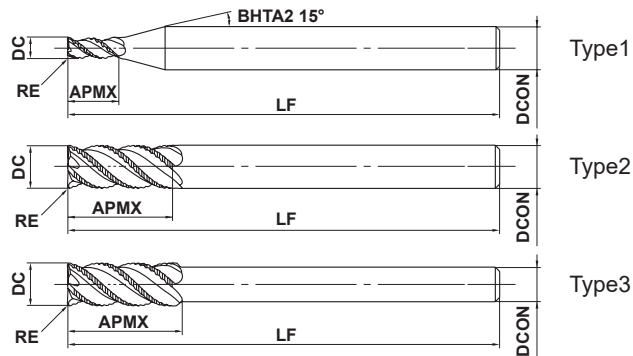
# SOLID END MILLS

## VQSVR

Roughing end mill, Short cut 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	Aluminium 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
VQSVRD1000	10	0.5	22	90	10	4	●	2
VQSVRD1000S08	10	0.5	22	90	8	4	●	3
VQSVRD1200	12	0.5	27	100	12	4	●	2
VQSVRD1200S10	12	0.5	27	100	10	4	●	3
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 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.

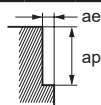
## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

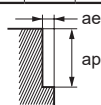
#### High efficiency conditions

Work Material	Carbon steel, Alloy steel, Mild steel					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel					Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys					Hardened stainless steels, 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									
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



#### 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 steels, Titanium alloys					Hardened stainless steels, 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									
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Hole Depth ap (mm)	Hole Depth ae (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



- 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 alloys and heat-resistant alloys 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.

# SOLID END MILLS

## VQSVR

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

CARBIDE

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

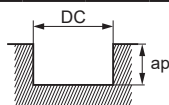
### RECOMMENDED CUTTING CONDITIONS

#### ■ Slotting

The rigidity of the machine or workpiece and chip discharge are sufficient at high efficiency conditions.  
The rigidity of the machine or workpiece or chip discharge is insufficient at general-purpose conditions.

#### High efficiency conditions

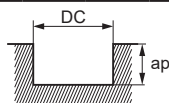
Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys AISI 304, AISI 306, Ti-6Al-4V				Hardened stainless steels, Cobalt chromium alloy AISI 630, AISI 631, 15-5PH, 17-4PH				Copper, Copper alloy			
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



DC: Dia.

#### General-purpose conditions

Dia. DC (mm)	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340				Austenitic, Ferritic and Martensitic stainless steels, Titanium alloys AISI 304, AISI 306, Ti-6Al-4V				Hardened stainless steels, Cobalt chromium alloy AISI 630, AISI 631, 15-5PH, 17-4PH				Copper, Copper alloy			
	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min <sup>-1</sup> )	Feed rate (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



DC: Dia.

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 alloys and heat-resistant alloys 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) Finishing at a faster feedrate is possible when the depth of cut is small.



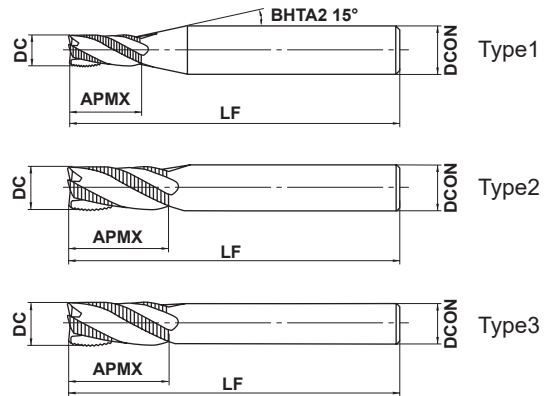
# VFSFPR

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	Aluminium Alloy
○	○			○	○		



DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20
$\begin{matrix} 0 \\ -0.008 \end{matrix}$	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$

● Impact Miracle roughing end mills for a wide range of work materials from carbon and alloy steel through to difficult-to-cut materials.

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
VFSFPRD1000	10	22	70	10	4	●	2
VFSFPRD1000S08	10	22	90	8	4	●	3
VFSFPRD1200	12	27	75	12	4	●	2
VFSFPRD1200S10	12	27	100	10	4	●	3
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

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

● : Inventory maintained in Japan.



# SOLID END MILLS

## VFSFPR

Roughing end mill, Short cut length, 3–4 flute

CARBIDE

### 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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	16000	960	13000	640	6400	260	5300	320	4200	70
4	12000	960	9500	640	4800	260	4000	320	3200	70
5	9500	960	7600	640	3800	260	3200	320	2500	70
6	8000	960	6400	680	3200	290	2700	340	2100	75
8	6000	1050	4800	760	2400	340	2000	400	1600	95
10	4800	1050	3800	760	1900	340	1600	400	1300	105
12	4000	960	3200	700	1600	320	1300	400	1100	110
16	3000	840	2400	620	1200	300	1000	360	800	110
20	2400	760	1900	560	1000	300	800	320	600	100

Depth of cut

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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	13000	720	11000	480	4800	190	3200	190	2100	25
4	9500	720	8000	480	3600	190	2400	190	1600	25
5	7600	720	6400	480	3200	190	1900	190	1300	25
6	6400	720	5300	480	2700	200	1600	200	1100	30
8	4800	800	4000	520	2000	220	1200	220	800	35
10	3800	800	3200	520	1600	220	1000	220	600	35
12	3200	750	2700	520	1300	210	800	210	500	40
16	2400	620	2000	450	1000	180	600	180	400	45
20	1900	540	1600	400	800	160	500	160	300	40

Depth of cut

Depth of cut

DC: Dia.

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

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.

# VFSFPRCH

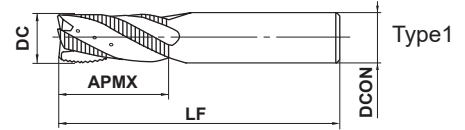
Roughing end mill, Short cut length, 4 flute, with multiple internal through coolant holes



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	Aluminium Alloy
○	○			◎	◎		

**CoolStar**  
END MILLS



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.

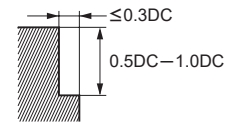
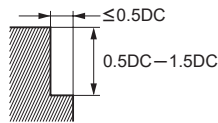
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSFPRCHD1600	16	33	90	16	4	●	1
VFSFPRCHD2000	20	38	100	20	4	●	1

## RECOMMENDED CUTTING CONDITIONS

### ■ Side 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 alloys	
	AISI 1050, AISI No 35 B, AISI P20		AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	3000	840	2400	620	1200	300	800	110
20	2400	760	1900	560	1000	300	600	100

Depth of cut

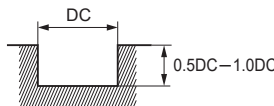


DC: Dia.

### ■ Slotting

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	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	2400	620	2000	450	800	100
20	1900	540	1600	400	600	80

Depth of cut



DC: Dia.

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.

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

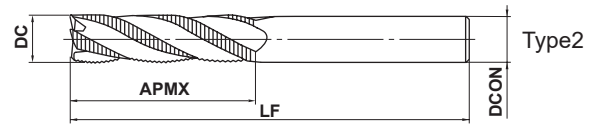
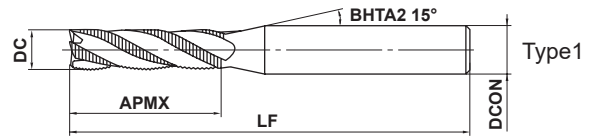
## VFMFPR

Roughing end mill, Medium cut length, 4 flute



TOOL NEWS

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	Aluminium Alloy
○	○			◎	◎		



h6	DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20
	<sup>0</sup> / <sub>-0.008</sub>	<sup>0</sup> / <sub>-0.009</sub>	<sup>0</sup> / <sub>-0.011</sub>	<sup>0</sup> / <sub>-0.013</sub>

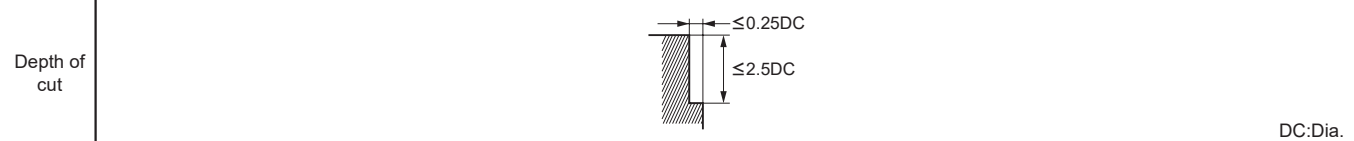
● Impact Miracle roughing end mills suitable for the machining of deep walled components.

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 alloys	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
AISI 1050, AISI No 35 B, AISI P20			AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		AISI H13		Inconel718	
5	3800	360	3200	290	2500	150	2500	150	1900	50
6	3200	360	2700	290	2100	160	2100	160	1600	60
8	2400	450	2000	360	1600	160	1600	160	1200	70
10	1900	450	1600	360	1300	180	1300	180	1000	75
12	1600	400	1300	320	1100	180	1100	180	800	80
16	1200	360	1000	290	800	160	800	160	600	80
20	1000	340	800	270	600	150	600	150	500	80



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

● : Inventory maintained in Japan.

# VF6SVRCH

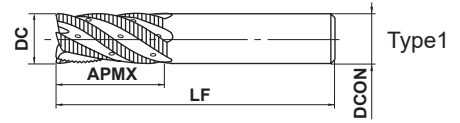
Roughing end mill, Short cut length, 6 flute, Irregular helix flutes, with multiple internal through coolant holes



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	Aluminium Alloy
○	○			◎	◎		

**CoolStar**  
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.

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

### ■ Side milling

Work Material	Alloy steel, Tool steel, Pre-hardened steel		Austenitic stainless steel, Titanium alloy		Heat resistant alloys	
	AISI H13, AISI W1-10, AISI P21		AISI 304, AISI 306, Ti-6Al-4V		Inconel718	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
16	3000	1500	2400	1200	800	160
20	2400	1200	2000	1000	640	140

Depth of cut		
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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 workpiece 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



SOLID END MILLS

# SOLID END MILLS

## CSRARB

Corner radius roughing end mill, Short cut length, 3 flute, For aluminium alloy

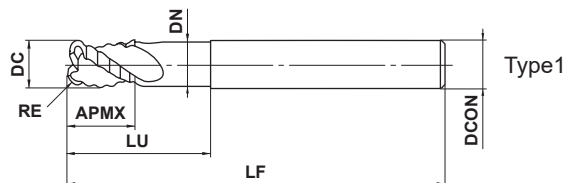


37.5°



TOOL NEWS

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	Aluminium Alloy
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SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

h6	DCON=10	12≤DCON≤16	20≤DCON≤25		
	$\begin{matrix} 0 \\ -0.009 \end{matrix}$	$\begin{matrix} 0 \\ -0.011 \end{matrix}$	$\begin{matrix} 0 \\ -0.013 \end{matrix}$		

● 3 flute uncoated end mill for roughing aluminium alloy.

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CSRARBD1000R100	10	1	12	25	9.4	75	10	3	●	1
CSRARBD1000R200	10	2	12	25	9.4	75	10	3	●	1
CSRARBD1200R100	12	1	15	30	11.4	75	12	3	●	1
CSRARBD1200R200	12	2	15	30	11.4	75	12	3	●	1
CSRARBD1600R200	16	2	18	35	15.4	100	16	3	●	1
CSRARBD1600R300	16	3	18	35	15.4	100	16	3	●	1
CSRARBD2000R200	20	2	25	50	18.0	125	20	3	●	1
CSRARBD2000R300	20	3	25	50	18.0	125	20	3	●	1
CSRARBD2500R300	25	3	30	60	23.0	125	25	3	●	1
CSRARBD2500R400	25	4	30	60	23.0	125	25	3	●	1
CSRARBD2500R500	25	5	30	60	23.0	125	25	3	●	1

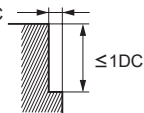
(mm)

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

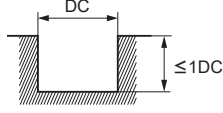
### Side milling

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	19000	8600	9500	3400	
<b>12</b>	16000	8200	8000	3200	
<b>16</b>	12000	7600	6000	3100	
<b>18</b>	10500	7200	5300	2900	
<b>20</b>	9500	7100	4800	2900	
<b>22</b>	8500	6900	4300	2800	
<b>25</b>	7500	6800	3800	2700	

Depth of cut  $\leq 0.5DC$   DC:Dia.

### Slotting

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	19000	6800	9500	2700	
<b>12</b>	16000	6500	8000	2600	
<b>16</b>	12000	6100	6000	2400	
<b>18</b>	10500	5800	5300	2400	
<b>20</b>	9500	5700	4800	2300	
<b>22</b>	8500	5500	4300	2200	
<b>25</b>	7500	5400	3800	2200	

Depth of cut  DC:Dia.

Note 1) Water-soluble cutting fluid is recommended.

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

Note 3) Climb cutting is recommended for side milling.

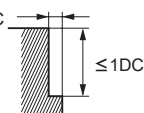
Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.

## Using a high-speed and high-rigidity machining center

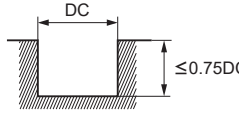
### Side milling

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	30000	11000	19000	5400	
<b>12</b>	30000	12000	16000	5300	
<b>16</b>	24000	12000	12000	4900	
<b>18</b>	21000	12000	10500	4700	
<b>20</b>	19000	11000	9500	4600	
<b>22</b>	17000	11000	8500	4300	
<b>25</b>	15000	11000	7500	4300	

Depth of cut  $\leq 0.5DC$   DC:Dia.

### Slotting

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	30000	8600	19000	4300	
<b>12</b>	30000	9900	16000	4300	
<b>16</b>	24000	9700	12000	4000	
<b>18</b>	21000	9500	10500	3800	
<b>20</b>	19000	9100	9500	3700	
<b>22</b>	17000	8700	8500	3400	
<b>25</b>	15000	8600	7500	3400	

Depth of cut  DC:Dia.

Note 1) Water-soluble cutting fluid is recommended.

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

Note 3) Climb cutting is recommended for side milling.

Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.

# SOLID END MILLS

## CSRA

Roughing end mill, Short cut length, 3 flute, For aluminium alloy

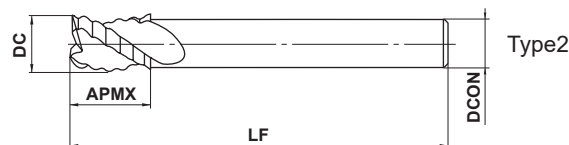
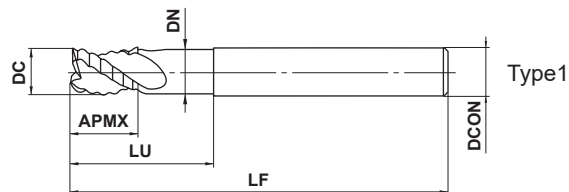


37.5°



TOOL NEWS

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	Aluminium Alloy
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h6	DCON=10	12≤DCON≤16	20≤DCON≤25		
	0 - 0.009	0 - 0.011	0 - 0.013		

● 3 flute uncoated end mill for roughing aluminium alloy.

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type	(mm)
CSRAD1000	10	12	25	9.4	75	10	3	●	1	
CSRAD1200	12	15	30	11.4	75	12	3	●	1	
CSRAD1600	16	18	35	15.4	100	16	3	●	1	
CSRAD1800	18	22	—	—	100	16	3	●	2	
CSRAD2000	20	25	50	18.0	125	20	3	●	1	
CSRAD2200	22	25	—	—	125	20	3	●	2	
CSRAD2500	25	30	60	23.0	125	25	3	●	1	

● : Inventory maintained in Japan.

CARBIDE  
SQUARE  
BALL  
RADIUS  
TAPER  
BARREL  
ROUGHING  
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

### Side milling

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	19000	8600	9500	3400	
<b>12</b>	16000	8200	8000	3200	
<b>16</b>	12000	7600	6000	3100	
<b>18</b>	10500	7200	5300	2900	
<b>20</b>	9500	7100	4800	2900	
<b>22</b>	8500	6900	4300	2800	
<b>25</b>	7500	6800	3800	2700	

Depth of cut			DC:Dia.

### Slotting

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	19000	6800	9500	2700	
<b>12</b>	16000	6500	8000	2600	
<b>16</b>	12000	6100	6000	2400	
<b>18</b>	10500	5800	5300	2400	
<b>20</b>	9500	5700	4800	2300	
<b>22</b>	8500	5500	4300	2200	
<b>25</b>	7500	5400	3800	2200	

Depth of cut			DC:Dia.

Note 1) Water-soluble cutting fluid is recommended.

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

Note 3) Climb cutting is recommended for side milling.

Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.

## Using a high-speed and high-rigidity machining center

### Side milling

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	30000	11000	19000	5400	
<b>12</b>	30000	12000	16000	5300	
<b>16</b>	24000	12000	12000	4900	
<b>18</b>	21000	12000	10500	4700	
<b>20</b>	19000	11000	9500	4600	
<b>22</b>	17000	11000	8500	4300	
<b>25</b>	15000	11000	7500	4300	

Depth of cut			DC:Dia.

### Slotting

Work Material	Aluminium alloy		Aluminium alloy casting		
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>10</b>	30000	8600	19000	4300	
<b>12</b>	30000	9900	16000	4300	
<b>16</b>	24000	9700	12000	4000	
<b>18</b>	21000	9500	10500	3800	
<b>20</b>	19000	9100	9500	3700	
<b>22</b>	17000	8700	8500	3400	
<b>25</b>	15000	8600	7500	3400	

Depth of cut			DC:Dia.

Note 1) Water-soluble cutting fluid is recommended.

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

Note 3) Climb cutting is recommended for side milling.

Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.



# SOLID END MILLS

## CMRA

Roughing end mill, Medium cut length, 3 flute, For aluminium alloy

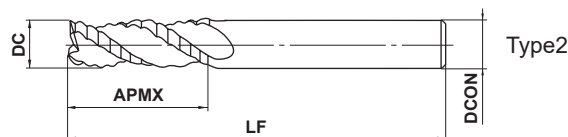
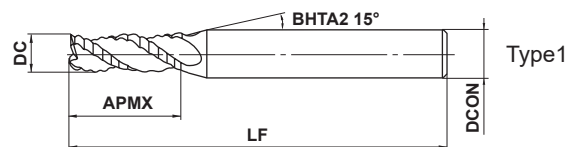


37.5°



TOOL NEWS

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	Aluminium Alloy
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h6	DCON=6	8≤DCON≤10	12≤DCON≤16	20≤DCON≤25
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

● 3 flute uncoated end mill for roughing aluminium alloy.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
CMRAD0300	3	8	50	6	3	●	1
CMRAD0400	4	11	50	6	3	●	1
CMRAD0500	5	13	50	6	3	●	1
CMRAD0600	6	13	50	6	3	●	2
CMRAD0800	8	19	60	8	3	●	2
CMRAD1000	10	22	75	10	3	●	2
CMRAD1200	12	26	75	12	3	●	2
CMRAD1600	16	32	100	16	3	●	2
CMRAD2000	20	38	125	20	3	●	2
CMRAD2500	25	45	125	25	3	●	2

(mm)

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Aluminium alloy		Aluminium alloy casting	
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
<b>3</b>	40000	2700	25000	1100
<b>4</b>	36000	2700	20000	1100
<b>5</b>	30000	5400	16000	2200
<b>6</b>	27000	6100	13000	2300
<b>8</b>	20000	6000	10000	2400
<b>10</b>	16000	5800	8000	2300
<b>12</b>	13000	5300	6500	2100
<b>16</b>	10000	5100	5000	2000
<b>20</b>	8000	4800	4000	1900
<b>25</b>	6400	4600	3200	1800

Depth of cut			DC: Dia.

### ■ Slotting

Work Material	Aluminium alloy		Aluminium alloy casting	
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
<b>3</b>	30000	1800	16000	700
<b>4</b>	24000	2200	12000	900
<b>5</b>	19000	2300	10000	900
<b>6</b>	16000	2400	8000	1000
<b>8</b>	12000	2500	6000	1000
<b>10</b>	9500	2600	5000	1100
<b>12</b>	8000	2300	4000	900
<b>16</b>	6000	2100	3000	800
<b>20</b>	4800	2000	2400	800
<b>25</b>	3800	2000	1900	700

Depth of cut			DC: Dia.

Note 1) Water-soluble cutting fluid is recommended.

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

Note 3) Climb cutting is recommended for side milling.

Note 4) These end mills do not have a centre cutting edge, therefore when entering a workpiece use a ramping process rather than vertical feed.

Note 5) 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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

↩

SOLID END MILLS

# SOLID END MILLS

## GBE

CBN end mill, Single flute



CBN

SQUARE

BALL

RADIUS

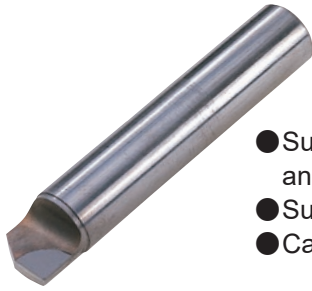
TAPER

BARREL

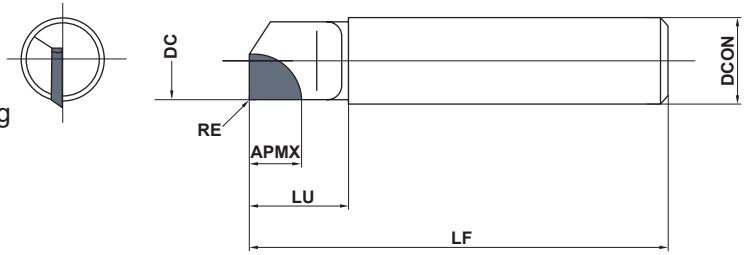
ROUGHING

SOLID END MILLS

Light Alloy	Cast Iron	Carbon Steel + Alloy Steel	Stainless Steel	Hardened Steel
				◎



- Suitable for shoulder milling and die machining.
- Suitable for re-grinding.
- Carbide shank.



Right hand tool holder only.

Order Number	Number of Flutes	Stock	Dimensions (mm)					
		MB730	DC	RE	LF	DCON	LU	APMX
GBE06S0640	1	●	6	0.5	40	6	8	3.5
GBE08S0845	1	●	8	0.5	45	8	13	6
GBE10S1050	1	●	10	0.5	50	10	13	6
GBE12S1255	1	●	12	0.5	55	12	13	6

### RECOMMENDED CUTTING CONDITIONS

	Work Material	Hardness	Grade	Cutting Speed (m/min)	Feed (mm/rev)	Depth of Cut (mm)
H	Hardened Steel	45-68HRC	<b>MB730</b>	140 (80-200)	0.08 (0.02-0.15)	≤0.5
	Hardened Steel	45-68HRC	<b>MB730</b>	100 (60-150)	0.06 (0.02-0.10)	≤0.5

● : Inventory maintained in Japan.

# Memo

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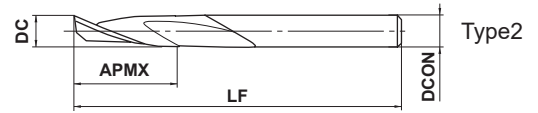
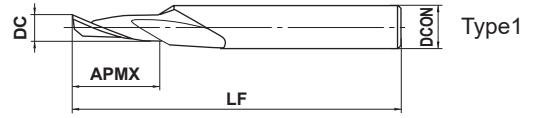
# SOLID END MILLS

## 1MA

End mill, Medium cut length, 1 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	Aluminium Alloy
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$3 \leq DC \leq 8$					
0					
- 0.050					

● Single flute end mill for aluminium channel and wood working.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
1MAD0300	3	10	60	8	1	●	1
1MAD0400	4	12	60	8	1	●	1
1MAD0500	5	15	65	8	1	●	1
1MAD0600	6	15	65	8	1	●	1
1MAD0800	8	20	75	8	1	●	2

(mm)

● : Inventory maintained in Japan.

HSS

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

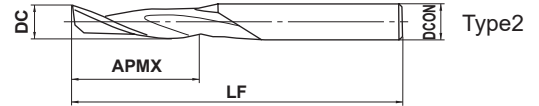
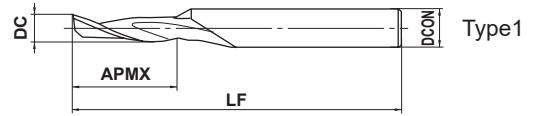
# 1LA

End mill, Long cut length, 1 flute



HSS

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	Aluminium Alloy
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$4 \leq DC \leq 12$				
$0$				
$- 0.050$				

● Single flute end mill with longer cut length and overall length than standard for deeper machining.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
1LAD0400	4	18	70	8	1	●	1
1LAD0500	5	20	70	8	1	●	1
1LAD0600	6	20	70	8	1	●	1
1LAD0800	8	30	80	8	1	●	2
1LAD1000	10	35	90	10	1	●	2
1LAD1200	12	45	100	12	1	●	2

(mm)

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

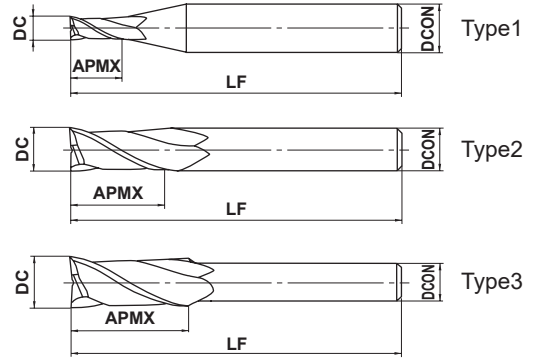
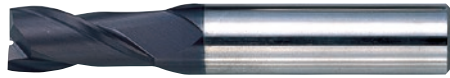
## VA2SS

End mill, Short cut length, 2 flute



HSS

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	Aluminium Alloy
○	○			○	○		



	$3 \leq DC \leq 20$				
	0				
	- 0.030				

● 2 flute end mill with high grade HSS substrate and Violet coating for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VA2SSD0300	3	8	50	6	2	●	1
VA2SSD0400	4	8	60	8	2	●	1
VA2SSD0500	5	10	60	8	2	●	1
VA2SSD0600	6	12	60	8	2	●	1
VA2SSD0700	7	15	65	10	2	●	1
VA2SSD0800	8	15	65	10	2	●	1
VA2SSD0900	9	20	75	10	2	●	1
VA2SSD1000	10	20	75	12	2	●	1
VA2SSD1100	11	22	85	12	2	●	1
VA2SSD1200	12	22	85	12	2	●	2
VA2SSD1300	13	26	90	12	2	●	3
VA2SSD1400	14	26	95	16	2	●	1
VA2SSD1500	15	30	100	16	2	●	1
VA2SSD1600	16	32	100	16	2	●	2
VA2SSD1700	17	34	100	16	2	●	3
VA2SSD1800	18	34	100	16	2	●	3
VA2SSD1900	19	38	120	20	2	●	1
VA2SSD2000	20	38	120	20	2	●	2

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

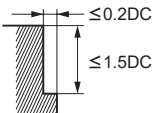
SOLID END MILLS

## RECOMMENDED CUTTING CONDITIONS

### Side milling

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	5400	170	4000	125	2700	85	2200	65
4	4300	200	3200	150	2100	100	1800	75
5	3600	210	2700	160	1800	105	1500	80
6	3200	220	2400	165	1600	110	1300	85
8	2400	240	1800	180	1200	120	1000	90
10	1900	260	1400	190	950	130	800	100
12	1600	240	1200	180	800	120	660	90
16	1200	210	900	160	600	105	500	80
20	950	180	720	135	480	90	400	70
25	760	150	570	115	380	75	320	60
30	640	130	480	100	320	65	270	50
40	470	100	350	75	240	50	200	40

Depth of cut

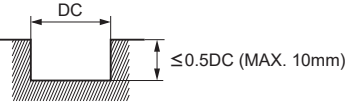


DC: Dia.

### Slotting

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	3700	110	3000	95	2100	65	1600	50
4	3200	140	2800	130	1800	75	1400	60
5	2900	160	2400	145	1500	80	1200	60
6	2600	170	2100	150	1300	85	1000	70
8	2000	190	1600	160	1000	90	800	70
10	1600	210	1300	180	800	100	640	80
12	1300	190	1100	165	660	90	530	70
16	1000	170	800	140	500	80	400	65
20	720	130	640	120	400	70	320	55
25	570	110	450	90	320	60	230	40
30	480	90	370	75	270	50	190	35
40	360	70	280	60	200	40	140	25

Depth of cut



DC: Dia.

Note 1) Supply cutting fluid sufficiently during slotting. When dry cut, slotting decrease the revolution and feed rate by 20–30% proportionately.

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

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.



# SOLID END MILLS

## VA2MS

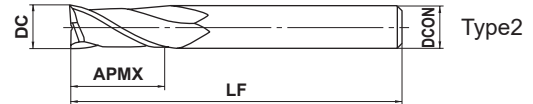
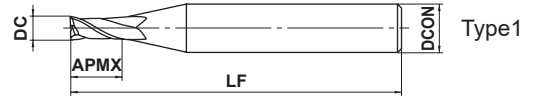
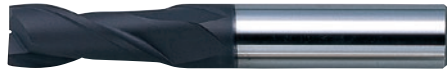
End mill, Medium cut length, 2 flute



DC<3

DC≥3

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	Aluminium Alloy
○	○			○	○		



DC ≤ 20	DC > 20			
0	0			
-0.030	-0.040			

● 2 flute end mill with high grade HSS substrate and Violet coating for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VA2MSD0300	3	10	50	6	2	●	1
VA2MSD0400	4	12	60	8	2	●	1
VA2MSD0500	5	15	60	8	2	●	1
VA2MSD0600	6	15	60	8	2	●	1
VA2MSD0700	7	20	65	10	2	●	1
VA2MSD0800	8	20	65	10	2	●	1
VA2MSD0900	9	25	75	10	2	●	1
VA2MSD1000	10	25	75	10	2	●	2
VA2MSD1100	11	30	85	12	2	●	1
VA2MSD1200	12	30	85	12	2	●	2
VA2MSD1300	13	35	90	12	2	●	3
VA2MSD1400	14	35	95	16	2	●	1
VA2MSD1500	15	40	100	16	2	●	1
VA2MSD1600	16	40	100	16	2	●	2
VA2MSD1700	17	40	100	16	2	●	3
VA2MSD1800	18	40	100	16	2	●	3
VA2MSD1900	19	45	120	20	2	●	1
VA2MSD2000	20	45	120	20	2	●	2
VA2MSD2200	22	45	120	20	2	●	3
VA2MSD2400	24	50	140	25	2	●	1
VA2MSD2500	25	50	140	25	2	●	2
VA2MSD2600	26	50	140	25	2	●	3
VA2MSD2800	28	55	145	25	2	●	3
VA2MSD3000	30	55	145	25	2	●	3
VA2MSD3200	32	60	160	32	2	●	2
VA2MSD3500	35	60	160	32	2	●	3
VA2MSD4000	40	65	165	32	2	●	3

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### Side milling

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	5400	170	4000	125	2700	85	2200	65
4	4300	200	3200	150	2100	100	1800	75
5	3600	210	2700	160	1800	105	1500	80
6	3200	220	2400	165	1600	110	1300	85
8	2400	240	1800	180	1200	120	1000	90
10	1900	260	1400	190	950	130	800	100
12	1600	240	1200	180	800	120	660	90
16	1200	210	900	160	600	105	500	80
20	950	180	720	135	480	90	400	70
25	760	150	570	115	380	75	320	60
30	640	130	480	100	320	65	270	50
40	470	100	350	75	240	50	200	40

Depth of cut

DC: Dia.

### Slotting

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	3700	110	3000	95	2100	65	1600	50
4	3200	140	2800	130	1800	75	1400	60
5	2900	160	2400	145	1500	80	1200	60
6	2600	170	2100	150	1300	85	1000	70
8	2000	190	1600	160	1000	90	800	70
10	1600	210	1300	180	800	100	640	80
12	1300	190	1100	165	660	90	530	70
16	1000	170	800	140	500	80	400	65
20	720	130	640	120	400	70	320	55
25	570	110	450	90	320	60	230	40
30	480	90	370	75	270	50	190	35
40	360	70	280	60	200	40	140	25

Depth of cut

DC: Dia.

Note 1) Supply cutting fluid sufficiently during slotting. When dry cut, slotting decrease the revolution and feed rate by 20–30% proportionately.

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

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.

# SOLID END MILLS

## 2SS

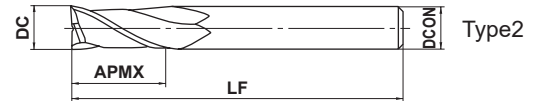
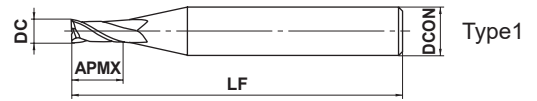
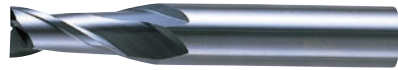
End mill, Short cut length, 2 flute



DC < 3

DC ≥ 3

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	Aluminium Alloy
○	○			○	○		○



DC ≤ 3	DC > 3			
0	0			
- 0.020	- 0.030			

● 2 flute HSS end mill with rigid design.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2SSD0050	0.5	0.8	50	6	2	●	1
2SSD0100	1	2	50	6	2	●	1
2SSD0150	1.5	3.5	50	6	2	●	1
2SSD0200	2	5	50	6	2	●	1
2SSD0250	2.5	6	50	6	2	●	1
2SSD0300	3	8	50	6	2	●	1
2SSD0350	3.5	8	60	8	2	●	1
2SSD0400	4	8	60	8	2	●	1
2SSD0450	4.5	10	60	8	2	●	1
2SSD0500	5	10	60	8	2	●	1
2SSD0550	5.5	12	60	8	2	●	1
2SSD0600	6	12	60	8	2	●	1
2SSD0650	6.5	15	65	10	2	●	1
2SSD0700	7	15	65	10	2	●	1
2SSD0750	7.5	15	65	10	2	●	1
2SSD0800	8	15	65	10	2	●	1
2SSD0850	8.5	20	75	10	2	●	1
2SSD0900	9	20	75	10	2	●	1
2SSD0950S10	9.5	20	75	10	2	●	1
2SSD0950S12	9.5	20	75	12	2	●	1
2SSD1000S10	10	20	75	10	2	●	2
2SSD1000S12	10	20	75	12	2	●	1
2SSD1050	10.5	22	85	12	2	●	1
2SSD1100	11	22	85	12	2	●	1
2SSD1150	11.5	22	85	12	2	●	1
2SSD1200	12	22	85	12	2	●	2
2SSD1250	12.5	26	90	12	2	●	3
2SSD1300	13	26	90	12	2	●	3
2SSD1350	13.5	26	90	16	2	●	1
2SSD1400	14	26	90	16	2	●	1
2SSD1450	14.5	26	100	16	2	●	1
2SSD1500	15	30	100	16	2	●	1
2SSD1550	15.5	32	100	16	2	●	1
2SSD1600	16	32	100	16	2	●	2

● : Inventory maintained in Japan.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2SSD1650	16.5	32	100	16	2	●	3
2SSD1700	17	34	100	16	2	●	3
2SSD1750	17.5	34	100	16	2	●	3
2SSD1800	18	34	100	16	2	●	3
2SSD1850	18.5	38	115	20	2	●	1
2SSD1900	19	38	115	20	2	●	1
2SSD1950	19.5	38	115	20	2	●	1
2SSD2000	20	38	115	20	2	●	2

## RECOMMENDED CUTTING CONDITIONS

Work Material	Structural steel, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel		Cast iron		Aluminium alloy	
	AISI 1045, AISI 1050		AISI 1055, AISI P20		AISI H13		AISI 304, AISI 316		AISI No 35 B			
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>0.5</b>	8000	60 (50)	7000	40 (35)	4500	30 (25)	3500	25 (20)	7500	65 (55)	16000	120 (100)
<b>1</b>	5300	80 (65)	4200	50 (40)	3000	35 (30)	2400	27 (22)	4500	85 (70)	11000	170 (140)
<b>2</b>	3100	85 (70)	2600	60 (50)	1800	50 (40)	1400	30 (25)	2700	90 (75)	6800	190 (150)
<b>3</b>	2300	90 (75)	1800	65 (55)	1400	55 (45)	1100	35 (30)	2000	95 (80)	4800	240 (190)
<b>4</b>	1800	100 (85)	1400	70 (60)	1100	55 (45)	850	35 (30)	1600	110 (90)	3800	310 (250)
<b>5</b>	1600	110 (95)	1200	90 (75)	900	60 (50)	710	40 (35)	1300	120 (100)	3200	360 (290)
<b>6</b>	1400	120 (100)	1000	90 (75)	780	65 (55)	610	50 (40)	1100	130 (110)	2800	400 (320)
<b>8</b>	1100	130 (110)	800	95 (80)	580	65 (55)	470	50 (40)	850	140 (120)	2200	460 (370)
<b>10</b>	860	140 (120)	640	100 (80)	470	65 (55)	380	55 (45)	700	160 (130)	1800	440 (350)
<b>12</b>	720	130 (110)	530	95 (80)	390	60 (50)	310	50 (40)	580	140 (120)	1600	420 (340)
<b>16</b>	540	110 (95)	400	85 (70)	300	55 (45)	230	40 (35)	440	120 (100)	1200	350 (280)
<b>20</b>	430	100 (80)	320	70 (60)	240	45 (38)	190	35 (30)	350	100 (85)	960	300 (240)

Depth of cut	$\leq 0.1DC$ ( $DC \leq \phi 3$ ) $\leq 0.2DC$ ( $DC > \phi 3$ )					
	DC: Dia.					

( ) : Indicates standard feed rate for slotting.

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## 2MS

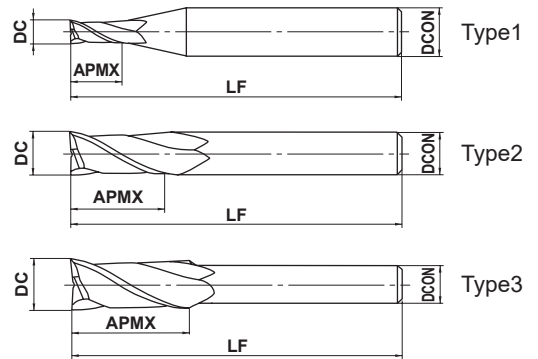
End mill, Medium cut length, 2 flute



DC<3

DC≥3

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	Aluminium Alloy
○	○			○	○		○



DC ≤ 3	3 < DC ≤ 20	DC > 20		
0 - 0.020	0 - 0.030	0 - 0.040		

● 2 flute end mill with high grade HSS substrate for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2MSD0100	1	3	50	6	2	●	1
2MSD0150	1.5	4.5	50	6	2	●	1
2MSD0200	2	6	50	6	2	●	1
2MSD0250	2.5	7.5	50	6	2	●	1
2MSD0300	3	10	50	6	2	●	1
2MSD0350	3.5	12	50	6	2	●	1
2MSD0400	4	12	50	6	2	●	1
2MSD0450	4.5	15	55	6	2	●	1
2MSD0500	5	15	55	6	2	●	1
2MSD0550	5.5	15	55	6	2	●	1
2MSD0600	6	15	55	6	2	●	2
2MSD0650	6.5	20	65	8	2	●	1
2MSD0700	7	20	65	8	2	●	1
2MSD0750	7.5	20	65	8	2	●	1
2MSD0800	8	20	65	8	2	●	2
2MSD0850	8.5	25	75	10	2	●	1
2MSD0900	9	25	75	10	2	●	1
2MSD0950	9.5	25	75	10	2	●	1
2MSD1000	10	25	75	10	2	●	2
2MSD1100	11	30	85	12	2	●	1
2MSD1200	12	30	85	12	2	●	2
2MSD1300	13	35	90	12	2	●	3
2MSD1400	14	35	95	16	2	●	1
2MSD1500	15	40	100	16	2	●	1
2MSD1600	16	40	100	16	2	●	2
2MSD1700	17	40	100	16	2	●	3
2MSD1800	18	40	100	16	2	●	3
2MSD1900	19	45	115	20	2	●	1
2MSD2000	20	45	115	20	2	●	2
2MSD2100	21	45	115	20	2	●	3
2MSD2200	22	45	115	20	2	●	3
2MSD2300	23	50	120	25	2	●	1
2MSD2400	24	50	120	25	2	●	1
2MSD2500	25	50	120	25	2	●	2

● : Inventory maintained in Japan.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2MSD2600	26	50	120	25	2	●	3
2MSD2700	27	55	125	25	2	●	3
2MSD2800	28	55	125	25	2	●	3
2MSD2900	29	55	125	25	2	●	3
2MSD3000	30	55	125	25	2	●	3
2MSD3100	31	60	145	25	2	●	3
2MSD3200	32	60	145	32	2	●	2
2MSD3300	33	60	145	32	2	●	3
2MSD3400	34	60	145	32	2	●	3
2MSD3500	35	60	145	32	2	●	3
2MSD3600	36	65	150	32	2	●	3
2MSD3700	37	65	150	32	2	●	3
2MSD3800	38	65	150	32	2	●	3
2MSD3900	39	65	150	32	2	●	3
2MSD4000	40	65	150	32	2	●	3
2MSD4100	41	70	155	32	2	●	3
2MSD4200S32	42	70	155	32	2	●	3
2MSD4200S42	42	70	155	42	2	●	2
2MSD4500S32	45	70	155	32	2	●	3
2MSD4500S42	45	70	155	42	2	●	3
2MSD4600S32	46	70	155	32	2	●	3
2MSD4600S42	46	70	155	42	2	●	3
2MSD5000S32	50	70	155	32	2	●	3
2MSD5000S42	50	70	155	42	2	●	3
2MSD5500	55	80	175	42	2	●	3
2MSD6000	60	85	185	42	2	●	3

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## 2LS

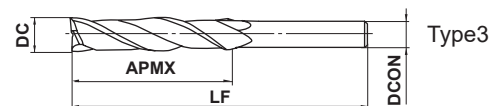
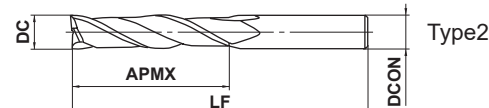
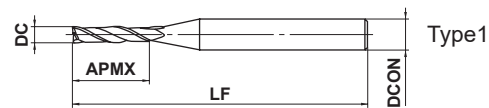
End mill, Long cut length, 2 flute



DC<3

DC≥3

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	Aluminium Alloy
○	○			○	○		○



DC ≤ 3	3 < DC ≤ 20	DC > 20		
0 - 0.020	0 - 0.030	0 - 0.040		

● 2 flute end mill with high grade HSS substrate for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2LSD0100	1	6	50	6	2	●	1
2LSD0150	1.5	7.5	50	6	2	●	1
2LSD0200	2	10	55	6	2	●	1
2LSD0250	2.5	15	55	6	2	●	1
2LSD0300	3	15	55	6	2	●	1
2LSD0350	3.5	15	55	6	2	●	1
2LSD0400	4	20	55	6	2	●	1
2LSD0450	4.5	20	55	6	2	●	1
2LSD0500	5	25	60	6	2	●	1
2LSD0550	5.5	25	60	6	2	●	1
2LSD0600	6	25	60	6	2	●	2
2LSD0650	6.5	35	75	8	2	●	1
2LSD0700	7	35	75	8	2	●	1
2LSD0750	7.5	35	75	8	2	●	1
2LSD0800	8	35	75	8	2	●	2
2LSD0850	8.5	35	75	10	2	●	1
2LSD0900	9	45	90	10	2	●	1
2LSD0950	9.5	45	90	10	2	●	1
2LSD1000	10	45	90	10	2	●	2
2LSD1050	10.5	55	105	12	2	●	1
2LSD1100	11	55	105	12	2	●	1
2LSD1150	11.5	55	105	12	2	●	1
2LSD1200	12	55	105	12	2	●	2
2LSD1250	12.5	55	105	12	2	●	3
2LSD1300	13	55	105	12	2	●	3
2LSD1350	13.5	55	110	16	2	●	1
2LSD1400	14	55	110	16	2	●	1
2LSD1450	14.5	65	120	16	2	●	1
2LSD1500	15	65	120	16	2	●	1
2LSD1550	15.5	65	120	16	2	●	1
2LSD1600	16	65	120	16	2	●	2
2LSD1650	16.5	65	120	16	2	●	3
2LSD1700	17	65	120	16	2	●	3
2LSD1750	17.5	65	120	16	2	●	3

● : Inventory maintained in Japan.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2LSD1800	18	65	120	16	2	●	3
2LSD1850	18.5	75	140	20	2	●	1
2LSD1900	19	75	140	20	2	●	1
2LSD1950	19.5	75	140	20	2	●	1
2LSD2000	20	75	140	20	2	●	2
2LSD2100	21	75	140	20	2	●	3
2LSD2200	22	75	140	20	2	●	3
2LSD2300	23	90	160	25	2	●	1
2LSD2400	24	90	160	25	2	●	1
2LSD2500	25	90	160	25	2	●	2
2LSD2600	26	90	160	25	2	●	3
2LSD2700	27	90	160	25	2	●	3
2LSD2800	28	90	160	25	2	●	3
2LSD2900	29	90	160	25	2	●	3
2LSD3000	30	90	160	25	2	●	3
2LSD3100	31	95	180	25	2	●	3
2LSD3200	32	95	180	32	2	●	2
2LSD3300	33	95	180	32	2	●	3
2LSD3400	34	100	185	32	2	●	3
2LSD3500	35	100	185	32	2	●	3
2LSD3600	36	105	190	32	2	●	3
2LSD3700	37	105	190	32	2	●	3
2LSD3800	38	105	190	32	2	●	3
2LSD3900	39	110	195	32	2	●	3
2LSD4000	40	110	195	32	2	●	3

SQUARE

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ROUGHING



SOLID END MILLS



# SOLID END MILLS

## 2MS

End mill, Medium cut length, 2 flute

## 2LS

End mill, Long cut length, 2 flute

### RECOMMENDED CUTTING CONDITIONS(2MS)

Work Material	Structural steel, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel		Cast iron		Aluminium alloy	
	AISI 1045, AISI 1050		AISI 1055, AISI P20		AISI H13		AISI 304, AISI 316		AISI No 35 B			
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
1	5300	65 (50)	4200	40 (30)	3000	30 (25)	2400	22 (18)	4500	70 (55)	11000	140 (110)
2	3100	70 (55)	2600	50 (40)	1800	40 (30)	1400	25 (20)	2700	75 (60)	6800	160 (130)
3	2300	75 (60)	1800	55 (45)	1400	45 (35)	1100	30 (25)	2000	80 (65)	4800	200 (160)
4	1800	85 (70)	1400	60 (50)	1100	45 (35)	850	30 (25)	1600	90 (70)	3800	260 (210)
5	1600	95 (75)	1200	75 (60)	900	50 (40)	710	35 (25)	1300	100 (80)	3200	300 (240)
6	1400	100 (80)	1000	75 (60)	780	55 (45)	610	40 (30)	1100	110 (90)	2800	330 (260)
8	1100	110 (90)	800	80 (65)	580	55 (45)	470	40 (30)	850	115 (90)	2200	380 (300)
10	860	120 (95)	640	85 (70)	470	55 (45)	380	45 (35)	700	130 (105)	1800	360 (290)
12	720	110 (90)	530	80 (65)	390	50 (40)	310	40 (30)	580	115 (90)	1600	350 (280)
16	540	95 (75)	400	75 (60)	300	45 (35)	230	35 (28)	440	100 (80)	1200	290 (230)
20	430	80 (65)	320	60 (50)	240	38 (30)	190	30 (25)	350	85 (70)	960	250 (200)
25	350	70 (55)	250	50 (40)	190	32 (25)	150	25 (20)	285	75 (60)	760	220 (180)
30	290	65 (50)	210	45 (35)	160	28 (22)	120	22 (18)	240	70 (55)	640	200 (160)
40	210	50 (40)	150	30 (25)	120	22 (18)	90	18 (15)	180	55 (45)	480	160 (130)
50	160	40 (30)	115	28 (22)	90	20 (15)	70	15 (12)	140	45 (35)	380	130 (105)
60	130	35 (28)	95	25 (20)	75	18 (15)	55	12 (10)	115	40 (30)	310	110 (90)
Depth of cut	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><math>\leq 0.1DC</math> (<math>DC \leq \phi 3</math>) <math>\leq 0.2DC</math> (<math>DC &gt; \phi 3</math>)</p> <p><math>\leq 1.5DC</math></p> </div> <div style="text-align: center;"> <p><math>\leq 0.1DC</math> (<math>DC &lt; \phi 2</math>) <math>\leq 0.3DC</math> (<math>\phi 2 \leq DC \leq \phi 3</math>) <math>\leq 0.5DC</math> (<math>DC &gt; \phi 3</math>)</p> </div> </div> <p style="text-align: right;">DC: Dia.</p>											

( ) : Indicates standard feed rate for slotting.

Note 1) Decrease the revolution by 20–30% and the feed rate by 40–50% for 2LS.

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.

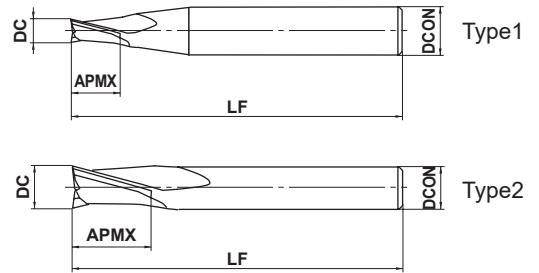
# 2MK

End mill, Short cut length, 2 flute, For key ways



HSS

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	Aluminium Alloy
○	○			○			○



2MKP	2MKN	2MKNN		
+ 0.02	0	- 0.02		
0	- 0.02	- 0.04		

● 2 flute end mill for NN (JIS) standards and plus or minus tolerance diameters.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
2MKPD0300	3	5	50	6	2	●	1
2MKPD0400	4	6	60	8	2	●	1
2MKPD0500	5	8	60	8	2	●	1
2MKPD0600	6	8	60	8	2	●	1
2MKPD0700	7	10	65	10	2	●	1
2MKPD0800	8	10	65	10	2	●	1
2MKPD1000	10	15	75	12	2	●	1
2MKPD1200	12	18	75	12	2	●	2
2MKPD1500	15	22	75	16	2	●	1
2MKPD1800	18	22	80	20	2	●	1
2MKPD2000	20	22	85	20	2	●	2
2MKNND0300	3	5	50	6	2	●	1
2MKNND0400	4	6	60	8	2	●	1
2MKNND0500	5	8	60	8	2	●	1
2MKNND0600	6	8	60	8	2	●	1
2MKNND0700	7	10	65	10	2	●	1
2MKNND0800	8	10	65	10	2	●	1
2MKNND1000	10	15	75	12	2	●	1
2MKNND1200	12	18	75	12	2	●	2
2MKNND1500	15	22	75	16	2	●	1
2MKNND1800	18	22	80	20	2	●	1
2MKNND2000	20	22	85	20	2	●	2
2MKND0300	3	5	50	6	2	●	1
2MKND0400	4	6	60	8	2	●	1
2MKND0500	5	8	60	8	2	●	1
2MKND0600	6	8	60	8	2	●	1
2MKND0700	7	10	65	10	2	●	1
2MKND0800	8	10	65	10	2	●	1
2MKND1000	10	15	75	12	2	●	1
2MKND1200	12	18	75	12	2	●	2
2MKND1500	15	22	75	16	2	●	1

● : Inventory maintained in Japan.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

SOLID END MILLS

# SOLID END MILLS

## S2SDA

End mill, Short cut length, 2 flute, For aluminium alloy



HSS

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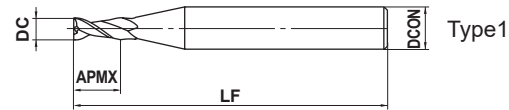
TAPER

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ROUGHING

SOLID END MILLS

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	Aluminium Alloy
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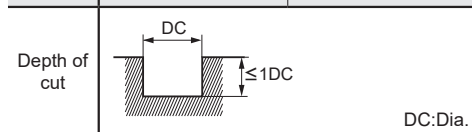
	DC=3	DC>3			
	0 - 0.020	0 - 0.030			

● 2 flute end mill for aluminium alloy and soft materials.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
S2SDAD0300	3	8	50	6	2	●	1
S2SDAD0400	4	8	60	8	2	●	1
S2SDAD0500	5	10	60	8	2	●	1
S2SDAD0600	6	12	60	8	2	●	1
S2SDAD0800	8	15	65	10	2	●	1
S2SDAD1000	10	20	75	10	2	●	2
S2SDAD1200	12	22	85	12	2	●	2
S2SDAD1400	14	26	90	16	2	●	1
S2SDAD1600	16	32	100	16	2	●	2
S2SDAD1800	18	34	100	16	2	●	3
S2SDAD2000	20	38	115	20	2	●	2

### RECOMMENDED CUTTING CONDITIONS

Work Material	Cast aluminium, Rolled aluminium, Magnesium alloy resin	
	AC, ADC, A5052, A7075	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	8200	410
4	6500	530
6	4800	680
8	3800	780
10	3200	750
12	2700	710
16	2000	600
20	1600	510



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.

● : Inventory maintained in Japan.

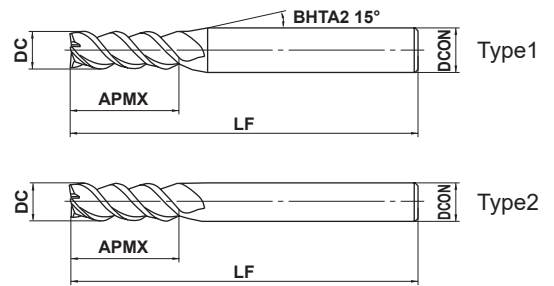
# VAMH

End mill, Medium cut length, 2–4 flute



HSS

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	Aluminium Alloy
○	○			○	○		



5 ≤ DC ≤ 30				
0				
- 0.040				

● 2–4 flute end mill with high grade HSS substrate and Violet coating for general use.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VAMHD0500	5	12	65	8	2	●	1
VAMHD0600	6	15	65	8	3	●	1
VAMHD0700	7	20	75	10	3	●	1
VAMHD0800	8	20	75	10	3	●	1
VAMHD0900	9	25	90	10	3	●	1
VAMHD1000	10	25	90	12	3	●	1
VAMHD1100	11	30	95	12	3	●	1
VAMHD1200	12	30	95	12	3	●	2
VAMHD1300	13	35	105	16	3	●	1
VAMHD1400	14	35	105	16	3	●	1
VAMHD1500	15	40	115	16	3	●	1
VAMHD1600	16	40	115	16	3	●	2
VAMHD1800	18	40	125	20	3	●	1
VAMHD2000	20	45	130	20	3	●	2
VAMHD2100	21	45	135	25	4	●	1
VAMHD2200	22	45	135	25	4	●	1
VAMHD2300	23	50	140	25	4	●	1
VAMHD2400	24	50	140	25	4	●	1
VAMHD2500	25	50	140	25	4	●	2
VAMHD2800	28	55	150	32	4	●	1
VAMHD3000	30	55	150	32	4	●	1

SQUARE

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TAPER

BARREL

ROUGHING



SOLID END MILLS

# SOLID END MILLS

## VAMH

End mill, Medium cut length, 2–4 flute

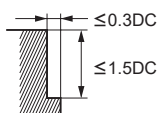
HSS

### RECOMMENDED CUTTING CONDITIONS

#### ■ Side milling

Dia. DC (mm)	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>5</b>	3600	140	2700	100	1800	70	1500	60
<b>6</b>	3200	200	2400	150	1600	100	1300	80
<b>8</b>	2400	220	1800	160	1200	110	1000	90
<b>10</b>	1900	230	1400	170	960	120	800	100
<b>12</b>	1600	240	1200	180	800	120	660	100
<b>16</b>	1200	220	900	160	600	110	500	90
<b>20</b>	950	200	720	150	480	100	400	85
<b>25</b>	760	220	570	170	380	110	320	95
<b>30</b>	640	200	480	150	320	100	270	85

Depth of cut	
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DC: Dia.

Note 1) Supply cutting fluid sufficiently during slotting. When slotting with dry cut, decrease the revolution and feed rate proportionately by 20–30%.

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.

SQUARE

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BARREL

ROUGHING

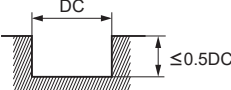


SOLID END MILLS

## Slotting

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>5</b>	2900	105	2400	75	1500	50	1200	45
<b>6</b>	2600	150	2100	110	1300	75	1000	60
<b>8</b>	2000	165	1600	120	1000	80	800	70
<b>10</b>	1600	170	1300	130	800	90	640	75
<b>12</b>	1300	180	1100	135	660	90	530	75
<b>16</b>	1000	165	800	120	500	80	400	70
<b>20</b>	720	150	640	110	400	75	320	65
<b>25</b>	570	165	450	130	320	80	230	70
<b>30</b>	480	150	370	110	270	75	190	65

Depth of cut	 <p style="text-align: right;">DC: Dia.</p>
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Note 1) Supply cutting fluid sufficiently during slotting. When slotting with dry cut, decrease the revolution and feed rate proportionately by 20–30%.

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.

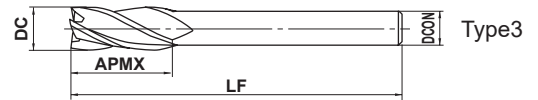
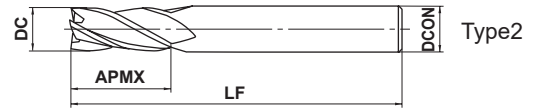
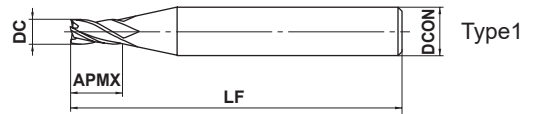
# SOLID END MILLS

## VA4MC

End mill, 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	Aluminium Alloy
○	○			○	○		



	DC ≤ 20	DC > 20			
	0	0			
	+0.030	+0.040			

● 4 flute end mill with high grade HSS substrate and Violet coating for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VA4MCD0300	3	10	50	6	4	●	1
VA4MCD0400	4	12	60	8	4	●	1
VA4MCD0500	5	15	60	8	4	●	1
VA4MCD0600	6	15	60	8	4	●	1
VA4MCD0700	7	20	65	10	4	●	1
VA4MCD0800	8	20	65	10	4	●	1
VA4MCD0900	9	25	75	10	4	●	1
VA4MCD1000	10	25	75	10	4	●	2
VA4MCD1100	11	30	85	12	4	●	1
VA4MCD1200	12	30	85	12	4	●	2
VA4MCD1300	13	35	90	12	4	●	3
VA4MCD1400	14	35	95	16	4	●	1
VA4MCD1500	15	40	100	16	4	●	1
VA4MCD1600	16	40	100	16	4	●	2
VA4MCD1700	17	40	100	16	4	●	3
VA4MCD1800	18	40	100	16	4	●	3
VA4MCD1900	19	45	115	20	4	●	1
VA4MCD2000	20	45	115	20	4	●	2
VA4MCD2200	22	45	115	20	4	●	3
VA4MCD2400	24	50	120	25	4	●	1
VA4MCD2500	25	50	120	25	4	●	2
VA4MCD2800	28	55	125	25	4	●	3
VA4MCD3000	30	55	125	25	4	●	3

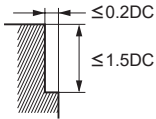
● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>3</b>	5400	270	4000	200	2700	140	2200	100
<b>4</b>	4300	320	3200	240	2100	160	1800	120
<b>5</b>	3600	340	2700	250	1800	170	1500	130
<b>6</b>	3200	350	2400	260	1600	180	1300	140
<b>8</b>	2400	380	1800	290	1200	190	1000	145
<b>10</b>	1900	420	1400	300	950	210	800	160
<b>12</b>	1600	380	1200	290	800	190	660	145
<b>16</b>	1200	340	900	260	600	170	500	130
<b>20</b>	950	290	720	220	480	140	400	110
<b>25</b>	760	240	570	180	380	120	320	100
<b>30</b>	640	210	480	160	320	100	270	80

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

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SOLID END MILLS



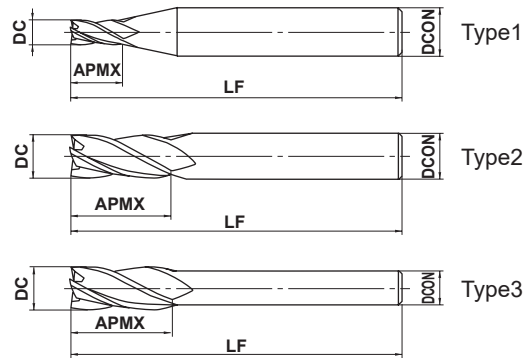
# SOLID END MILLS

## 4MC

End mill, Medium cut length, 4 flute, Center cutting



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	Aluminium Alloy
○	○			○	○		○



DC ≤ 20	DC > 20			
0 + 0.020	0 + 0.030			

● 4 flute end mill for general use.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
4MCD0250	2.5	10	50	6	4	●	1
4MCD0300	3	10	50	6	4	●	1
4MCD0350	3.5	12	60	8	4	●	1
4MCD0400	4	12	60	8	4	●	1
4MCD0450	4.5	15	60	8	4	●	1
4MCD0500	5	15	60	8	4	●	1
4MCD0550	5.5	15	60	8	4	●	1
4MCD0600	6	15	60	8	4	●	1
4MCD0650	6.5	20	65	10	4	●	1
4MCD0700	7	20	65	10	4	●	1
4MCD0750	7.5	20	65	10	4	●	1
4MCD0800	8	20	65	10	4	●	1
4MCD0850	8.5	25	75	10	4	●	1
4MCD0900	9	25	75	10	4	●	1
4MCD0950	9.5	25	75	10	4	●	1
4MCD1000	10	25	75	10	4	●	2
4MCD1100	11	30	85	12	4	●	1
4MCD1200	12	30	85	12	4	●	2
4MCD1300	13	35	90	12	4	●	3
4MCD1400	14	35	95	16	4	●	1
4MCD1500	15	40	100	16	4	●	1
4MCD1600	16	40	100	16	4	●	2
4MCD1700	17	40	100	16	4	●	3
4MCD1800	18	40	100	16	4	●	3
4MCD1900	19	45	115	20	4	●	1
4MCD2000	20	45	115	20	4	●	2
4MCD2100	21	45	115	20	4	●	3
4MCD2200	22	45	115	20	4	●	3
4MCD2300	23	50	120	25	4	●	1
4MCD2400	24	50	120	25	4	●	1
4MCD2500	25	50	120	25	4	●	2
4MCD2600	26	50	120	25	4	●	3
4MCD2700	27	55	125	25	4	●	3
4MCD2800	28	55	125	25	4	●	3

● : Inventory maintained in Japan.

(mm)

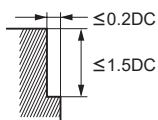
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
4MCD2900	29	55	125	25	4	●	3
4MCD3000	30	55	125	25	4	●	3
4MCD3100	31	60	145	25	4	●	3
4MCD3200	32	60	145	32	4	●	2
4MCD3300	33	60	145	32	4	●	3
4MCD3400	34	60	145	32	4	●	3
4MCD3500	35	60	145	32	4	●	3
4MCD3600	36	65	150	32	4	●	3
4MCD3700	37	65	150	32	4	●	3
4MCD3800	38	65	150	32	4	●	3
4MCD3900	39	65	150	32	4	●	3
4MCD4000	40	65	150	32	4	●	3

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Structural steel, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel		Cast iron		Aluminium alloy	
	AISI 1045, AISI 1050		AISI 1055, AISI P20		AISI H13		AISI 304, AISI 316		AISI No 35 B			
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	2300	105	1800	80	1400	65	1100	45	2000	110	4800	280
4	1800	120	1400	85	1100	65	850	45	1600	125	3800	370
5	1600	135	1200	105	900	70	710	50	1300	140	3200	420
6	1400	140	1000	105	780	80	610	55	1100	155	2800	460
8	1100	155	800	110	580	80	470	55	850	160	2200	530
10	860	170	640	120	470	80	380	65	700	180	1800	500
12	720	155	530	110	390	70	310	55	580	160	1600	490
16	540	135	400	105	300	65	230	50	440	140	1200	410
20	430	110	320	85	240	55	190	45	350	120	960	350
25	350	100	250	70	190	45	150	35	285	105	760	310
30	290	90	210	65	160	40	120	30	240	100	640	280
40	210	70	150	40	120	30	90	25	180	80	480	220

Depth of cut



DC: Dia.

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.

SQUARE

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BARREL

ROUGHING

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SOLID END MILLS

# SOLID END MILLS

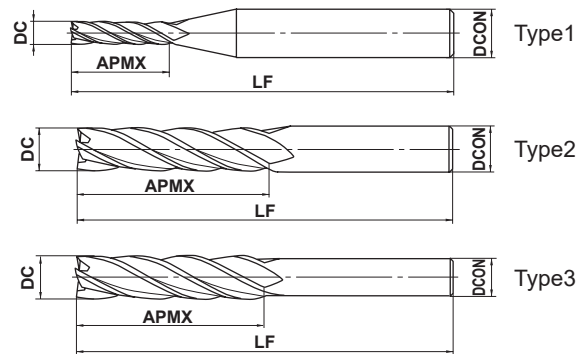
## 4LC

End mill, Long cut length, 4 flute, Center cutting



HSS

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	Aluminium Alloy
○	○			○	○		○



DC ≤ 20	DC > 20			
0 + 0.020	0 + 0.030			

● 4 flute end mill with long flute for deep cutting applications.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
4LCD0300	3	15	55	6	4	●	1
4LCD0400	4	20	55	8	4	●	1
4LCD0500	5	25	60	8	4	●	1
4LCD0600	6	25	60	8	4	●	1
4LCD0700	7	35	75	10	4	●	1
4LCD0800	8	35	75	10	4	●	1
4LCD0900	9	45	90	10	4	●	1
4LCD1000	10	45	90	10	4	●	2
4LCD1100	11	55	105	12	4	●	1
4LCD1200	12	55	105	12	4	●	2
4LCD1300	13	55	105	12	4	●	3
4LCD1400	14	55	110	16	4	●	1
4LCD1500	15	65	120	16	4	●	1
4LCD1600	16	65	120	16	4	●	2
4LCD1700	17	65	120	16	4	●	3
4LCD1800	18	65	120	16	4	●	3
4LCD1900	19	75	140	20	4	●	1
4LCD2000	20	75	140	20	4	●	2
4LCD2100	21	75	140	20	4	●	3
4LCD2200	22	75	140	20	4	●	3
4LCD2300	23	90	160	25	4	●	1
4LCD2400	24	90	160	25	4	●	1
4LCD2500	25	90	160	25	4	●	2
4LCD2600	26	90	160	25	4	●	3
4LCD2700	27	90	160	25	4	●	3
4LCD2800	28	90	160	25	4	●	3
4LCD2900	29	90	160	25	4	●	3
4LCD3000	30	90	160	25	4	●	3
4LCD3100	31	95	180	25	4	●	3
4LCD3200	32	95	180	32	4	●	2
4LCD3300	33	95	180	32	4	●	3
4LCD3400	34	100	185	32	4	●	3
4LCD3500	35	100	185	32	4	●	3
4LCD3600	36	105	190	32	4	●	3

● : Inventory maintained in Japan.

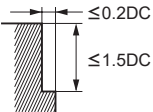
(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
4LCD3700	37	105	190	32	4	●	3
4LCD3800	38	105	190	32	4	●	3
4LCD3900	39	110	195	32	4	●	3
4LCD4000	40	110	195	32	4	●	3

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Structural steel, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel		Cast iron		Aluminium alloy	
	AISI 1045, AISI 1050		AISI 1055, AISI P20		AISI H13		AISI 304, AISI 316		AISI No 35 B			
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
3	2300	105	1800	80	1400	65	1100	45	2000	110	4800	280
4	1800	120	1400	85	1100	65	850	45	1600	125	3800	370
5	1600	135	1200	105	900	70	710	50	1300	140	3200	420
6	1400	140	1000	105	780	80	610	55	1100	155	2800	460
8	1100	155	800	110	580	80	470	55	850	160	2200	530
10	860	170	640	120	470	80	380	65	700	180	1800	500
12	720	155	530	110	390	70	310	55	580	160	1600	490
16	540	135	400	105	300	65	230	50	440	140	1200	410
20	430	110	320	85	240	55	190	45	350	120	960	350
25	350	100	250	70	190	45	150	35	285	105	760	310
30	290	90	210	65	160	40	120	30	240	100	640	280
40	210	70	150	40	120	30	90	25	180	80	480	220

Depth of cut		
	DC	DC
	≤0.2DC	≤1.5DC

DC: Dia.

Note 1) Use the milling by reducing the revolution in the table shown above by 20–30% and the feedrate 40–50% to match the cutting type.

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.

SQUARE

BALL

RADIUS

TAPER

BARREL

ROUGHING

J

SOLID END MILLS

# SOLID END MILLS

## VASFPR

Roughing end mill, Short cut length, 4–6 flute, Fine pitch form

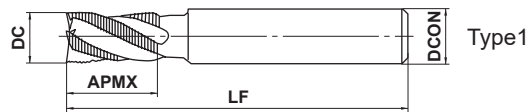


DC≤24

25≤DC≤32

DC≥35

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	Aluminium Alloy
○	○			○	○		



● Roughing 4–6 flute end mill with high grade HSS substrate and Violet coating for general use.

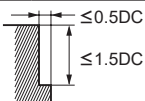
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)
							Type
VASFPRD0500	5	10	80	6	4	●	1
VASFPRD0600	6	12	80	6	4	●	2
VASFPRD0700	7	17	80	8	4	●	1
VASFPRD0800	8	17	85	8	4	●	2
VASFPRD0900	9	22	100	10	4	●	1
VASFPRD1000	10	22	100	10	4	●	2
VASFPRD1200	12	27	110	12	4	●	2
VASFPRD1400	14	27	110	12	4	●	3
VASFPRD1500	15	27	125	16	4	●	1
VASFPRD1600	16	33	125	16	4	●	2
VASFPRD1800	18	33	125	16	4	●	3
VASFPRD2000	20	38	145	20	4	●	2
VASFPRD2200	22	38	145	20	4	●	3
VASFPRD2400	24	43	150	25	4	●	1
VASFPRD2500	25	43	150	25	5	●	2
VASFPRD2800	28	43	160	25	5	●	3
VASFPRD3000	30	48	165	25	5	●	3
VASFPRD3200	32	55	175	25	5	●	3
VASFPRD3500	35	55	175	32	6	●	3
VASFPRD4000	40	65	185	32	6	●	3
VASFPRD4500	45	65	200	42	6	●	3
VASFPRD5000	50	75	200	42	6	●	3

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

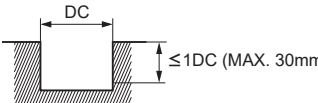
### Side milling

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
5	2800	140	2200	120	1500	80	1300	70
6	2600	180	2000	140	1400	90	1200	80
8	2200	230	1700	180	1200	130	990	100
10	1750	330	1350	250	950	160	800	130
12	1450	330	1100	260	800	180	660	140
16	1100	330	850	260	600	180	500	140
20	880	340	680	260	480	180	400	140
25	700	330	540	250	380	170	320	140
30	580	300	450	230	320	170	270	140
40	350	210	270	170	190	120	160	100
50	250	170	190	130	130	90	110	75

Depth of cut  DC: Dia.

### Slotting

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
5	2100	100	1650	80	1150	50	960	35
6	2000	130	1550	100	1050	60	900	45
8	1600	160	1300	130	920	90	760	60
10	1300	220	1000	175	730	110	610	80
12	1050	230	850	190	610	130	500	85
16	800	230	640	190	460	130	380	85
20	640	230	510	180	370	130	300	85
25	510	200	410	160	290	110	240	80
30	420	190	320	140	210	90	180	75
40	280	140	210	110	140	70	120	60
50	190	110	150	90	95	55	85	45

Depth of cut  DC: Dia.

Note 1) Supply cutting fluid sufficiently during cutting. For dry-cutting, decrease the revolution and feed rate proportionately by 20–50%.

Note 2) For smaller depths and widths of cut, the revolution may be increased by 10–20% and the feed rate by 10–40%.

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

Note 4) 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.

# SOLID END MILLS

## VAMFPR

Roughing end mill, Medium cut length, 4–6 flute, Fine pitch form

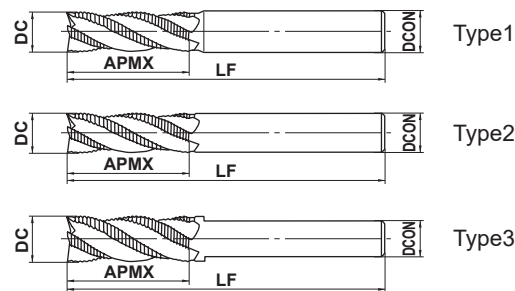
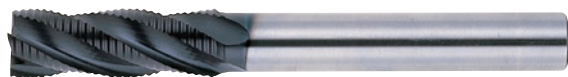


DC ≤ 20

22 ≤ DC ≤ 28

DC ≥ 30

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	Aluminium Alloy
○	○			○	○		



● 4–6 flute end mill with medium cut length.

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
							Type	
VAMFPRD0500	5	15	80	6	4	●	1	
VAMFPRD0600	6	17	80	6	4	●	2	
VAMFPRD0700	7	22	80	8	4	●	1	
VAMFPRD0800	8	28	85	8	4	●	2	
VAMFPRD0900	9	28	95	10	4	●	1	
VAMFPRD1000	10	34	100	10	4	●	2	
VAMFPRD1200	12	40	110	12	4	●	2	
VAMFPRD1400	14	40	110	12	4	●	3	
VAMFPRD1500	15	40	120	16	4	●	1	
VAMFPRD1600	16	48	125	16	4	●	2	
VAMFPRD1800	18	48	125	16	4	●	3	
VAMFPRD2000	20	57	145	20	4	●	2	
VAMFPRD2200	22	57	145	20	5	●	3	
VAMFPRD2400	24	68	150	25	5	●	1	
VAMFPRD2500	25	68	150	25	5	●	2	
VAMFPRD2800	28	68	160	25	5	●	3	
VAMFPRD3000	30	68	165	25	6	●	3	
VAMFPRD3200	32	80	175	32	6	●	2	
VAMFPRD3500	35	80	175	32	6	●	3	
VAMFPRD4000	40	94	185	32	6	●	3	
VAMFPRD4500	45	94	200	42	6	●	3	
VAMFPRD5000	50	113	200	42	6	●	3	

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

### ■ Side milling

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC)	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>5</b>	2600	90	2000	70	1400	50	1200	40
<b>6</b>	2500	100	1900	90	1300	50	1100	50
<b>8</b>	2000	170	1600	130	1100	90	930	80
<b>10</b>	1650	220	1300	170	900	100	750	90
<b>12</b>	1400	260	1000	210	750	140	620	120
<b>16</b>	1000	290	800	230	560	160	470	130
<b>20</b>	830	300	640	230	450	160	380	130
<b>25</b>	660	290	510	220	360	160	300	130
<b>30</b>	550	270	420	210	300	140	250	130
<b>40</b>	330	180	250	140	180	100	150	90
<b>50</b>	240	160	180	120	120	80	100	70

Depth of cut		DC: Dia.

Note 1) Supply cutting fluid sufficiently during cutting. For dry-cutting, decrease the revolution and feed rate proportionately by 20–50%.

Note 2) When the diameter exceeds 30 and the metal removal is less than the quantity shown in the table, the revolution and feed rate may be increased proportionately by 10–40%.

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

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SOLID END MILLS



# SOLID END MILLS

## VAMR

Roughing end mill, Medium cut length, 4–6 flute



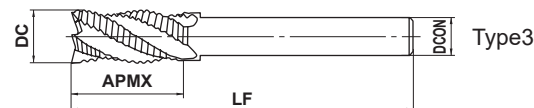
DC≤15

16≤DC≤26

28≤DC≤32

DC≥35

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	Aluminium Alloy
○	○			○	○		



● Roughing 4–6 flute end mill with high grade HSS substrate and Violet coating for general use.

(mm)

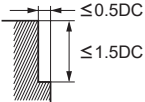
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VAMRD0500	5	15	60	6	4	●	1
VAMRD0600	6	15	60	6	4	●	2
VAMRD0700	7	20	70	8	4	●	1
VAMRD0800	8	20	70	8	4	●	2
VAMRD0900	9	25	80	10	4	●	1
VAMRD1000	10	25	80	10	4	●	2
VAMRD1100	11	30	110	12	4	●	1
VAMRD1200	12	30	110	12	4	●	2
VAMRD1300	13	35	115	12	4	●	3
VAMRD1400	14	35	135	16	4	●	1
VAMRD1500	15	40	140	16	4	●	1
VAMRD1600	16	40	140	16	4	●	2
VAMRD1700	17	40	140	16	4	●	3
VAMRD1800	18	40	140	16	4	●	3
VAMRD1900	19	45	145	20	4	●	1
VAMRD2000	20	45	145	20	4	●	2
VAMRD2200	22	45	145	20	4	●	3
VAMRD2400	24	50	150	25	4	●	1
VAMRD2500	25	50	150	25	4	●	2
VAMRD2600	26	50	150	25	4	●	3
VAMRD2800	28	55	160	25	5	●	3
VAMRD3000	30	55	165	25	5	●	3
VAMRD3200	32	60	175	32	5	●	2
VAMRD3500	35	60	175	32	6	●	3
VAMRD4000	40	65	185	32	6	●	3
VAMRD4500	45	70	200	42	6	●	3
VAMRD5000	50	70	200	42	6	●	3

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

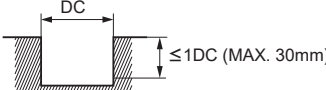
### ■ Side milling

Work Material	Structural steel, Cast iron, Carbon steel AISI 1045, AISI No 35 B, AISI 1050		Carbon steel, Alloy steel (20–30HRC) AISI 1055, AISI P20		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC) AISI H13, AISI D2		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC) AISI 304, AISI 316	
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
<b>5</b>	2400	120	1800	90	1200	60	1000	50
<b>6</b>	2200	155	1700	120	1100	70	930	65
<b>8</b>	1800	200	1400	140	950	100	780	85
<b>10</b>	1500	250	1100	200	810	125	680	100
<b>12</b>	1250	270	960	220	680	160	560	120
<b>16</b>	930	270	720	220	510	160	430	120
<b>20</b>	750	290	580	220	410	160	340	120
<b>25</b>	600	270	460	210	320	140	270	120
<b>30</b>	490	250	380	200	270	140	230	120
<b>40</b>	300	180	230	140	160	105	140	90
<b>50</b>	210	140	160	110	110	80	90	65

Depth of cut  DC: Dia.

### ■ Slotting

Work Material	Structural steel, Cast iron, Carbon steel AISI 1045, AISI No 35 B, AISI 1050		Carbon steel, Alloy steel (20–30HRC) AISI 1055, AISI P20		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC) AISI H13, AISI D2		Austenitic stainless steel, Alloy steel, Tool steel (35–40HRC) AISI 304, AISI 316	
	Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )
<b>5</b>	1800	85	1350	60	920	40	740	25
<b>6</b>	1700	110	1300	85	830	45	700	35
<b>8</b>	1300	140	1050	100	730	70	600	50
<b>10</b>	1100	170	810	140	620	85	520	60
<b>12</b>	900	190	740	160	520	115	420	75
<b>16</b>	680	190	540	160	390	115	330	75
<b>20</b>	550	195	440	150	320	115	260	75
<b>25</b>	440	170	350	135	240	90	200	70
<b>30</b>	350	160	270	120	180	75	155	65
<b>40</b>	240	120	180	90	120	60	105	55
<b>50</b>	260	90	125	75	80	50	70	40

Depth of cut  DC: Dia.

Note 1) Supply cutting fluid sufficiently during cutting. For dry-cutting, decrease the revolution and feed rate proportionately by 20–50%.

Note 2) When the diameter exceeds 30 and the metal removal is less than the quantity shown in the table, the revolution and feed rate may be increased proportionately by 10–40%.

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

J

SOLID END MILLS

# SOLID END MILLS

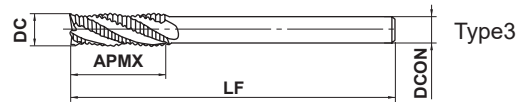
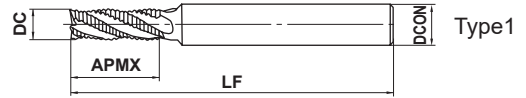
## MR

Roughing end mill, Medium cut length, 4–6 flute



DC ≤ 15    16 ≤ DC ≤ 26    28 ≤ DC ≤ 32    DC ≥ 35

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	Aluminium Alloy
○	○			○	○		○



● 4–6 flute roughing end mill with full radius cutting edge profile for heavy cutting.

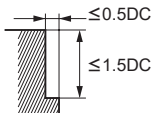
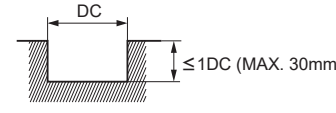
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	(mm)	
							Type	
MRD0500	5	15	60	6	4	●	1	
MRD0600	6	15	60	6	4	●	2	
MRD0700	7	20	70	8	4	●	1	
MRD0800	8	20	70	8	4	●	2	
MRD0900	9	25	80	10	4	●	1	
MRD1000	10	25	80	10	4	●	2	
MRD1100	11	30	110	12	4	●	1	
MRD1200	12	30	110	12	4	●	2	
MRD1300	13	35	115	12	4	●	3	
MRD1400	14	35	135	16	4	●	1	
MRD1500	15	40	140	16	4	●	1	
MRD1600	16	40	140	16	4	●	2	
MRD1700	17	40	140	16	4	●	3	
MRD1800	18	40	140	16	4	●	3	
MRD1900	19	45	145	20	4	●	1	
MRD2000	20	45	145	20	4	●	2	
MRD2200	22	45	145	20	4	●	3	
MRD2400	24	50	150	25	4	●	1	
MRD2500	25	50	150	25	4	●	2	
MRD2600	26	50	150	25	4	●	3	
MRD2800	28	55	160	25	5	●	3	
MRD3000S25	30	55	165	25	5	●	3	
MRD3000S32	30	55	165	32	5	●	1	
MRD3200	32	60	175	32	5	●	2	
MRD3500	35	60	175	32	6	●	3	
MRD4000S32	40	65	185	32	6	●	3	
MRD4000S42	40	65	185	42	6	●	1	
MRD4500	45	70	200	42	6	●	3	
MRD5000	50	70	200	42	6	●	3	

● : Inventory maintained in Japan.

## RECOMMENDED CUTTING CONDITIONS

Work Material	Structural steel, Cast iron, Carbon steel		Carbon steel, Alloy steel (20–30HRC)		Alloy steel, Tool steel, Pre-hardened steel (30–35HRC)		Austenitic stainless steel	
	AISI 1045, AISI No 35 B, AISI 1050		AISI 1055, AISI P20		AISI H13, AISI D2		AISI 304, AISI 316	
Dia. DC (mm)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)	Revolution (min <sup>-1</sup> )	Feed rate (mm/min)
<b>5</b>	1000 (750)	40 (30)	760 (570)	30 (25)	610 (460)	25 (20)	510 (380)	20 (15)
<b>6</b>	960 (720)	50 (40)	720 (540)	40 (30)	570 (430)	30 (25)	480 (360)	25 (20)
<b>8</b>	800 (600)	65 (50)	600 (450)	50 (40)	500 (380)	40 (30)	400 (300)	30 (25)
<b>10</b>	640 (480)	90 (70)	480 (360)	70 (55)	380 (290)	50 (40)	320 (240)	40 (30)
<b>12</b>	530 (400)	90 (70)	400 (300)	70 (55)	320 (240)	55 (40)	270 (200)	45 (35)
<b>16</b>	400 (300)	90 (70)	300 (230)	70 (55)	240 (180)	55 (40)	200 (150)	45 (35)
<b>20</b>	320 (240)	95 (70)	240 (180)	70 (55)	190 (140)	55 (40)	160 (120)	45 (35)
<b>25</b>	250 (190)	90 (70)	190 (140)	65 (50)	150 (110)	50 (40)	130 (100)	45 (35)
<b>30</b>	210 (160)	85 (65)	160 (120)	65 (50)	130 (100)	50 (40)	110 (85)	45 (35)
<b>40</b>	135 (100)	60 (45)	100 (75)	45 (40)	80 (60)	35 (26)	70 (55)	30 (25)
<b>50</b>	100 (75)	50 (40)	75 (55)	40 (30)	60 (45)	30 (23)	50 (40)	25 (20)

Depth of cut			DC: Dia.
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( ) : Indicates standard revolution and feed rate for slotting.

Note 1) Supply cutting fluid sufficiently during cutting.

Note 2) When the diameter exceeds 30 and the metal removal is less than the quantity shown in the table, the revolution and feed rate may be increased by 10–40%.

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



SOLID END MILLS