MITSUBISHI MATERIALS

C010A

CUTTING TOOLS 2024

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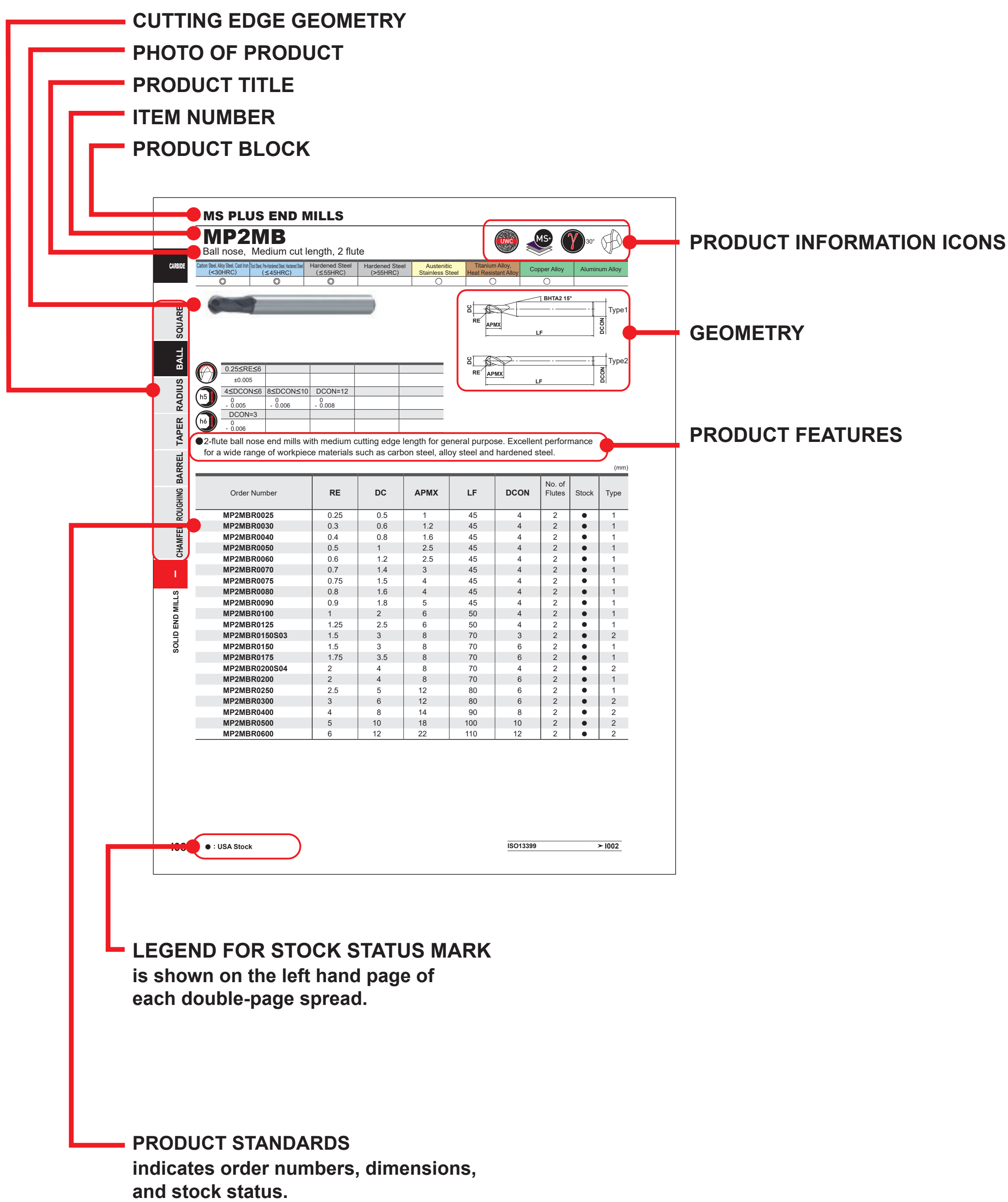
DIAEDGE

HOW TO READ THE STANDARD OF SOLID END MILLS

●How this section page is organized

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



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

MILLING

SOLID CARBIDE END MILLS

*Arranged by Alphabetical order

IDENTIFICATION

ORDER NUMBER OF END MILLS

VQ 4 S VB R0100 * * *

End Mill Names

- **VQ** : SMART MIRACLE end mills
- **VQT** : SMART MIRACLE end mills focused on machining Ti-alloys
- **VQN** : SMART MIRACLE end mills focused on machining Ni-based alloys
- **VFR** : IMPACT MIRACLE REVOLUTION end mills
- **VF** : IMPACT MIRACLE end mills
- **MP** : MS plus end mills
- **MS** : Mstar end mills
- **VC** : Miracle end mills
- **DLC** : DLC coated end mills
- **A** : ALIMASTER end mills
- **DFC** : CVD diamond coated end mills
- **DF** : Diamond coated end mills
- **DC** : Diamond coated end mills
- **CE** : Ceramic end mills
- **C** : Carbide end mills

Number of Flutes

- **1** : 1flute
- **2** : 2flute
- **3** : 3flute
- **4** : 4flute
- **5** : 5flute
- **6** : 6flute
- **8** : 8flute
- • • •

Flute Length

- **ES** : Extra short
- **S** : Short
- **M** : Medium
- **J** : Semi long
- **L** : Long
- **XL** : Long neck
- **X** : Taper neck

Features

- **S** : General use
- **U** : For stainless steel
- **K** : For keyway
- **A** : For light alloy
- **C** : Center cut, chamfering
- **D** : For deep cut
- **V** : Irregular spiral helix angle
- **B** : Ball nose
- **VB** : Irregular spiral helix angle, Ball nose
- **R** : Roughing
- **FPR** : Fine roughing
- **H** : High helix
- **T** : Taper
- **TB** : Taper ball nose
- **WB** : Wide ball nose
- **RB** : Corner radius
- **FDRB** : Duplex corner radius
- **CH** : Coolant holes (side)
- **OH** : Coolant holes (end)
- **UR** : Multi step radius
- **Z** : Drilling

Dimensions

- **D****** : Diameter

ex.
D0050 → ϕ0.5
D0500 → ϕ5

- **R****** : Radius of ball nose

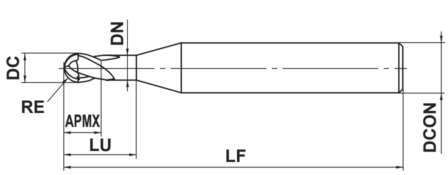
ex.
R0050 → R0.5
R0500 → R5

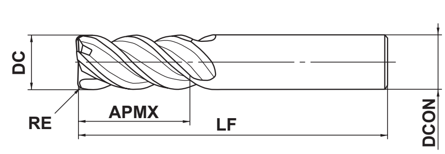
Others

- **S**** : Shank diameter
- **N***** : Neck length
- **T****** : Taper angle one side
- **L**** : Flute length
- **A***** : Overall Length
- **C** : Coolant holes (center)

*Other types are available by special order.

GUIDE FOR ISO13399 SYMBOLS





Symbol	Content
APMX	Depth of cut maximum
DC	Cutting diameter
DN	Neck diameter
LF	Functional length
LU	Usable length
RE	Corner radius

*There are exceptions other than those listed above. For more details, please refer to the technical data (page N002).

SYMBOL DESCRIPTIONS

Tool Material

Ultra Micro Grain Carbide
Ultra micro grain carbide is used as the substrate material.

Cubic Boron Nitride
Mitsubishi's original CBN is used.

Ceramic
Ceramic is used as the substrate material.

Tolerances

Outside Diameter Tolerance
Indicates diameter tolerance of end mill.

R Tolerance
Indicates the radial tolerance of a ball nose end mill.

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

Tolerance of Taper Angle
Indicates the tolerance of the taper angle.

Tolerance of Point Angle
Indicates the tolerance of the point angle.

Shank Diameter Tolerance
Indicates the shank diameter tolerance of end mill.

Angle, Coolant hole, Sharp corner edge and Gash land

Helix Angle
Indicates the helix angle of the end mill.

End Cutting Edge with Coolant Hole

Peripheral Cutting Edge with Coolant Hole

Sharp Corner Edge
Indicates the end mill has a sharp corner edge.

Gash Land
Indicates the end mill cutting edge has a gash land.

Series

SMART MIRACLE End Mills
(Al, Cr)N coaitng optimum for difficult-to-cut materials.

SMART MIRACLE End Mills
(Al, Cr)N coating optimum for Ti-alloys.

SMART MIRACLE End Mills
(Al, Ti, Si)N coating optimum for Ni-based alloys.

IMPACT MIRACLE REVOLUTION End Mills
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 End Mills
Single phase nano crystal coating technology for higher film hardness and heat resistance.

MS PLUS End Mills
Offers higher versatility for carbon steel, alloy steel and hardened steel.

MS End Mills
PVD offers higher versatility.

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

DLC Coated End Mills
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

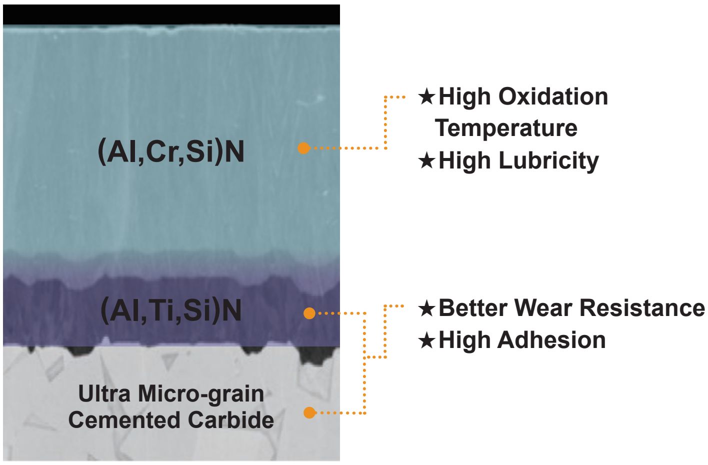
CVD Diamond Coated End Mills
High performance coating for hard brittle materials excelling in film adhesion to the substrate.

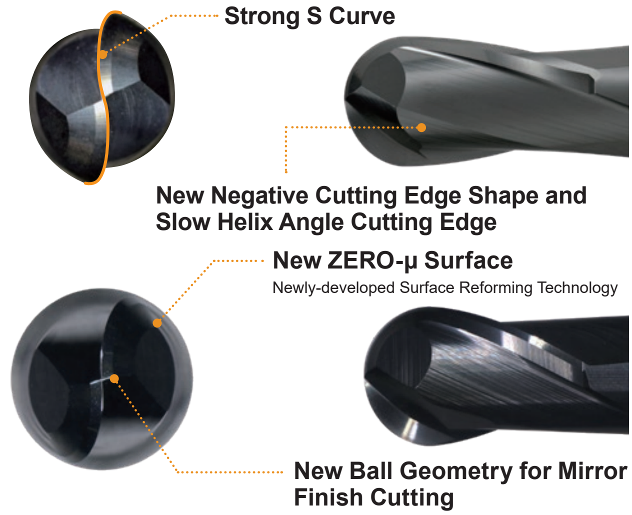
DF End Mills
Suitable for graphite machining.

COATING TECHNOLOGY

VFR

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.





VF

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.

Properties of IMPACT MIRACLE End Mills

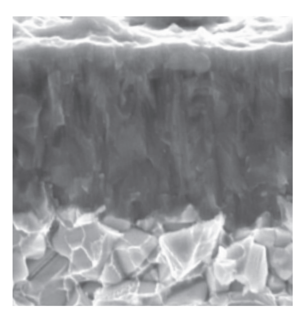
	IMPACT MIRACLE Single-phase nano coating (Al,Ti,Si)N	(Al,Ti,Si)N	(Al,Ti)N
Hardness (HV)	**3700**	3200	2800
Oxidation Temperature (°F)	**2370**	2010	1540
Adhesion (N)[1]	**100**	80	80
Wear Coefficient[2]	**0.48**	0.53	0.58

1) Adhesion : Measured by critical load scratch test.
2) Coefficient of friction : Measured by ball-on-disk method.
(Counter gear : AISI D2 60HRC)

MS+

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.

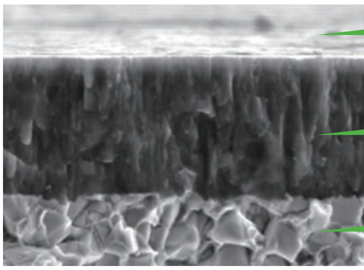


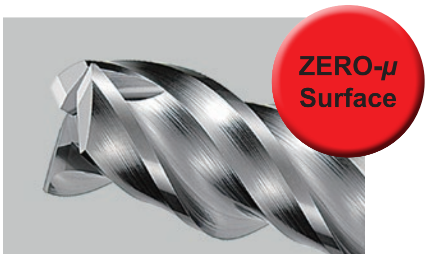
Properties of MS plus End Mills

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

VQ VQT

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.





SMART MIRACLE Coating

ZERO- μ Surface

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

VQN

The (Al, Ti, Si)N based coatings maintain their film hardness and heat resistant properties under the harshest of conditions, making it highly suitable for applying to end mills for machining heat resistant super alloys.

DLC

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

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

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 for non-ferrous and new non-metal materials.

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

VC

MIRACLE coating for high speed milling.

Miracle coating is produced by adding Al to the existing TiN coating.
This coating layer consists of a compound solid solution of (Al,Ti)N.
This results in improving the heat resistance during cutting, and thus delivers high performance in high hardness material machining and high speed dry cutting. It also has the high adhesion strength for the cemented carbide substrate, and extends the tool life significantly compared to conventional products.

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	P: Carbon Steel, Alloy Steel, Cast Iron	P: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
SQUARE															
	2	General Use	MS	MS2SS	 End mill, Short cut length, 2 flute	METRIC DC 0.1–12	◎	◎	○		○	○	○		I014
	2	General Use	MS	MS2MS	 End mill, Medium cut length, 2 flute	METRIC DC 0.2–20	◎	◎	○		○	○	○		I015
	2	General Use	MS	MS2MD	 End mill, Medium cut length, 2 flute, Strong geometry type	METRIC DC 1–12	◎	◎	○		○	○			I018
	2	General Use	MS	MS2JS	 End mill, Semi long cut length, 2 flute	METRIC DC 0.1–12	◎	◎	○		○	○	○		I020
	2	General Use	MS	MS2LS	 End mill, Long cut length, 2 flute	METRIC DC 0.2–12	◎	◎	○		○	○	○		I022
	2	For Swiss-Type Lathes	MS+	NEW MP2ES	 End mill, 2 flute, For Swiss-Type lathes	METRIC DC 3–10	◎	◎	○		○	○	○		I097
	2	For Swiss-Type Lathes	MS	MS2ES	 End mill, 2 flute, For Swiss-Type lathes	METRIC DC 3–12	◎	◎	○		○	○	○		I054
	2	For Hardened Steel	VF	VF2MV	 End mill, Medium cut length, 2 flute, Irregular helix flutes	METRIC DC 0.5–6		○	◎	◎					I199
	2	For Aluminum Alloy	UWC	C2MHA	 End mill, Medium cut length, 2 flute, For aluminum alloy	METRIC DC 3–25								◎	I296
	3	General Use	MS	MSMHZD	 Slotting, Medium cut length, 3 flute	METRIC DC 1–20 INCH DC .0625–.7500	◎	◎	○		○	○	○		METRIC I038 INCH I040
	3	General Use	MS+	MP3MC	 End Mill, Medium cut length, 3 flute	INCH DC .0312–.5000	◎	◎	○		○	○			I070
	3	For Swiss-Type Lathes	MS+	NEW MP3ES	 End mill, 3 flute, For Swiss-Type lathes	METRIC DC 3–12	◎	◎	○		○	○	○		I100
	3	For Swiss-Type Lathes	MS	MS3ES	 End mill, 3 flute, For Swiss-Type lathes	METRIC DC 3–12	◎	◎	○		○	○	○		I056
	3	For Difficult-to-cut Materials	VQ	VQMHZV	 End mill, Medium cut length, 3 flute for drilling and slotting	METRIC DC 1–20 INCH DC .0625–.5000	◎	◎			◎	◎	○		METRIC I120 INCH I126
	3	For Difficult-to-cut Materials	VQ	VQMHZVOH	 End mill, Medium cut length, 3 flute for drilling and slotting with thru-coolant	METRIC DC 6–16 INCH DC .2500–.5000	◎	◎			◎	◎	○		METRIC I130 INCH I134

* DC : Cutting Diameter

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Workpiece Material P: Carbon Steel, Alloy Steel, Cast Iron	P: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
	3	For Aluminum Alloy	UWC	NEW A3SA	End mill, Short cut length, 3 flute, with multiple internal thru-coolant holes	METRIC DC 12–25								◎	I277
	3	For Aluminum Alloy	DLC	NEW DLC3SA	End mill, Short cut length, 3 flute, with multiple internal thru-coolant holes	METRIC DC 12–25								◎	I279
	4	General Use	MS	MS4SC	End mill, Short cut length, 4 flute	METRIC DC 1–12	◎	◎	○		○	○	○		I042
	4	General Use	MS	MS4MC	End mill, Medium cut length, 4 flute	METRIC DC 1–20	◎	◎	○		○	○	○		I044
	4	General Use	MS	MS4JC	End mill, Semi long cut length, 4 flute	METRIC DC 1–12	◎	◎	○		○	○	○		I046
	4	General Use	MS+	MP4MC	End Mill, Medium cut length, 4 flute	INCH DC .0312–.5000	◎	◎	○		○	○			I072
	4	General Use	MS+	MP4JC	End Mill, Semi long cut length, 4 flute	INCH DC .0625–.5000	◎	◎	○		○	○			I074
	4	General Use	MS	MSSHD	High power, Short cut length, 4 flute	METRIC DC 3–20	◎	◎	○		○	○	○		I034
	4	General Use	MS	MSMHD	High power, Medium cut length, 4 flute	METRIC DC 2–25	◎	◎	○		○	○	○		I035
	4	For Swiss-Type Lathes	MS+	NEW MP4EC	End mill, 4 flute, For Swiss-Type lathes	METRIC DC 3–14	◎	◎	○		○	○	○		I103
	4	For Swiss-Type Lathes	MS	MS4EC	End mill, 4 flute, For Swiss-Type lathes	METRIC DC 3–14	◎	◎	○		○	○	○		I058
	4	For Hardened Steel	VF	VF4MV	End mill, Medium cut length, 4 flute, Irregular helix flutes	METRIC DC 6–20		○	◎	◎					I201
	4	For Difficult-to-cut Materials	VQ	VQMHV	End mill, Medium cut length, 4 flute, Irregular helix flutes	METRIC DC 1–25 INCH DC .1250–.5000	◎	◎			◎	◎	○		METRIC I137 INCH I141
	4	For Difficult-to-cut Materials	VQ	VQJHV	End mill, Semi long cut length, 4 flute, Irregular helix flutes	METRIC DC 1–20 INCH DC .1250–.5000	◎	◎			◎	◎	○		METRIC I144 INCH I146
	4	For CFRP	DFC	DFC4JC	End mill, 4 flute, For CFRP	METRIC DC 6–12	CFRP : ◎								I282
	4	For Graphite	DF	DF4JC	End mill, Semi long cut length, 4 flute, For graphite	METRIC DC 3–12	Graphite : ◎ GFRP/CFRP : ○ Machineable Ceramics : ○						◎	○	I288

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SOLID END MILLS

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	P: Carbon Steel, Alloy Steel, Cast Iron	P: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
SQUARE															
	5	For Difficult-to-cut Materials	VQ	NEW VQJCS	 End mill, Semi long cut length, 5 flute, Irregular pitch flutes, Chip breaker	METRIC DC 6–20	◎	◎			◎	◎	○		I116
	5	For Difficult-to-cut Materials	VQ	NEW VQLCS	 End mill, Long cut length, 5 flute, Irregular pitch flutes, Chip breaker	METRIC DC 6–12	◎	◎			◎	◎	○		I118
	5	For Difficult-to-cut Materials	VQ	NEW VQ5MHV	 End mill, Medium cut length, 5 flute, Irregular helix flutes	INCH DC .2500–.5000	◎	○			◎	◎			I175
	4 6	For Hardened Steel	VF	VFSD	 End mill, Short cut length, For hardened materials	METRIC DC 1–12		○	◎	◎					I205
	4 6	For Hardened Steel	VF	VFMD	 End mill, Medium cut length, For hardened materials	METRIC DC 1–25 INCH DC .0313–.5000		○	◎	◎					METRIC I206 INCH I208
	6	For Hardened Steel	VC	VCLD	 End mill, Long cut length, 6 flute	METRIC DC 6–25		○	◎	◎					I106
	6	For Difficult-to-cut Materials	VF	VF6MHV	 End mill, Medium cut length, 6 flute, Irregular helix flutes	METRIC DC 6–20	○	○			◎	◎			I203
	6	For Difficult-to-cut Materials	VQ	VQ6MHVCH	 End mill, Medium cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 10–20	○	○			◎	◎	○		I179
	8	For Difficult-to-cut Materials	VF	VF8MHVCH	 End mill, Medium cut length, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16,20	○	○			◎	◎			I204
	10 12	For CFRP	DFC	DFCJRT	 End mill with cross-nick, For CFRP	METRIC DC 6–12	CFRP : ◎								I283
LONG NECK SQUARE															
	3 4	For Difficult-to-cut Materials	VQ	VQXL	 End mill, Short cut length, 3–4 flute, Long neck	METRIC DC 0.2–1	◎	◎			◎	◎	○		I194
	2	For Deep Slotting	MS	MS2XL	 End mill, Short cut length, 2 flute, Long neck	METRIC DC 0.2–6 INCH DC .0156–.2500	◎	◎	○		○	○	○		METRIC I024 INCH I032
	2	For Deep Slotting	MS	MS2XL6	 End mill, Short cut length, 2 flute, 6mm shank	METRIC DC 0.3–2.5	◎	◎	○		○	○	○		I028
	2	For Deep Slotting Hardened Steel	VF	VF2XL	 End mill, 2 flute, Long neck	METRIC DC 0.2–3	○	◎	◎	◎					I197

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

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SOLID END MILLS

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Carbon Steel, Alloy Steel, Cast Iron (P)	Tool steel, Pre-Hardened Steel, Hardened Steel (P)	Hardened Steel(-55HRC) (H)	Hardened Steel(55HRC-) (H)	Austenitic Stainless Steel (M)	Titanium Alloy, Heat Resistant Alloy (S)	Copper Alloy (N)	Aluminum Alloy (N)	Page
	4	For Deep Slotting / General Use	MS	MS4XL	End mill, Short cut length, 4 flute, Long neck	METRIC DC 1–10 INCH DC .0625–.2500	◎	◎	○		○	○	○		METRIC I048 INCH I052
BALL															
	2	General Use	MS+	MP2SSB	Ball nose, Short cut length, 2 flute, Short shank	METRIC RE 0.1–6	◎	◎	◎		○	○	○		I078
	2	General Use	MS+	MP2SB	Ball nose, Short cut length, 2 flute	METRIC RE 0.1–6	◎	◎	◎		○	○	○		I079
	2	General Use	MS+	MP2MB	Ball nose, Medium cut length, 2 flute	METRIC RE 0.25–6 INCH RE .0156–.2500	◎	◎	◎		○	○	○		METRIC I080 INCH I083
	2	General Use	MS+	MP2SDB	Ball nose, Short cut length, 2 flute, High strength	METRIC RE 0.5–6	○	◎	◎						I086
	2	For Hardened Steel	VFR	VFR2SSB	Ball nose, Short cut length, 2 flute, Short shank	METRIC RE 0.5–6		○	◎	◎					I260
	2	For Hardened Steel	VFR	VFR2SB	Ball nose, Short cut length, 2 flute	METRIC RE 0.1–10		○	◎	◎					I262
	2	For Hardened Steel	VFR	VFR2SBF	Ball nose, Short cut length, 2 flute, For Mirror finish cutting	METRIC RE 0.5–3		○	◎	◎					I264
	2	For Hardened Steel	VF	VF2SB	Ball nose, Short cut length, 2 flute, For hardened materials	INCH RE .0156–.2500	○	◎	◎	◎	○	○			I217
	2	For Difficult-to-cut Materials	VQN	NEW VQN2MB	Ball nose, Medium cut length, 2 flute	METRIC RE 0.5–6						◎			I187
	2	For Hard Brittle Materials	DC	DC2SB	Ball nose, Short cut length, 2 flute, For hard brittle materials	METRIC RE 0.1–3	Cemented Carbide : ◎ Alumina / Zirconia : ○ Silicon Carbide / Nitride : ○ Quartz Glass : ○								I290
	4	For Hardened Steel	VFR	NEW VFR4MB	Ball nose, Medium cut length, 4 flute	METRIC RE 0.5–6		○	◎	◎					I266
	4	For Hardened Steel	VF	VF4MB	Ball nose, Medium cut length, 4 flute	METRIC RE 0.5–6		○	◎	◎					I234
	4	For Difficult-to-cut Materials	VQN	NEW VQN4MB	Ball nose, Medium cut length, 4 flute	METRIC RE 1–6						◎			I189
	4	For Difficult-to-cut Materials	VQN	NEW VQN4MBF	Ball nose, Medium cut length, 4 flute	METRIC RE 1–6						◎			I190
	4	For Difficult-to-cut Materials	VQ	VQ4SVB	Ball nose, Medium cut length, 4 flute	METRIC RE 1–6 INCH RE .0625–.2500	◎	◎			◎	◎	○		METRIC I169 INCH I170

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	P: Carbon Steel, Alloy Steel, Cast Iron	H: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
LONG NECK BALL															
	2	General Use	MS+	MP2XLB	Ball nose, Short cut length, 2 flute, Long neck	METRIC RE 0.05–3	◎	◎	◎		○	○	○		I088
	2	For Profiling of Special Geometry	VF	VF2WB	Wide ball nose, Medium cut length, 2 flute	METRIC RE 1–3	○	○	○		◎	◎			I216
	2	For Deep Slotting of Hardened Steel	VFR	NEW VFR2XLB	Ball nose, 2 flute, Long neck	METRIC RE 0.1–3		○	◎	◎					I268
	2	For Deep Slotting of Hardened Steel	VF	VF2XLBS	Ball nose, 2 flute, Long neck, Short shank	METRIC RE 0.2–1	○	◎	◎	◎					I219
	2	For Deep Slotting of Hardened Steel	VF	VF2XLB	Ball nose, 2 flute, Long neck	METRIC RE 0.1–3 INCH RE .0156–.1250	○	◎	◎	◎					METRIC I220 INCH I226
	2	For Deep Slotting of Hardened Steel	VQ	NEW VQ2XLB	Ball nose, Short cut length, 2 flute, Long neck	METRIC RE 0.5–1.5						◎			I164
	2	For Hard Brittle Materials	DC	DC2XLB	Ball nose, Short cut length, 2 flute, For hard brittle materials	METRIC RE 0.1–3	Cemented Carbide : ◎ Alumina / Zirconia : ○ Silicon Carbide / Nitride : ○ Quartz Glass : ○								I292
	2	For Graphite	DF	DF2XLB	Ball nose, Medium cut length, 2 flute, Long neck, For graphite	METRIC RE 0.15–2	Graphite : ◎ GFRP/CFRP : ○ Machineable Ceramics : ○						◎	○	I284
	2	For Graphite	DF	DF2XLBF	Ball nose, Medium cut length, 2 flute, Long neck, For graphite	METRIC RE 0.3–1.5	Graphite : ◎ Zirconia : ◎ Rigid Composite Resin : ◎ Machineable Ceramics : ○						◎	○	I286
	2	For Deep Slotting	MS	MS2XLB	Ball nose, 2 flute, Long neck	INCH RE .0078–.1250	◎	◎	○		○	○			I060
	4	For Profiling of Special Geometry	VQ	NEW VQ4WB	Lollipop, Short cut length, 4 flute	METRIC RE 0.5–3	◎	◎			◎	◎	○		I172
TAPER NECK BALL															
	3	For Deep Slotting Hardened Steel	VF	VF3XB	Ball nose, Medium cut length, 3 flute, Taper neck	METRIC RE 0.4–2.5	○	◎	◎	◎					I228
RADIUS															
	2	General Use	MS	MS2MRB	Corner radius, Medium cut length, 2 flute	METRIC DC 1–12	◎	◎	○		○	○	○		I062

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

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Workpiece Material P: Carbon Steel, Alloy Steel, Cast Iron	P: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
	3	For Aluminum Alloy	UWC	NEW A3SARB	Corner radius end mill, Short cut length, 3 flute, with multiple internal thru-coolant holes	METRIC DC 12–25								◎	I278
	3	For Aluminum Alloy	DLC	NEW DLC3SARB	Corner radius end mill, Short cut length, 3 flute, with multiple internal thru-coolant holes	METRIC DC 12–25								◎	I280
	4	For High Efficiency Machining	VF	VFHVRB	4 flute, Corner radius, Short cut length, Irregular helix flutes	METRIC DC 1–16 INCH DC .1250–.5000	◎	◎	◎	○	○	○			METRIC I238 INCH I244
	4	General Use	MS+	MP4MRB	Corner radius, Medium cut length, 4 flute	INCH DC .1250–.5000	◎	◎	○		○	○			I076
	4	General Use	MS	MS4MRB	Corner radius, Medium cut length, 4 flute	METRIC DC 3–20	◎	◎	○		○	○	○		I065
	4	General Use	VC	VC4JRB	Corner radius, Semi long cut length, 4 flute	METRIC DC 3–20	○	◎	○		○	○			I108
	4	For Swiss Style Lathes	VQ	NEW VQ4MRB-FB	Corner radius end mill, Medium cut length, 4 flute, For Swiss-Type lathes	METRIC DC 4–10	◎	◎			◎	◎	○		I166
	4	For Hardened Steel	VFR	NEW VFRPSRB	Corner radius, Short cut length, 4 Flute	METRIC DC 0.5–12		○	◎	◎					I272
	4	For Difficult-to-cut Materials	VQ	NEW VQHVRB	Corner radius, Short cut length, 4 flute, Irregular helix flutes	METRIC DC 1–4						◎			I114
	4	For Difficult-to-cut Materials	VQ	NEW VQFDRB	Duplex corner radius end mill for high speed cutting	METRIC DC 3–6						◎			I112
	4	For Difficult-to-cut Materials	VQ	VQMHVRB	Corner radius, Medium cut length, 4 flute, Irregular helix flutes	METRIC DC 2–20 INCH DC .1250–.5000	◎	◎			◎	◎	○		METRIC I148 INCH I153
	4	For Difficult-to-cut Materials	VQ	VQMHVRBF	Corner radius, Medium cut length, 4 flute, Irregular helix flutes (for finishing)	METRIC DC 6–16 INCH DC .2500–.5000	◎	◎			◎	◎	○		METRIC I156 INCH I158
	4	For Hardened Steel	VF	VFMHVRBCH	Corner radius, Medium cut length, 4 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16.20	○	○			◎	◎			I254
	4 6	For Hardened Steel	VF	VFFDRB	Multi-task corner radius end mill for impact miracle high speed cutting	METRIC DC 3–12		○	◎	◎					I236
	4 6	For Difficult-to-cut Materials	VQN	NEW VQN4MVRB/ VQN6MVRB	Corner Radius, Medium cut length, 4/6 flute	METRIC DC 3–12						◎			I192
	5	For Difficult-to-cut Materials	VQ	NEW VQ5MHVRB	Corner radius, Medium cut length, 5 flute, Irregular helix flutes	INCH DC .2500–.5000	◎	○			◎	◎			I176

END MILLS SELECTION CHART

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	Workpiece Material P: Carbon Steel, Alloy Steel, Cast Iron	P: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
RADIUS															
	6	For Hardened Steel	VF	VFSDRB	 Corner radius, Short cut length, 6 flute	METRIC DC 3–12		○	◎	◎					I250
	6	For Hardened Steel	VF	VFMDRB	 Corner radius, Medium cut length, 6 flute, For hardened materials	METRIC DC 3–20		○	◎	◎					I252
	6	For Difficult-to-cut Materials	VF	VF6MHVRB	 Corner radius, Medium cut length, 6 flute, Irregular helix flutes	METRIC DC 6–20	○	○			◎	◎			I256
	6	For Difficult-to-cut Materials	VQ	VQ6MHVRBCH	 Corner radius, Medium cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 10–20	○	○			◎	◎	○		I180
	5	For Difficult-to-cut Materials	VQT	VQT5MVRB	 Corner radius, Medium cut length, 5 flute, Irregular helix flutes, with coolant hole	METRIC DC 16,20,25						◎			I182
	8	For Difficult-to-cut Materials	VF	VF8MHVRBCH	 Corner radius, Medium cut length, 8 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16,20	○	○			◎	◎			I258
	4	For Heat Resistant Alloy	CERAMIC	CE4SRB	 Corner radius, short cut length, 4 flute	METRIC DC 6–12						◎			I294
	6	For Heat Resistant Alloy	CERAMIC	CE6SRB	 Corner radius, short cut length, 6 flute	METRIC DC 6–12						◎			I295
TAPER NECK RADIUS															
	4	For High Efficiency Machining	VF	VFHVRB	 4 flute, Corner radius, Short cut length,Irregular helix flutes	METRIC DC 1–12	◎	◎	◎	○	○	○			I238
TAPER BALL															
	4	For Aluminum Alloy	DLC	NEW DLC4LATB	 Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers	METRIC RE 0.5–2								◎	I300
	4	For Aluminum Alloy	UWC	C4LATB	 Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers	METRIC RE 0.5–2								◎	I298
BARREL END MILL															
	6	For Difficult-to-cut Materials	VQT	VQT6UR	 Barrel, Medium cut length, 6 flute	METRIC DC 8–12					○	◎		○	I184

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

Type	No. of Flutes	Applications, Features	Coating or Substrate	Product Code	Shape	Size Range	P: Carbon Steel, Alloy Steel, Cast Iron	P: Tool steel, Pre-Hardened Steel, Hardened Steel	H: Hardened Steel(-55HRC)	H: Hardened Steel(55HRC-)	M: Austenitic Stainless Steel	S: Titanium Alloy, Heat Resistant Alloy	N: Copper Alloy	N: Aluminum Alloy	Page
ROUGHING															
	3 4	For Difficult-to-cut Materials	VQ	**VQSVR**	 Roughing end mill, Short cut length, 3–4 flute, Irregular helix flutes	METRIC DC 3–20	◎	◎			◎	◎	○		**I161**
	3 4	For Difficult-to-cut Materials	VF	**VFSFPR**	 Roughing end mill, Short cut length, 3–4 flute	METRIC DC 3–20	○	○			◎	◎			**I210**
	4	For Difficult-to-cut Materials	VF	**VFMFPR**	 Roughing end mill, Medium cut length, 4 flute	METRIC DC 5–20	○	○			◎	◎			**I214**
	4	For Difficult-to-cut Materials	VF	**VFSFPRCH**	 Roughing end mill, Short cut length, 4 flute, with multiple thru-coolant	METRIC DC 16,20	○	○			◎	◎			**I212**
	6	For Difficult-to-cut Materials	VF	**VF6SVRCH**	 Roughing end mill, Short cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant	METRIC DC 16,20	○	○			◎	◎			**I213**
CHAMFER CUTTER															
	3	For Chamfering	MS+	NEW **MP3C**	 Chamfer cutter, 3 flute	METRIC DC 2–12	◎	◎	○		◎	◎			**I068**
	2	For Chamfering	VC	**VC2C**	 Chamfer cutter, 2 flute	METRIC DC 2–12	◎	◎	○		◎	◎	○	○	**I110**

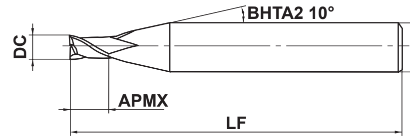
MS2SS

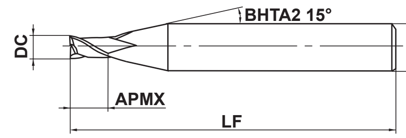
End mill, Short cut length, 2 flute

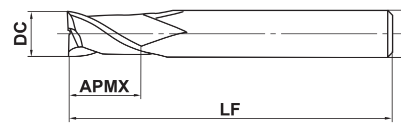
30°

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	Aluminum Alloy
◎	◎	○		○	○	○	







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

h6

● 2 flute end mill for general use.

(mm)

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

● : USA Stock ★ : Stocked in Japan

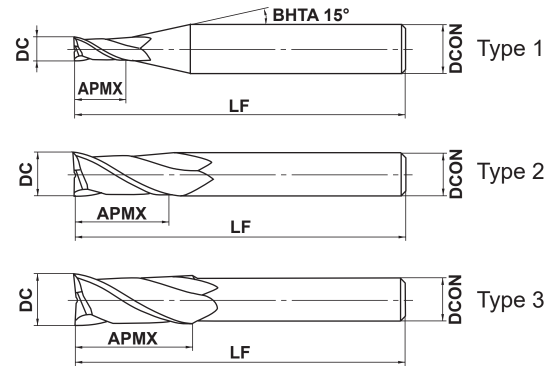
MS2MS

End mill, Medium cut length, 2 flute

30°

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	Aluminum Alloy
◎	◎	○		○	○	○	



	DC≤12	DC>12			
	0 - 0.020	0 - 0.030			
h6	4≤DCON≤6	8≤DCON≤10	12≤DCON≤16	DCON=20	
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

● 2 flute end mill for general use.

(mm)

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

MS2MS

End mill, Medium cut length, 2 flute

(mm)

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

● : USA Stock ★ : Stocked in Japan

ISO13399

➤ I002

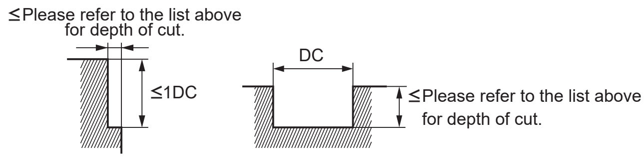
MS2SS
End mill, Short cut length, 2 flute

MS2MS
End mill, Medium cut length, 2 flute

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.				Hardened steel (45—55HRC) AISI H13 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
0.1	40000	40	1.6	0.001	40000	40	1.6	0.001
0.2	40000	100	3.9	0.002	40000	100	3.9	0.002
0.3	40000	200	7.9	0.005	40000	200	7.9	0.005
0.4	40000	600	23.6	0.01	40000	600	23.6	0.01
0.5	40000	1000	39.4	0.015	40000	960	37.8	0.015
0.6	40000	1200	47.2	0.02	40000	1200	47.2	0.02
0.7	40000	1400	55.1	0.02	40000	1400	55.1	0.02
0.8	40000	1600	63.0	0.03	40000	1600	63.0	0.03
0.9	40000	1800	70.9	0.04	40000	1600	63.0	0.04
1	40000	2000	78.7	0.06	32000	1600	63.0	0.06
1.5	40000	3000	118.1	0.12	32000	1900	74.8	0.08
2	30000	3000	118.1	0.18	24000	1900	74.8	0.10
2.5	24000	2600	102.4	0.25	19000	1600	63.0	0.13
3	20000	2300	90.6	0.30	16000	1400	55.1	0.15
4	15000	2000	78.7	0.40	12000	1200	47.2	0.20
5	12000	1600	63.0	0.50	9000	900	35.4	0.25
6	10000	1400	55.1	0.60	7000	700	27.6	0.30
8	8000	1000	39.4	0.80	5600	550	21.7	0.40
10	6400	900	35.4	1.00	4500	500	19.7	0.50
12	5400	820	32.3	1.00	3800	450	17.7	0.50
16	2400	380	15.0	3.00	1200	100	3.9	0.80
20	1900	320	12.6	4.00	1000	80	3.1	1.00

Depth of cut



DC:Dia.

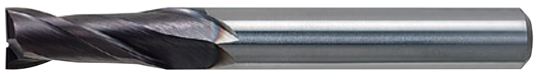
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.
Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

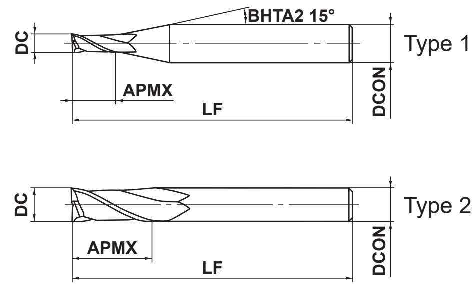
MS2MD

End mill, Medium cut length, 2 flute

UWC MS 30° 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	Aluminum Alloy
◎	◎	○		○	○		





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

h6

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

(mm)

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

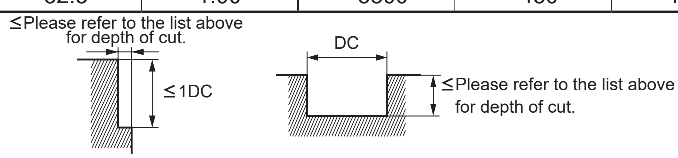
★ : Stocked in Japan

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut



DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

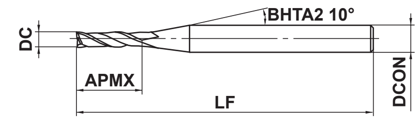
CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

MS2JS

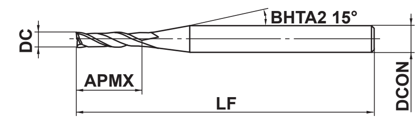
End mill, Semi long cut length, 2 flute

UWC MS 30° DC<3 DC≥3 DC<3 DC≥3

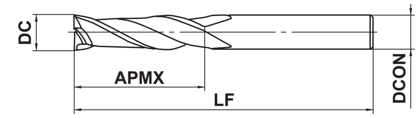
Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
◎	◎	○		○	○	○	



Type 1



Type 2



Type 3

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		

h6

● 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

● : USA Stock

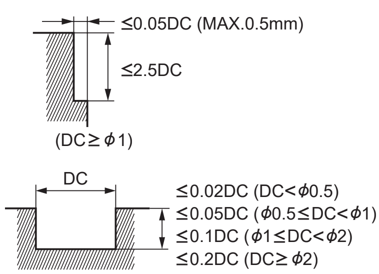
ISO13399

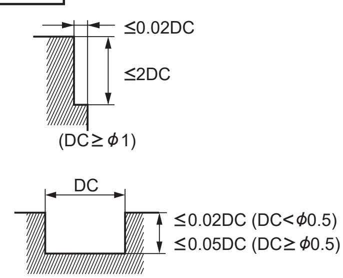
➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut





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

DC:Dia.

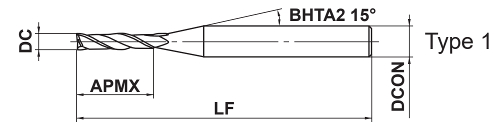
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

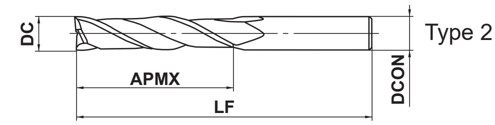
MS2LS

End mill, Long cut length, 2 flute

UWC MS 30° 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	Aluminum Alloy
◎	◎	○		○	○	○	





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

●2 flute end mill for general use.

(mm)

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

★ : Stocked in Japan

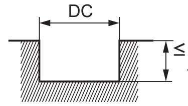
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Slotting

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
0.2	40000	400	15.7	0.001	30000	250	9.8	0.001
0.3	40000	600	23.6	0.005	35000	420	16.5	0.005
0.4	40000	700	27.6	0.007	30000	420	16.5	0.007
0.5	40000	800	31.5	0.01	24000	380	15.0	0.01
0.6	33000	800	31.5	0.015	21000	480	18.9	0.01
0.7	28000	800	31.5	0.015	18000	480	18.9	0.015
0.8	25000	800	31.5	0.02	16000	480	18.9	0.02
0.9	22000	800	31.5	0.03	15000	500	19.7	0.03
1	20000	800	31.5	0.04	13000	500	19.7	0.04
1.5	13000	800	31.5	0.10	9000	500	19.7	0.10
2	10000	800	31.5	0.15	6700	500	19.7	0.15
2.5	9000	800	31.5	0.20	6000	500	19.7	0.20
3	8000	800	31.5	0.20	5200	460	18.1	0.20
4	6000	600	23.6	0.20	4000	340	13.4	0.20
5	4800	480	18.9	0.30	3200	280	11.0	0.20
6	4000	400	15.7	0.30	2600	210	8.3	0.20
8	3000	300	11.8	0.30	2000	170	6.7	0.30
10	2400	240	9.4	0.30	1600	140	5.5	0.30
12	2000	200	7.9	0.30	1300	110	4.3	0.30

Depth of cut



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

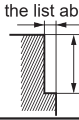
DC:Dia.

Side milling

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut (mm)
3	3500	370	14.6	0.05	2600	250	9.8	0.03
4	2800	370	14.6	0.06	2100	200	7.9	0.03
5	2200	330	13.0	0.06	1700	160	6.3	0.03
6	1800	300	11.8	0.06	1500	140	5.5	0.03
8	1600	270	10.6	0.08	1100	140	5.5	0.04
10	1400	240	9.4	0.10	900	140	5.5	0.05
12	1200	200	7.9	0.10	750	120	4.7	0.06

Depth of cut

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



DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

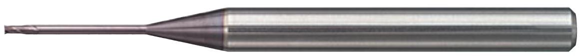
MS2XL

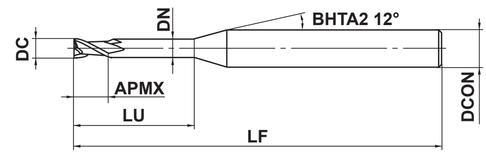
End mill, Short cut length, 2 flute, Long neck

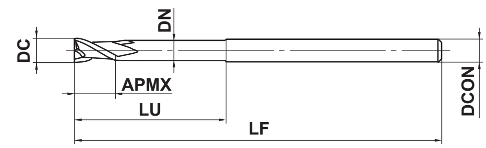
30°

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	Aluminum Alloy
◎	◎	○		○	○	○	







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

● 2 flute long neck end mill.

(mm)

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

● : USA Stock ★ : Stocked in Japan

(mm)

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

MS2XL

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

(mm)

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

● : USA Stock ★ : Stocked in Japan

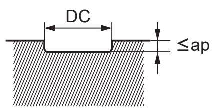
ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

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

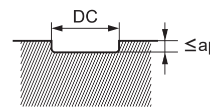
Depth of cut



DC:Dia.

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

Depth of cut



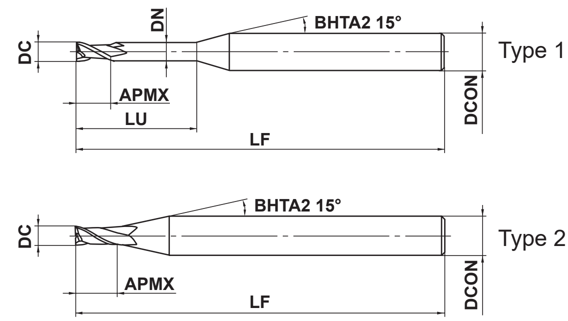
DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

MS2XL6

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

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



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

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

(mm)

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

● : USA Stock

(mm)

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

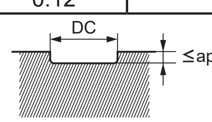
MS2XL6

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

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut

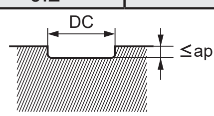


DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

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

Depth of cut



DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

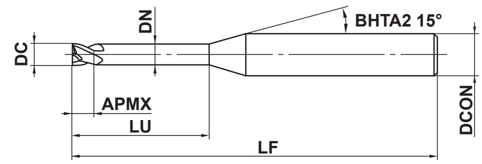
MS2XL – Inch sizes

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

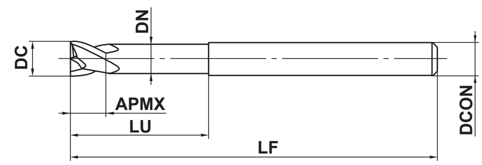
30°

DC < 1/8 DC ≥ 1/8

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	Aluminum Alloy
◎	◎	○		○	○	○	



Type 1



Type 2

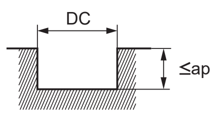
DC≤.2500"				
0 - .0008"				
DCON=.1250"	DCON=.1875"	DCON=.2500"		
0 - .00024"	0 - .00031"	0 - .00035"		

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

(inch)

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

RECOMMENDED CUTTING CONDITIONS

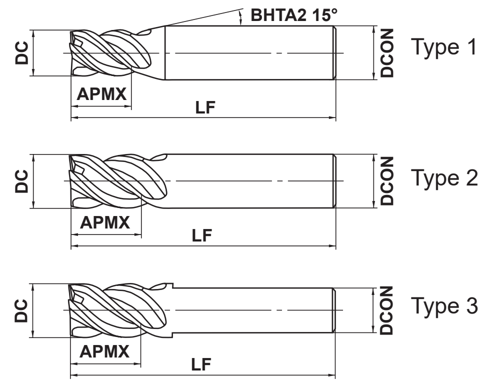
Workpiece Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.		
DC (inch)	**LU** (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap (inch)
.0156	**.0938**	40000	17.0	.0002
	.1250	30000	10.6	.0002
	.1875	20000	5.6	.0001
.0313	**.1875**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

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

MSSHD

High power, 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	Aluminum Alloy
◎	◎	○		○	○	○	



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

● 4 flute high power end mill.

(mm)

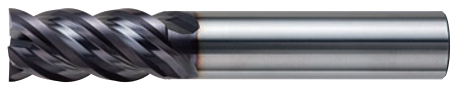
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MSSHDD0300	3	4.5	45	6	4	★	1
MSSHDD0350	3.5	5.3	45	6	4	★	1
MSSHDD0400	4	6	45	6	4	★	1
MSSHDD0450	4.5	6.8	45	6	4	★	1
MSSHDD0500	5	7.5	50	6	4	★	1
MSSHDD0550	5.5	8.3	50	6	4	★	1
MSSHDD0600	6	9	50	6	4	★	2
MSSHDD0650	6.5	9.8	60	8	4	★	1
MSSHDD0700	7	10.5	60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

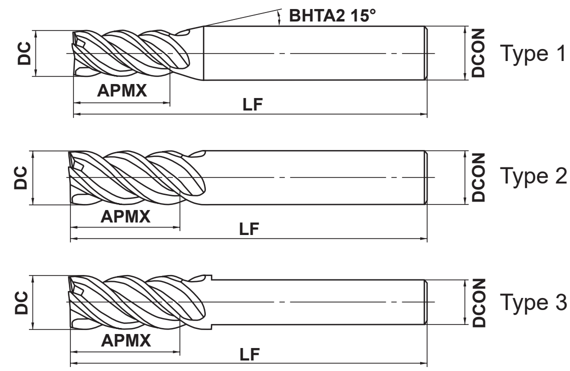
★ : Stocked in Japan

MSMHD

High power, Medium cut length, 4 flute

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





	DC≤12	DC>12			
	0 - 0.020	0 - 0.030			
h6	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.

(mm)

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

MSMHD

High power, Medium cut length, 4 flute

(mm)

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

★ : Stocked in Japan

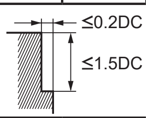
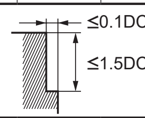
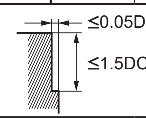
ISO13399 ➤ I002

MSSHD
High power, Short cut length, 4 flute

MSMHD
High power, Medium cut length, 4 flute

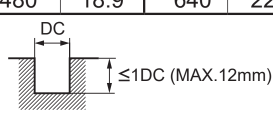
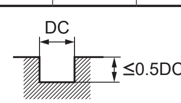
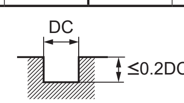
RECOMMENDED CUTTING CONDITIONS

■Side milling

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

DC:Dia.

■Slotting

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

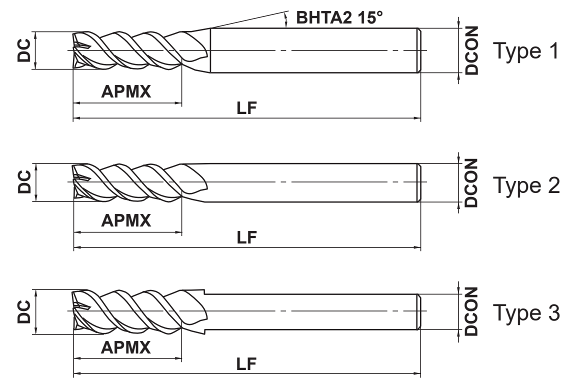
DC:Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSMHZD

Slotting, Medium cut length, 3 flute

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



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

●A single end mill for both plunging and slotting.

(mm)

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

● : USA Stock ★ : Stocked in Japan

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V etc.			Heat resistant alloy Inconel718 etc.		
DC	Revolution	Table feed		Revolution	Table feed		Revolution	Table feed		Revolution	Table feed	
(mm)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)
1	19000	600	23.6	13000	310	12.2	10000	200	7.9	9500	65	2.6
1.5	14000	600	23.6	9000	310	12.2	7500	210	8.3	6400	75	3.0
2	11000	600	23.6	7200	310	12.2	6000	210	8.3	4800	75	3.0
3	8500	770	30.3	5300	380	15.0	4400	220	8.7	3200	100	3.9
4	7200	850	33.5	4400	480	18.9	3700	250	9.8	2400	130	5.1
6	5300	940	37.0	3200	490	19.3	2700	270	10.6	1600	130	5.1
8	4000	1010	39.8	2400	560	22.0	2000	280	11.0	1200	120	4.7
10	3200	1000	39.4	1900	480	18.9	1600	300	11.8	950	110	4.3
12	2700	950	37.4	1600	440	17.3	1300	300	11.8	800	90	3.5
16	2000	720	28.3	1200	350	13.8	1000	260	10.2	600	70	2.8
20	1600	600	23.6	1000	290	11.4	800	240	9.4	480	60	2.4
Depth of cut	≤0.2DC (DC>ϕ3) ≤0.1DC (DC≤ϕ3) ≤1.5DC									0.05DC 1.5DC		

DC:Dia.

■Plunging

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V etc.		
DC	Revolution	Table feed		Revolution	Table feed		Revolution	Table feed	
(mm)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)
1	13000	80	3.1	10000	50	2.0	6000	10	0.4
1.5	12000	120	4.7	8000	80	3.1	6000	20	0.8
2	11000	200	7.9	7200	140	5.5	6000	30	1.2
3	8500	250	9.8	5300	180	7.1	4200	50	2.0
4	7200	300	11.8	4400	210	8.3	3300	60	2.4
6	5300	300	11.8	3200	210	8.3	2200	70	2.8
8	4000	320	12.6	2400	220	8.7	1600	80	3.1
10	3200	340	13.4	1900	240	9.4	1300	70	2.8
12	2700	320	12.6	1600	220	8.7	1100	70	2.8
16	2000	250	9.8	1200	180	7.1	800	55	2.2
20	1600	200	7.9	1000	140	5.5	640	55	2.2
Depth of cut	≤1DC (DC≥ϕ2) ≤0.5DC (DC<ϕ2)						≤0.5DC (DC≥ϕ2) ≤0.2DC (DC<ϕ2)		

DC:Dia.

■Slotting

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V etc.			Heat resistant alloy Inconel718 etc.		
DC	Revolution	Table feed		Revolution	Table feed		Revolution	Table feed		Revolution	Table feed	
(mm)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)	(min^{-1})	(mm/min)	(IPM)
1	13000	130	5.1	10000	80	3.1	6000	30	1.2	5700	25	1.0
1.5	12000	250	9.8	8000	150	5.9	6000	60	2.4	3800	30	1.2
2	11000	500	19.7	7200	260	10.2	6000	130	5.1	2800	35	1.4
3	8500	640	25.2	5300	320	12.6	4200	130	5.1	1900	50	2.0
4	7200	650	25.6	4400	370	14.6	3300	140	5.5	1400	70	2.8
6	5300	720	28.3	3200	380	15.0	2200	140	5.5	950	70	2.8
8	4000	780	30.7	2400	430	16.9	1600	140	5.5	720	60	2.4
10	3200	770	30.3	1900	370	14.6	1300	150	5.9	570	50	2.0
12	2700	730	28.7	1600	340	13.4	1100	150	5.9	480	40	1.6
16	2000	600	23.6	1200	290	11.4	800	130	5.1	360	30	1.2
20	1600	500	19.7	1000	240	9.4	640	120	4.7	290	25	1.0
Depth of cut	DC ≤1DC (DC≥ϕ2) ≤0.5DC (DC<ϕ2)						DC ≤0.5DC (DC≥ϕ2) ≤0.2DC (DC<ϕ2)			DC 0.2DC		

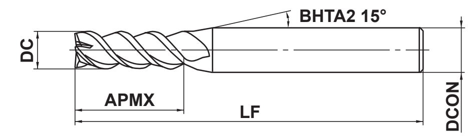
DC:Dia.

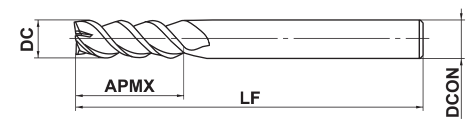
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MSMHZD – Inch sizes

Slotting, Medium cut length, 3 flute

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





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

●A single end mill for both plunging and slotting.

(inch)

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

● : USA Stock

ISO13399

➤ I002

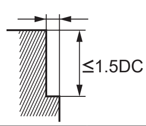
RECOMMENDED CUTTING CONDITIONS

Side milling

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

Depth of cut

≤0.2DC (DC>ϕ.1250)
≤0.1DC (DC≤ϕ.1250)

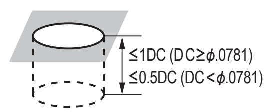


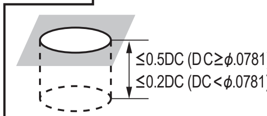
DC:Dia.

Plunging

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

Depth of cut



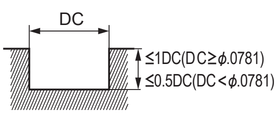


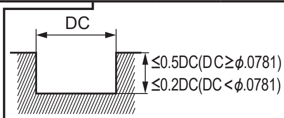
DC:Dia.

Slotting

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

Depth of cut





DC:Dia.

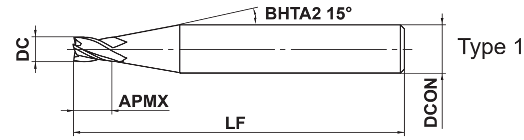
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

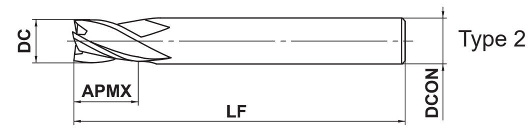
MS4SC

End mill, Short cut length, 4 flute

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	Aluminum Alloy
◎	◎	○		○	○	○	





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

●4 flute end mill for general use.

(mm)

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

★ : Stocked in Japan

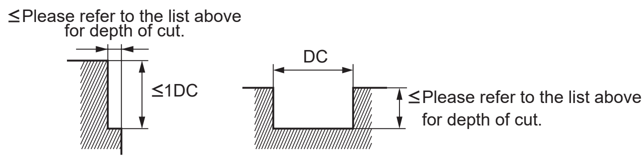
ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.				Hardened steel (45—55HRC) AISI H13 etc.			
DC (mm)	Revolution (min^{-1})	Table feed		Depth of cut (mm)	Revolution (min^{-1})	Table feed		Depth of cut (mm)
		(mm/min)	(IPM)			(mm/min)	(IPM)	
1	40000	3000	118.1	0.06	32000	2400	94.5	0.06
1.5	40000	4500	177.2	0.12	32000	3600	141.7	0.08
2	30000	4500	177.2	0.18	24000	3600	141.7	0.10
2.5	24000	3900	153.5	0.25	19000	3000	118.1	0.13
3	20000	3500	137.8	0.30	16000	2700	106.3	0.15
4	15000	3000	118.1	0.40	12000	2400	94.5	0.20
5	12000	2400	94.5	0.50	9000	1800	70.9	0.25
6	10000	2100	82.7	0.60	7000	1500	59.1	0.30
8	8000	1500	59.1	0.80	5600	1100	43.3	0.40
10	6400	1400	55.1	1.00	4500	950	37.4	0.50
12	5400	1200	47.2	1.00	3800	860	33.9	0.50

Depth of cut



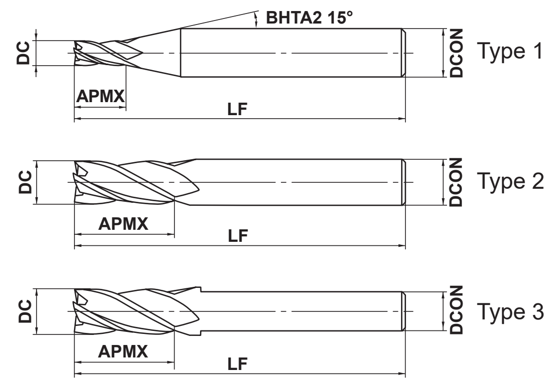
DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MS4MC

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	Aluminum Alloy
◎	◎	○		○	○	○	



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

●4 flute end mill for general use.

(mm)

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

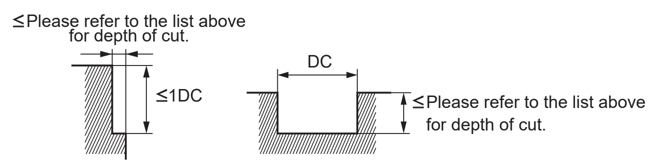
● : USA Stock ★ : Stocked in Japan

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut



DC:Dia.

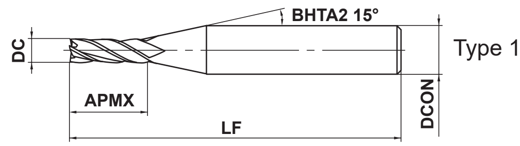
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionally.

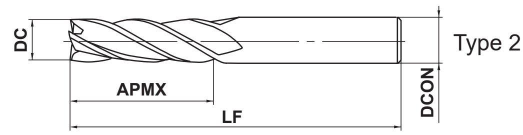
MS4JC

End mill, Semi long cut length, 4 flute

UWC MS 30° 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	Aluminum Alloy
◎	◎	○		○	○	○	





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

h6

●4 flute end mill for general use.

(mm)

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

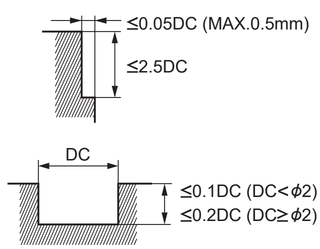
● : USA Stock

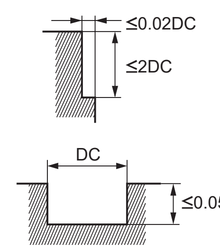
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut





DC:Dia.

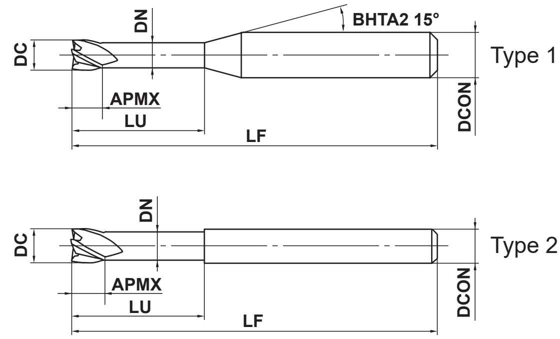
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below the values above.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MS4XL

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

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	Aluminum Alloy
◎	◎	○		○	○	○	



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

●4 flute long neck end mill.

(mm)

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

★ : Stocked in Japan

(mm)

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

ISO13399 ➤ I002

MS4XL

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

(mm)

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

★ : Stocked in Japan

ISO13399

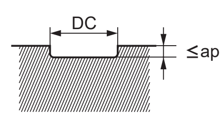
➤ I002

RECOMMENDED CUTTING CONDITIONS

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

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

Depth of cut



DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

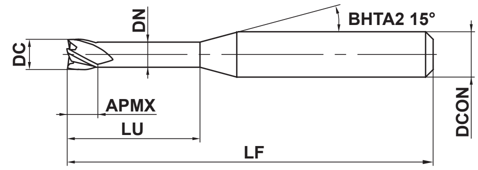
MS4XL – Inch sizes

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

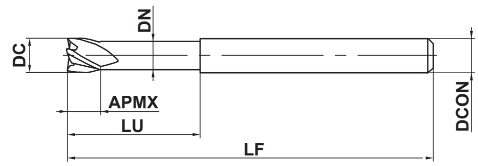
30°

DC＜1/8 DC≥1/8

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	Aluminum Alloy
◎	◎	○		○	○	○	



Type 1



Type 2

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

●4 flute long neck end mill.

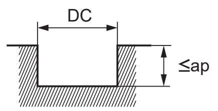
(inch)

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

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Carbon steel, Cast iron, Alloy steel, Pre-hardened steel AISI 1050, AISI No 35 B, AISI P20, AISI P21 etc.		
DC (inch)	**LU** (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap (inch)
.0625	**.3750**	40000	121.0	.0028
	.5000	30000	68.0	.0016
	.7500	10000	14.2	.0008
.0938	**.5625**	33000	109.1	.003
	.7500	20000	56.6	.002
	1.1250	10000	18.8	.001
.1250	**.7500**	25000	96.5	.004
.1875	**1.1250**	17000	72.2	.006
.2500	**1.5000**	13000	73.7	.008

Depth of cut



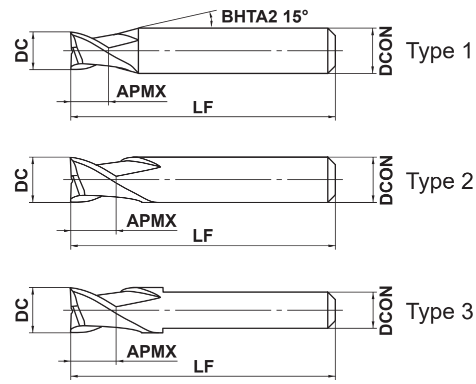
DC:Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions.
Please use the above table as a start reference point.

MS2ES

End mill, 2 flute, For Swiss-Type lathes

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



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

● 2 flute end mill.

Overall length 35mm

(mm)

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

Overall length 45mm

(mm)

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

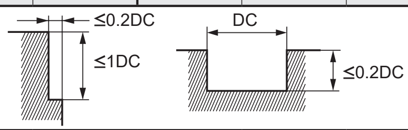
● : USA Stock

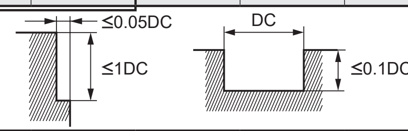
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut





DC:Dia.

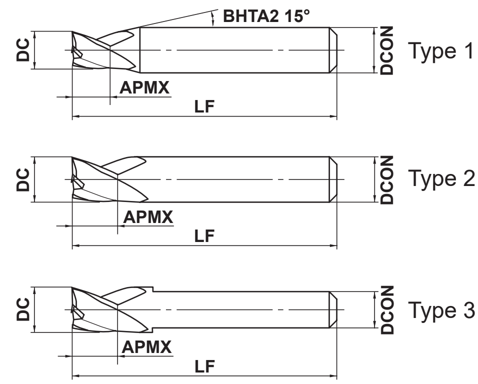
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MS3ES

End mill, 3 flute, For Swiss-Type lathes

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	Aluminum Alloy
◎	◎	○		○	○	○	



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

h6

● 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

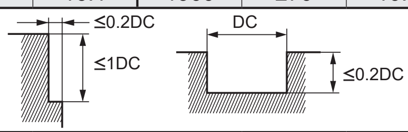
● : USA Stock

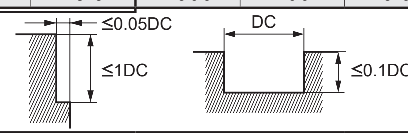
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut





DC:Dia.

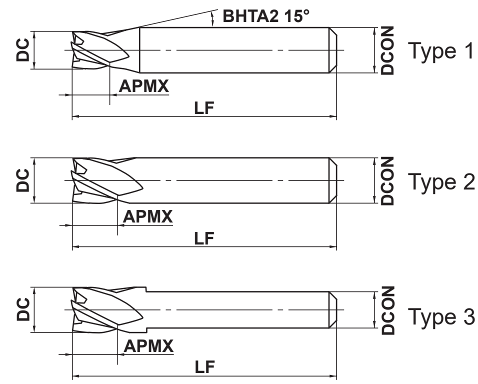
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MS4EC

End mill, 4 flute, For Swiss-Type lathes

UWC MS 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	Aluminum Alloy
◎	◎	○		○	○	○	



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

h6

● 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)

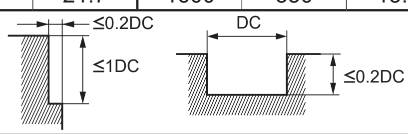
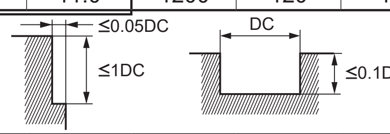
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MS4ECD0300L45S04	3	3	45	4	4	●	1
MS4ECD0350L45S04	3.5	3.5	45	4	4	●	1
MS4ECD0400L45S04	4	4	45	4	4	●	2
MS4ECD0500L45S06	5	5	45	6	4	●	1
MS4ECD0600L45S06	6	6	45	6	4	●	2
MS4ECD0700L45S07	7	7	45	7	4	●	2
MS4ECD0800L45S07	8	8	45	7	4	●	3
MS4ECD0800L45S08	8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

● : USA Stock

ISO13399

➢ I002

RECOMMENDED CUTTING CONDITIONS

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

DC:Dia.

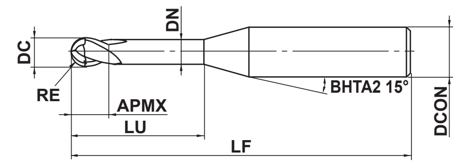
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below the values above.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

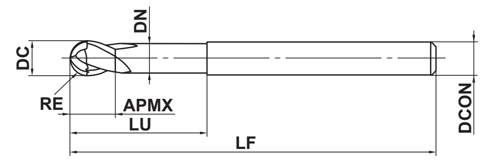
MS2XLB – Inch sizes

Ball nose, 2 flute, Long neck

UWC MS 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	Aluminum Alloy
◎	◎	○		○	○		





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

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

(inch)

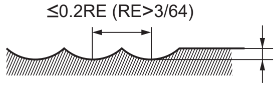
Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
MS2XLBD1/64N0094	.00781	.0156	.01563	.0938	.0144	2.0	.1250	2	▲	1
MS2XLBD1/64N0125	.00781	.0156	.01563	.1250	.0144	2.0	.1250	2	▲	1
MS2XLBD1/64N0187	.00781	.0156	.01563	.1875	.0144	2.0	.1250	2	▲	1
MS2XLBD1/32N0187	.01563	.0313	.03125	.1875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

▲ : This item to be discontinued with in two years.

ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

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

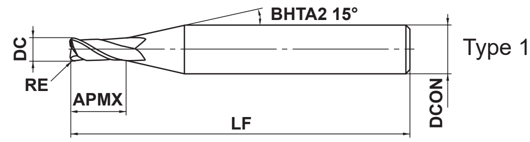
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

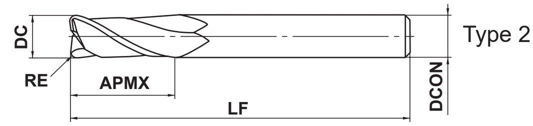
MS2MRB

Corner radius, Medium cut length, 2 flute

UWC MS 30° 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	Aluminum Alloy
◎	◎	○		○	○	○	





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

●2 flute corner radius end mill for general use.

(mm)

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

● : USA Stock ★ : Stocked in Japan

(mm)

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

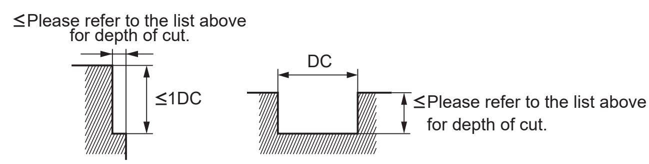
MS2MRB

Corner radius, Medium cut length, 2 flute

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut



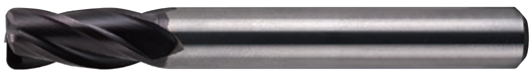
DC:Dia.

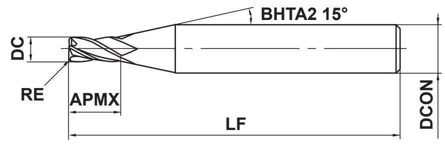
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) In case of slotting with over 3 mm endmill, please reduce revolution to 50—70% of above value, and reduce feed rate to 40—60% of above value.
Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

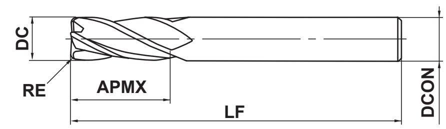
MS4MRB

Corner radius, Medium cut length, 4 flute

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







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

●4 flute corner radius end mill for general use.

(mm)

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

★ : Stocked in Japan

ISO13399 ➤ **I002**

MS4MRB

Corner radius, Medium cut length, 4 flute

(mm)

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

★ : Stocked in Japan

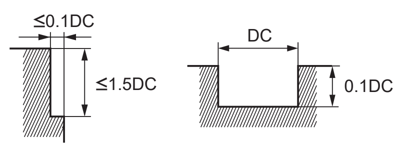
ISO13399

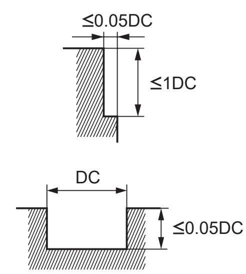
➤ I002

RECOMMENDED CUTTING CONDITIONS

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

Depth of cut





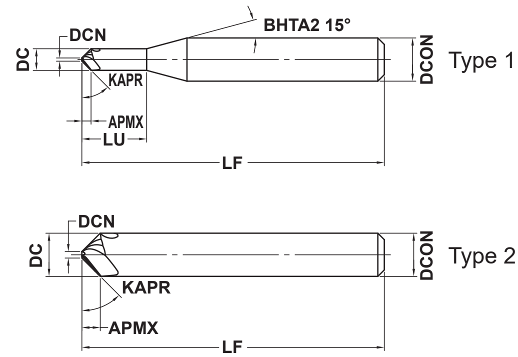
DC:Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

MP3C NEW

Chamfer cutter, 3 flute

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



DCN				
±0.03				
DCON=6	8≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

●The optimum helix flutes provides great sharpness and suppresses the occurrence of burrs.

(mm)

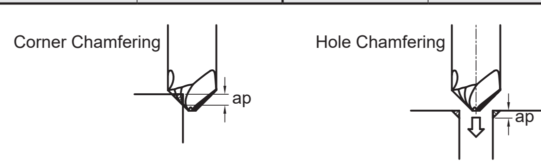
Order Number	DC	DCN	APMX	KAPR	LU	LF	DCON	No. of Flutes	Stock	Type
MP3CD0200	2	0.3	0.85	45°	6	50	6	3	●	1
MP3CD0400	4	0.3	1.85	45°	12	50	6	3	●	1
MP3CD0600	6	0.3	2.85	45°	—	50	6	3	●	2
MP3CD0800	8	0.4	3.8	45°	—	60	8	3	●	2
MP3CD1000	10	0.5	4.75	45°	—	70	10	3	★	2
MP3CD1200	12	0.5	5.75	45°	—	75	12	3	●	2

RECOMMENDED CUTTING CONDITIONS

■Corner and Hole Chamfering

Workpiece Material		Carbon Steel, Ductile Cast Iron, Non-alloy Steel (C≥0.55%)				Alloy Steel (325HB) (38−45HRC)			
DC		Revolution n	Table Feed vf	Corner Chamfering ap	Hole Chamfering ap	Revolution n	Table Feed vf	Corner Chamfering ap	Hole Chamfering ap
(mm)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)
2	**.079**	16000	55.1	≤.024	≤.016	11000	35.0	≤.024	≤.016
4	**.157**	8000	28.3	≤.047	≤.031	5600	17.7	≤.047	≤.031
6	**.236**	5300	18.9	≤.071	≤.047	3700	11.8	≤.071	≤.047
8	**.315**	4000	14.2	≤.094	≤.063	2800	9.1	≤.094	≤.063
10	**.394**	3200	11.4	≤.098	≤.079	2200	7.1	≤.098	≤.079
12	**.472**	2700	9.4	≤.098	≤.094	1900	5.9	≤.098	≤.094

Depth of Cut



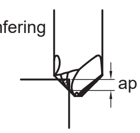
Note 1) For austenitic stainless steel the use of water-soluble coolant is effective.
Note 2) The revolution and feed rate can be increased with a smaller depth of cut.
Note 3) Vibration may occur if the rigidity of machine or workpiece material is low. In this case, please reduce the revolution and feed rate proportionately.

ISO13399 ➤ I002

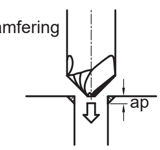
Workpiece Material		Austenitic stainless steel, Titanium alloy				Hardened Steel (45—55HRC)			
DC		Revolution **n**	Table Feed **vf**	Corner Chamfering **ap**	Hole Chamfering **ap**	Revolution **n**	Table Feed **vf**	Corner Chamfering **ap**	Hole Chamfering **ap**
(mm)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)
2	**.079**	9500	26.8	≤.024	≤.016	8000	18.9	≤.024	≤.016
4	**.157**	4800	13.8	≤.047	≤.031	4000	9.4	≤.047	≤.031
6	**.236**	3200	9.1	≤.071	≤.047	2700	6.3	≤.071	≤.047
8	**.315**	2400	6.7	≤.094	≤.063	2000	4.7	≤.094	≤.063
10	**.394**	1900	5.5	≤.098	≤.079	1600	3.8	≤.098	≤.079
12	**.472**	1600	4.7	≤.098	≤.094	1300	3.1	≤.098	≤.094

Depth of Cut

Corner Chamfering



Hole Chamfering



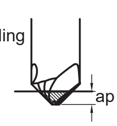
Note 1) For austenitic stainless steel the use of water-soluble coolant is effective.
Note 2) The revolution and feed rate can be increased with a smaller depth of cut.
Note 3) Vibration may occur if the rigidity of machine or workpiece material is low. In this case, please reduce the revolution and feed rate proportionately.

■V-Grooving

Workpiece Material		Carbon Steel, Ductile Cast Iron, Non-alloy Steel (C≥0.55%)			Alloy Steel (325HB) (38—45HRC)			Austenitic stainless steel, Titanium Alloys			Hardened Steel (45—55HRC)		
DC		Revolution **n**	Table Feed **vf**	Depth of Cut **ap**	Revolution **n**	Table Feed **vf**	Depth of Cut **ap**	Revolution **n**	Table Feed **vf**	Depth of Cut **ap**	Revolution **n**	Table Feed **vf**	Depth of Cut **ap**
(mm)	(inch)	(min^{-1})	(IPM)	(inch)	(min^{-1})	(IPM)	(inch)	(min^{-1})	(IPM)	(inch)	(min^{-1})	(IPM)	(inch)
2	**.079**	13000	37.0	≤.055	9500	24.4	≤.055	8000	18.1	≤.055	6400	12.2	≤.055
4	**.157**	6400	18.1	≤.110	4800	12.2	≤.110	4000	9.1	≤.110	3200	5.9	≤.110
6	**.236**	4200	11.8	≤.165	3200	8.3	≤.165	2700	6.3	≤.165	2100	3.9	≤.165
8	**.315**	3200	9.1	≤.220	2400	6.3	≤.220	2000	4.7	≤.220	1600	3.0	≤.220
10	**.394**	2500	7.1	≤.276	1900	4.7	≤.276	1600	3.6	≤.276	1300	2.4	≤.276
12	**.472**	2100	5.9	≤.331	1600	3.9	≤.331	1300	3.0	≤.331	1100	2.1	≤.331

Depth of Cut

V-Grooving Milling



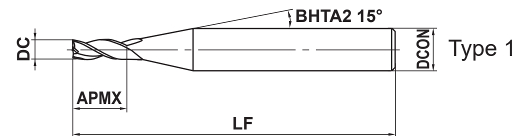
Note 1) For austenitic stainless steel the use of water-soluble coolant is effective.
Note 2) The revolution and feed rate can be increased with a smaller depth of cut.
Note 3) Vibration may occur if the rigidity of machine or workpiece material is low. In this case, please reduce the revolution and feed rate proportionately.

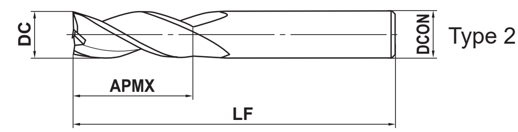
MP3MC -Inch sizes

End mill, Medium cut length, 3 flute

UWC MS+ 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	Aluminum Alloy
◎	◎	○		○	○		





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

(inch)

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

● : USA Stock

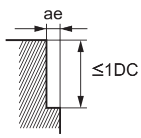
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

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

Depth of Cut



DC : Dia.

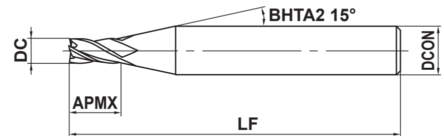
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

MP4MC - Inch sizes

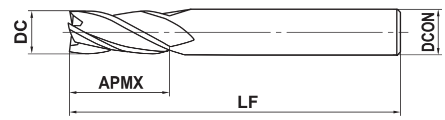
End mill, Medium cut length, 4 flute

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	Aluminum Alloy
◎	◎	○		○	○		



Type 1



Type 2

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

(inch)

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

● : USA Stock

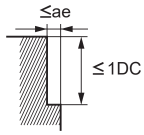
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

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

Depth of Cut



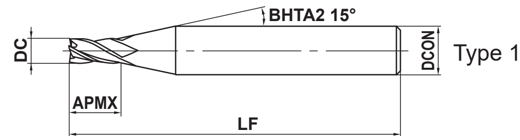
DC : Dia.

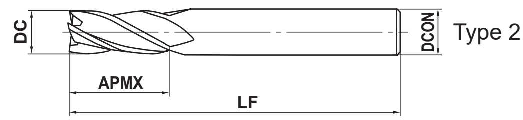
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

MP4JC -Inch sizes

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	Aluminum Alloy
◎	◎	○		○	○		





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

(inch)

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

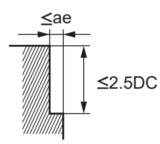
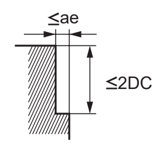
● : USA Stock

ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

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

DC : Dia.

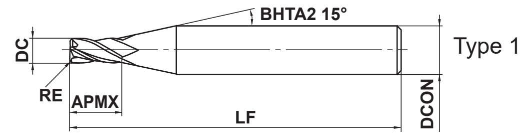
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

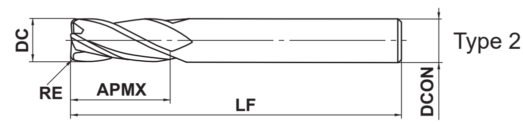
MP4MRB - Inch sizes

Corner radius, Medium cut length, 4 flute

UWC MS+ 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	Aluminum Alloy
◎	◎	○		○	○		





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

h6

(inch)

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

● : USA Stock

ISO13399

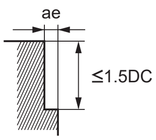
➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

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

Depth of Cut



DC : Dia.

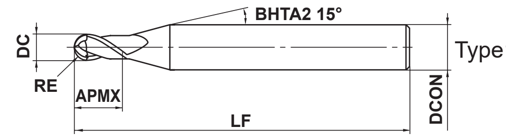
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

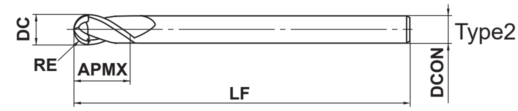
MP2SSB

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

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	Aluminum Alloy
◎	◎	◎		○	○	○	





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

h5

● 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

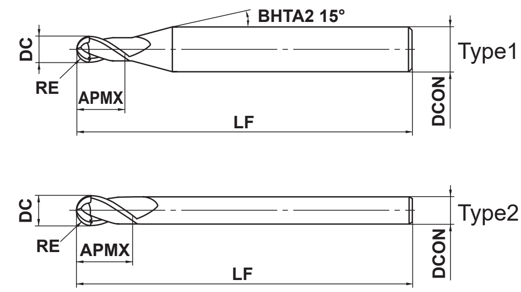
 ● : USA Stock

MP2SB

Ball nose, Short cut length, 2 flute

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	Aluminum Alloy
◎	◎	◎		○	○	○	



0.1≤RE≤6				
±0.005				

h5				
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)

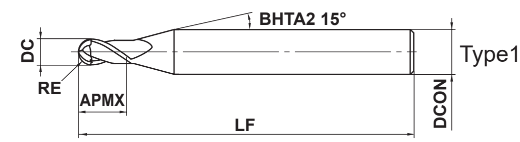
Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP2SBR0010	0.1	0.2	0.3	45	4	2	●	1
MP2SBR0015	0.15	0.3	0.5	45	4	2	●	1
MP2SBR0020	0.2	0.4	0.6	45	4	2	●	1
MP2SBR0020S06	0.2	0.4	0.6	50	6	2	●	1
MP2SBR0025	0.25	0.5	0.8	45	4	2	●	1
MP2SBR0030	0.3	0.6	0.9	45	4	2	●	1
MP2SBR0030S06	0.3	0.6	0.9	50	6	2	●	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

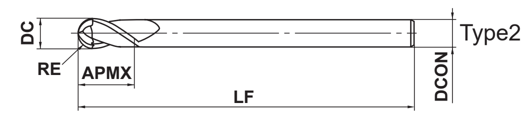
MP2MB

Ball nose, Medium cut length, 2 flute

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	Aluminum Alloy
◎	◎	◎		○	○	○	





	0.25≤RE≤6				
	±0.005				
h5	4≤DCON≤6	8≤DCON≤10	DCON=12		
	0 - 0.005	0 - 0.006	0 - 0.008		
h6	DCON=3				
	0 - 0.006				

● 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.

(mm)

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

● : USA Stock

ISO13399 ➤ I002

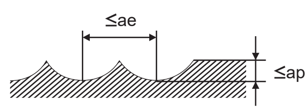
Ball nose, Short cut length, 2 flute, Short shank **MP2SSB**

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

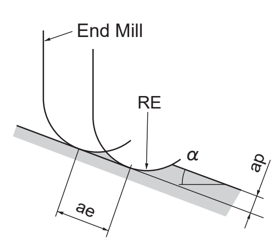
RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Mild Steel, Carbon Steel (180−280HB), Alloy Steel, Pre-hardened Steel, Hardened steel (−45HRC)						Austenitic Stainless Steel (≲200HB) Titanium Alloy					
RE (mm)	α≤15°		α>15°		Depth of Cut	Depth of Cut	α≤15°		α>15°		Depth of Cut	Depth of Cut
	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	**ap** (inch)	**ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	**ap** (inch)	**ae** (inch)
R0.1	40000	11.8	40000	9.8	.0001	.0008	40000	11.8	40000	9.8	.0001	.0008
R0.15	40000	19.7	40000	13.8	.0003	.0012	40000	19.7	40000	13.8	.0003	.0012
R0.2	40000	63.0	40000	47.2	.0008	.0016	40000	59.1	40000	39.4	.0006	.0016
R0.25	40000	94.5	40000	55.1	.0010	.0020	40000	82.7	40000	47.2	.0008	.0020
R0.3	40000	126.0	40000	63.0	.0012	.0024	40000	110.2	40000	55.1	.0012	.0024
R0.4	40000	189.0	40000	94.5	.002	.003	40000	181.1	40000	82.7	.002	.003
R0.5	40000	220.5	40000	126.0	.002	.004	40000	220.5	40000	133.9	.002	.004
R0.75	40000	255.9	40000	157.5	.004	.006	40000	255.9	36000	141.7	.003	.006
R1	40000	255.9	39000	185.0	.004	.008	40000	255.9	35000	157.5	.004	.008
R1.25	40000	275.6	33000	177.2	.005	.010	40000	291.3	29000	157.5	.005	.010
R1.5	40000	295.3	27000	169.3	.005	.012	36000	271.7	24000	153.5	.005	.012
R2	32000	295.3	20000	141.7	.006	.016	28000	271.7	18000	122.0	.006	.016
R2.5	25000	236.2	16000	114.2	.008	.020	22000	244.1	14000	102.4	.008	.020
R3	21000	228.3	13000	102.4	.010	.024	18000	212.6	11000	90.6	.010	.024
R4	16000	177.2	10000	78.7	.012	.031	14000	161.4	9000	66.9	.012	.031
R5	13000	141.7	8000	66.9	.020	.039	11000	129.9	7200	51.2	.020	.039
R6	9000	98.4	6000	51.2	.020	.047	8100	90.6	5400	43.3	.020	.047

Depth of Cut



Note 1) α is the inclination angle of the machined surface.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.



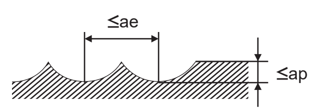
Ball nose, Short cut length, 2 flute, Short shank **MP2SSB**

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

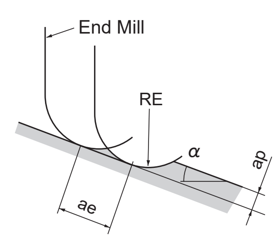
RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened Steel (45—55HRC)						Copper, Copper Alloy									
RE (mm)	$\alpha \le 15°$		$\alpha > 15°$		Depth of Cut ap (inch)	Depth of Cut ae (inch)	$\alpha \le 15°$		$\alpha > 15°$		Depth of Cut ap (inch)	Depth of Cut ae (inch)				
	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)			Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)						
R0.1	40000	11.8	40000	9.8	.0001	.0008	40000	11.8	40000	9.8	.0001	.0008				
R0.15	40000	19.7	40000	13.8	.0003	.0012	40000	19.7	40000	13.8	.0003	.0012				
R0.2	40000	51.2	40000	37.4	.0006	.0016	40000	51.2	40000	37.4	.0006	.0016				
R0.25	40000	74.8	40000	43.3	.0008	.0020	40000	74.8	40000	43.3	.0008	.0020				
R0.3	40000	98.4	40000	51.2	.0010	.0024	40000	98.4	40000	51.2	.0010	.0024				
R0.4	40000	157.5	40000	74.8	.002	.003	40000	157.5	40000	74.8	.002	.003				
R0.5	40000	220.5	40000	118.1	.002	.004	40000	220.5	40000	118.1	.002	.004				
R0.75	40000	255.9	32000	126.0	.003	.006	40000	255.9	32000	126.0	.003	.006				
R1	40000	255.9	31000	137.8	.004	.008	40000	255.9	31000	137.8	.004	.008				
R1.25	36000	255.9	26000	137.8	.005	.010	36000	255.9	26000	137.8	.005	.010				
R1.5	32000	236.2	22000	133.9	.005	.012	32000	236.2	22000	133.9	.005	.012				
R2	25000	236.2	16000	106.3	.006	.016	25000	236.2	16000	106.3	.006	.024				
R2.5	20000	212.6	13000	90.6	.008	.020	20000	212.6	13000	90.6	.008	.031				
R3	17000	185.0	10000	78.7	.010	.024	17000	185.0	10000	78.7	.010	.035				
R4	13000	141.7	8000	59.1	.012	.031	13000	141.7	8000	59.1	.012	.063				
R5	10000	114.2	6400	47.2	.020	.039	10000	114.2	6400	47.2	.020	.079				
R6	7200	78.7	4800	39.4	.020	.047	8500	90.6	5300	43.3	.020	.094				

Depth of Cut



Note 1) α is the inclination angle of the machined surface.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

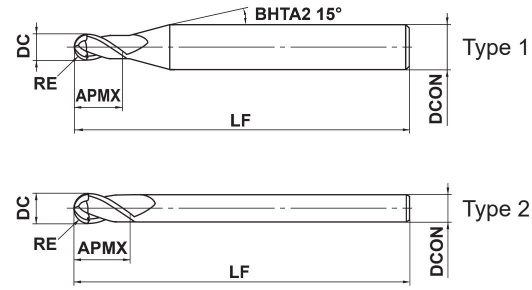


MP2MB - Inch sizes

Ball nose, Medium cut length, 2 flute

UWC MS+ 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	Aluminum Alloy
◎	◎	◎		○	○	○	



.0312"≤DCON≤.5000"				
±.0002"				
DCON=.125"	.250"≤DCON≤.375"	DCON=.500"		
0 - .00020"	0 - .00024"	0 - .00031"		

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

(inch)

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

● : USA Stock

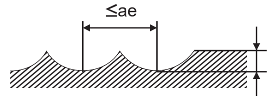
MP2MB - Inch sizes

Ball nose, Medium cut length, 2 flute

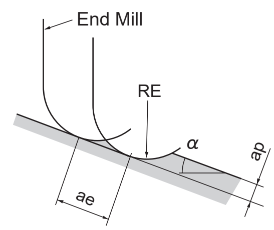
RECOMMENDED CUTTING CONDITIONS

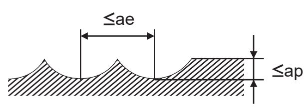
Workpiece Material		Mild Steel, Carbon Steel (180-280HB) Alloy Steel, Pre-hardened Steel, Hardened steel (— 45HRC)						Austenitic Stainless Steel (≤200HB) Titanium Alloy					
DC (inch)	RE (inch)	α≤15°		α>15°		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)	α≤15°		α>15°		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)
		Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)			Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)		
1/32	**.0156**	40000	189.0	40000	189.0	.002	.003	40000	157.5	40000	74.8	.002	.003
1/16	**.0312**	40000	255.9	40000	255.9	.004	.006	40000	255.9	32000	126.0	.004	.006
1/8	**.0625**	40000	295.3	40000	295.3	.005	.012	32000	236.2	22000	133.9	.005	.012
3/16	**.0938**	25000	236.2	25000	236.2	.008	.020	20000	212.6	13000	90.6	.008	.020
1/4	**.1250**	21000	228.3	21000	228.3	.010	.024	17000	185.0	10000	78.7	.010	.024
5/16	**.1562**	16000	177.2	16000	177.2	.012	.032	13000	141.7	8000	59.1	.012	.032
3/8	**.1875**	13000	141.7	13000	141.7	.020	.039	10000	114.2	6400	47.2	.020	.039
1/2	**.2500**	9000	98.4	9000	98.4	.020	.047	8500	90.6	5300	43.3	.020	.047

Depth of Cut

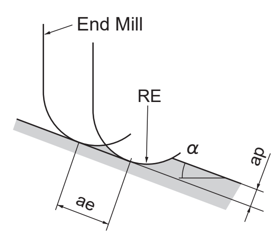


Note 1) α is the inclination angle of the machined surface.
Note 2) If the depth of cut is smaller, the revolution and the feed rate can be increased.
Note 3) If the rigidity of the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and the feed rate proportionately.



Workpiece Material		Hardened Steel (40-55HRC)						Copper, Copper Alloy					
DC (inch)	RE (inch)	$\alpha \leq 15°$		$\alpha > 15°$		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)	$\alpha \leq 15°$		$\alpha > 15°$		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)
		Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)			Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)		
1/32	**.0156**	40000	126.0	40000	59.8	.002	.003	40000	189.0	40000	189.0	.002	.003
1/16	**.0312**	40000	204.7	32000	100.8	.004	.006	40000	255.9	40000	255.9	.004	.006
1/8	**.0625**	32000	189.0	22000	107.1	.005	.012	40000	295.3	40000	295.3	.005	.012
3/16	**.0938**	20000	170.1	13000	72.5	.008	.020	25000	236.2	25000	236.2	.008	.020
1/4	**.1250**	17000	148.0	10000	63.0	.010	.024	21000	228.3	21000	228.3	.010	.024
5/16	**.1562**	13000	113.4	8000	47.3	.012	.032	16000	177.2	16000	177.2	.012	.032
3/8	**.1875**	10000	91.4	6400	37.8	.020	.039	13000	141.7	13000	141.7	.020	.039
1/2	**.2500**	8500	72.5	5300	34.6	.020	.047	9000	98.4	9000	98.4	.020	.047
Depth of Cut													

Note 1) α is the inclination angle of the machined surface.
Note 2) If the depth of cut is smaller, the revolution and the feed rate can be increased.
Note 3) If the rigidity of the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and the feed rate proportionately.

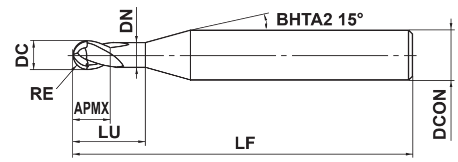


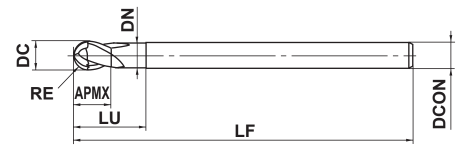
MS PLUS END MILLS

MP2SDB

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

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





0.5≤RE≤6				
±0.01				
4≤DCON≤6	DCON=8			
0 / - 0.005	0 / - 0.006			
DCON=10	DCON=12			
0 / - 0.009	0 / - 0.011			

h5

h6

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

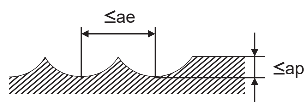
(mm)

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

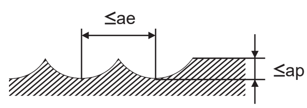
Note 1) MS plus end mills series MP2SB and MP2MB are recommended for finish surface processing.

RECOMMENDED CUTTING CONDITIONS

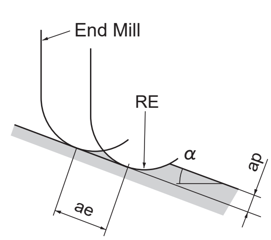
■ Overhang below DC x 5 (DC : Dia.)

Workpiece Material	Carbon Steel, Alloy Steel (180–280HB) Alloy Tool Steel, Tool Steel, Pre-hardened Steel						Hardened Steel (45－55HRC)					
RE (mm)	α≤15°		α>15°		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)	α≤15°		α>15°		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)
	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)			Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)		
R 0.5	40000	153.5	36000	82.7	.004	.010	40000	169.3	36000	86.6	.004	.010
R 0.75	40000	165.4	36000	102.4	.006	.014	40000	185.0	36000	106.3	.006	.014
R 1	40000	177.2	36000	122.0	.008	.020	40000	196.9	36000	129.9	.008	.020
R 1.5	37000	208.7	24000	106.3	.012	.030	37000	228.3	24000	110.2	.012	.030
R 2X4	24000	126.0	15000	78.7	.010	.028	19000	110.2	13000	63.0	.010	.028
R 2	30000	192.9	19000	98.4	.016	.039	28000	196.9	19000	94.5	.016	.039
R 2.5	25000	177.2	16000	90.6	.020	.051	22000	165.4	16000	86.6	.020	.049
R 3	22000	169.3	14000	86.6	.024	.071	18000	149.6	12000	70.9	.024	.059
R 4	19000	153.5	12000	78.7	.031	.094	15000	126.0	9500	63.0	.031	.079
R 5	15000	129.9	9500	70.9	.039	.118	11000	98.4	7000	55.1	.039	.098
R 6	12000	100.4	8000	63.0	.047	.142	9000	78.7	6000	51.2	.047	.118
Depth of Cut												

■ Overhang below DC x 7 (DC : Dia.)

Workpiece Material	Carbon Steel, Alloy Steel (180–280HB) Alloy Tool Steel, Tool Steel, Pre-hardened Steel						Hardened Steel (45－55HRC)					
RE (mm)	α≤15°		α>15°		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)	α≤15°		α>15°		Depth of Cut **ap** (inch)	Depth of Cut **ae** (inch)
	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)			Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)		
R 3	10000	59.1	6900	39.4	.008	.039	8000	55.1	5300	30.3	.008	.031
R 4	8000	55.1	5600	35.4	.012	.059	6400	51.2	4000	25.6	.012	.047
R 5	6000	47.2	4100	29.1	.016	.079	4800	43.3	3200	22.8	.016	.063
R 6	5000	39.4	3400	23.6	.018	.094	4000	35.4	2700	19.3	.018	.079
Depth of Cut												

Note 1) α is the inclination angle of the machined surface.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

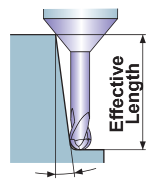


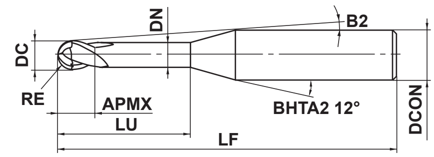
MP2XLB

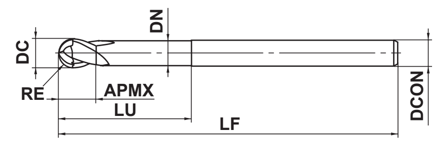
Ball nose, Short cut length, 2 flute, Long neck

UWC MS+ 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	Aluminum Alloy
◎	◎	◎		○	○	○	







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

h5

●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°
MP2XLBR0005N003	0.05	0.1	0.08	0.3	0.085	11.6°	50	4	2	●	1	0.3	0.3	0.4	0.4
MP2XLBR0005N005	0.05	0.1	0.08	0.5	0.085	11.4°	50	4	2	●	1	0.5	0.5	0.6	0.7
MP2XLBR0010N005	0.1	0.2	0.15	0.5	0.18	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.7
MP2XLBR0010N008	0.1	0.2	0.15	0.75	0.18	11.2°	50	4	2	●	1	0.8	0.8	0.9	1.0
MP2XLBR0010N010	0.1	0.2	0.15	1	0.18	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0010N013	0.1	0.2	0.15	1.25	0.18	10.6°	50	4	2	●	1	1.3	1.4	1.5	1.7
MP2XLBR0010N015	0.1	0.2	0.15	1.5	0.18	10.4°	50	4	2	●	1	1.6	1.6	1.8	2.0
MP2XLBR0010N018	0.1	0.2	0.15	1.75	0.18	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
MP2XLBR0010N020	0.1	0.2	0.15	2	0.18	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0010N025	0.1	0.2	0.15	2.5	0.18	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLBR0015N005	0.15	0.3	0.24	0.5	0.28	11.5°	50	4	2	●	1	0.5	0.5	0.6	0.6
MP2XLBR0015N008	0.15	0.3	0.24	0.75	0.28	11.2°	50	4	2	●	1	0.8	0.8	0.9	1.0
MP2XLBR0015N010	0.15	0.3	0.24	1	0.28	10.9°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0015N010S06	0.15	0.3	0.24	1	0.28	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0015N013	0.15	0.3	0.24	1.25	0.28	10.7°	50	4	2	●	1	1.3	1.4	1.5	1.6
MP2XLBR0015N013S06	0.15	0.3	0.24	1.25	0.28	11.1°	50	6	2	●	1	1.3	1.4	1.5	1.6
MP2XLBR0015N015	0.15	0.3	0.24	1.5	0.28	10.4°	50	4	2	●	1	1.6	1.6	1.8	2.0
MP2XLBR0015N015S06	0.15	0.3	0.24	1.5	0.28	10.9°	50	6	2	●	1	1.6	1.6	1.8	2.0
MP2XLBR0015N018	0.15	0.3	0.24	1.75	0.28	10.2°	50	4	2	●	1	1.8	1.9	2.1	2.3
MP2XLBR0015N020	0.15	0.3	0.24	2	0.28	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0015N025	0.15	0.3	0.24	2.5	0.28	9.5°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLBR0015N030	0.15	0.3	0.24	3	0.28	9.1°	50	4	2	●	1	3.1	3.3	3.6	4.0
MP2XLBR0015N035	0.15	0.3	0.24	3.5	0.28	8.7°	50	4	2	●	1	3.7	3.8	4.2	4.6
MP2XLBR0015N040	0.15	0.3	0.24	4	0.28	8.4°	50	4	2	●	1	4.2	4.4	4.8	5.3
MP2XLBR0020N005	0.2	0.4	0.3	0.5	0.37	11.6°	50	4	2	●	1	0.5	0.5	0.5	0.6
MP2XLBR0020N008	0.2	0.4	0.3	0.75	0.37	11.3°	50	4	2	●	1	0.7	0.8	0.9	0.9
MP2XLBR0020N010	0.2	0.4	0.3	1	0.37	11°	50	4	2	●	1	1.0	1.1	1.2	1.3
MP2XLBR0020N010S06	0.2	0.4	0.3	1	0.37	11.3°	50	6	2	●	1	1.0	1.1	1.2	1.3

● : USA Stock

(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°
MP2XLBR0020N015	0.2	0.4	0.3	1.5	0.37	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
MP2XLBR0020N020	0.2	0.4	0.3	2	0.37	9.9°	50	4	2	●	1	2.1	2.2	2.3	2.6
MP2XLBR0020N020S06	0.2	0.4	0.3	2	0.37	10.6°	50	6	2	●	1	2.1	2.2	2.3	2.6
MP2XLBR0020N025	0.2	0.4	0.3	2.5	0.37	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.3
MP2XLBR0020N030	0.2	0.4	0.3	3	0.37	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
MP2XLBR0020N035	0.2	0.4	0.3	3.5	0.37	8.7°	50	4	2	●	1	3.6	3.8	4.1	4.6
MP2XLBR0020N040	0.2	0.4	0.3	4	0.37	8.4°	50	4	2	●	1	4.2	4.3	4.7	5.2
MP2XLBR0020N045	0.2	0.4	0.3	4.5	0.37	8°	50	4	2	●	1	4.7	4.9	5.3	5.9
MP2XLBR0020N050	0.2	0.4	0.3	5	0.37	7.7°	50	4	2	●	1	5.2	5.4	5.9	6.6
MP2XLBR0020N055	0.2	0.4	0.3	5.5	0.37	7.5°	50	4	2	●	1	5.7	6.0	6.5	7.2
MP2XLBR0020N060	0.2	0.4	0.3	6	0.37	7.2°	50	4	2	●	1	6.2	6.5	7.1	7.9
MP2XLBR0025N010	0.25	0.5	0.37	1	0.47	11°	50	4	2	●	1	1.0	1.0	1.1	1.2
MP2XLBR0025N015	0.25	0.5	0.37	1.5	0.47	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
MP2XLBR0025N015S06	0.25	0.5	0.37	1.5	0.47	11°	50	6	2	●	1	1.5	1.6	1.7	1.9
MP2XLBR0025N020	0.25	0.5	0.37	2	0.47	9.9°	50	4	2	●	1	2.1	2.1	2.3	2.6
MP2XLBR0025N020S06	0.25	0.5	0.37	2	0.47	10.6°	50	6	2	●	1	2.1	2.1	2.3	2.6
MP2XLBR0025N025	0.25	0.5	0.37	2.5	0.47	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
MP2XLBR0025N025S06	0.25	0.5	0.37	2.5	0.47	10.3°	50	6	2	●	1	2.6	2.7	2.9	3.2
MP2XLBR0025N030	0.25	0.5	0.37	3	0.47	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
MP2XLBR0025N030S06	0.25	0.5	0.37	3	0.47	10°	50	6	2	●	1	3.1	3.2	3.5	3.9
MP2XLBR0025N035	0.25	0.5	0.37	3.5	0.47	8.7°	50	4	2	●	1	3.6	3.8	4.1	4.6
MP2XLBR0025N040	0.25	0.5	0.37	4	0.47	8.3°	50	4	2	●	1	4.1	4.3	4.7	5.2
MP2XLBR0025N045	0.25	0.5	0.37	4.5	0.47	8°	50	4	2	●	1	4.7	4.9	5.3	5.9
MP2XLBR0025N050	0.25	0.5	0.37	5	0.47	7.7°	50	4	2	●	1	5.2	5.4	5.9	6.6
MP2XLBR0025N055	0.25	0.5	0.37	5.5	0.47	7.4°	50	4	2	●	1	5.7	6.0	6.5	7.2
MP2XLBR0025N060	0.25	0.5	0.37	6	0.47	7.2°	50	4	2	●	1	6.2	6.5	7.1	7.9
MP2XLBR0025N070	0.25	0.5	0.37	7	0.47	6.7°	50	4	2	●	1	7.3	7.6	8.3	9.2
MP2XLBR0025N080	0.25	0.5	0.37	8	0.47	6.3°	50	4	2	●	1	8.3	8.7	9.5	10.5
MP2XLBR0025N090	0.25	0.5	0.37	9	0.47	5.9°	50	4	2	●	1	9.4	9.8	10.7	11.9
MP2XLBR0025N100	0.25	0.5	0.37	10	0.47	5.6°	50	4	2	●	1	10.4	10.9	11.9	13.2
MP2XLBR0030N015	0.3	0.6	0.45	1.5	0.57	10.4°	50	4	2	●	1	1.5	1.6	1.8	2.0
MP2XLBR0030N015S06	0.3	0.6	0.45	1.5	0.57	11°	50	6	2	●	1	1.5	1.6	1.8	2.0
MP2XLBR0030N020	0.3	0.6	0.45	2	0.57	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0030N020S06	0.3	0.6	0.45	2	0.57	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0030N025	0.3	0.6	0.45	2.5	0.57	9.4°	50	4	2	●	1	2.6	2.7	3.0	3.3
MP2XLBR0030N030	0.3	0.6	0.45	3	0.57	9°	50	4	2	●	1	3.1	3.3	3.6	4.0
MP2XLBR0030N030S06	0.3	0.6	0.45	3	0.57	9.9°	50	6	2	●	1	3.1	3.3	3.6	4.0
MP2XLBR0030N035	0.3	0.6	0.45	3.5	0.57	8.6°	50	4	2	●	1	3.7	3.8	4.2	4.6
MP2XLBR0030N040	0.3	0.6	0.45	4	0.57	8.2°	50	4	2	●	1	4.2	4.4	4.8	5.3
MP2XLBR0030N040S06	0.3	0.6	0.45	4	0.57	9.3°	50	6	2	●	1	4.2	4.4	4.8	5.3
MP2XLBR0030N045	0.3	0.6	0.45	4.5	0.57	7.9°	50	4	2	●	1	4.7	4.9	5.4	5.9
MP2XLBR0030N050	0.3	0.6	0.45	5	0.57	7.6°	50	4	2	●	1	5.2	5.5	6.0	6.6
MP2XLBR0030N050S06	0.3	0.6	0.45	5	0.57	8.8°	50	6	2	●	1	5.2	5.5	6.0	6.6
MP2XLBR0030N055	0.3	0.6	0.45	5.5	0.57	7.3°	50	4	2	●	1	5.8	6.0	6.6	7.3
MP2XLBR0030N060	0.3	0.6	0.45	6	0.57	7.1°	50	4	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0030N060S06	0.3	0.6	0.45	6	0.57	8.3°	50	6	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0030N065	0.3	0.6	0.45	6.5	0.57	6.8°	50	4	2	●	1	6.8	7.1	7.8	8.6
MP2XLBR0030N070	0.3	0.6	0.45	7	0.57	6.6°	50	4	2	●	1	7.3	7.6	8.4	9.3

MP2XLB

Ball nose, 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°
MP2XLBR0030N080	0.3	0.6	0.45	8	0.57	6.2°	50	4	2	●	1	8.4	8.7	9.6	10.6
MP2XLBR0030N080S06	0.3	0.6	0.45	8	0.57	7.6°	50	6	2	●	1	8.4	8.7	9.6	10.6
MP2XLBR0030N085	0.3	0.6	0.45	8.5	0.57	6°	50	4	2	●	1	8.9	9.3	10.2	11.3
MP2XLBR0030N090	0.3	0.6	0.45	9	0.57	5.8°	50	4	2	●	1	9.4	9.8	10.8	11.9
MP2XLBR0030N095	0.3	0.6	0.45	9.5	0.57	5.7°	50	4	2	●	1	9.9	10.4	11.4	12.6
MP2XLBR0030N100	0.3	0.6	0.45	10	0.57	5.5°	50	4	2	●	1	10.5	10.9	12.0	13.2
MP2XLBR0030N110	0.3	0.6	0.45	11	0.57	5.2°	50	4	2	●	1	11.5	12.0	13.2	14.6
MP2XLBR0030N120	0.3	0.6	0.45	12	0.57	5°	50	4	2	●	1	12.5	13.1	14.4	15.9
MP2XLBR0040N020	0.4	0.8	0.6	2	0.77	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0040N020S06	0.4	0.8	0.6	2	0.77	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
MP2XLBR0040N024S06	0.4	0.8	0.6	2.4	0.77	10.3°	50	6	2	●	1	2.5	2.6	2.8	3.1
MP2XLBR0040N030	0.4	0.8	0.6	3	0.77	8.9°	50	4	2	●	1	3.1	3.3	3.6	3.9
MP2XLBR0040N030S06	0.4	0.8	0.6	3	0.77	9.9°	50	6	2	●	1	3.1	3.3	3.6	3.9
MP2XLBR0040N040	0.4	0.8	0.6	4	0.77	8.2°	50	4	2	●	1	4.2	4.4	4.8	5.2
MP2XLBR0040N040S06	0.4	0.8	0.6	4	0.77	9.3°	50	6	2	●	1	4.2	4.4	4.8	5.2
MP2XLBR0040N050	0.4	0.8	0.6	5	0.77	7.5°	50	4	2	●	1	5.2	5.5	6.0	6.6
MP2XLBR0040N060	0.4	0.8	0.6	6	0.77	6.9°	50	4	2	●	1	6.3	6.5	7.2	7.9
MP2XLBR0040N070	0.4	0.8	0.6	7	0.77	6.5°	50	4	2	●	1	7.3	7.6	8.4	9.2
MP2XLBR0040N080	0.4	0.8	0.6	8	0.77	6°	50	4	2	●	1	8.4	8.7	9.5	10.6
MP2XLBR0040N090	0.4	0.8	0.6	9	0.77	5.7°	50	4	2	●	1	9.4	9.8	10.7	11.9
MP2XLBR0040N100	0.4	0.8	0.6	10	0.77	5.4°	50	4	2	●	1	10.5	10.9	11.9	13.2
MP2XLBR0040N120	0.4	0.8	0.6	12	0.77	4.8°	50	4	2	●	1	12.5	13.1	14.3	15.9
MP2XLBR0050N030	0.5	1	0.75	3	0.96	8.7°	50	4	2	●	1	3.2	3.4	3.7	4.1
MP2XLBR0050N030S06	0.5	1	0.75	3	0.96	9.8°	50	6	2	●	1	3.2	3.4	3.7	4.1
MP2XLBR0050N040	0.5	1	0.75	4	0.96	7.9°	50	4	2	●	1	4.3	4.5	4.9	5.4
MP2XLBR0050N040S06	0.5	1	0.75	4	0.96	9.2°	50	6	2	●	1	4.3	4.5	4.9	5.4
MP2XLBR0050N050	0.5	1	0.75	5	0.96	7.3°	50	4	2	●	1	5.3	5.6	6.1	6.7
MP2XLBR0050N050S06	0.5	1	0.75	5	0.96	8.6°	50	6	2	●	1	5.3	5.6	6.1	6.7
MP2XLBR0050N060	0.5	1	0.75	6	0.96	6.7°	50	4	2	●	1	6.4	6.7	7.3	8.1
MP2XLBR0050N060S06	0.5	1	0.75	6	0.96	8.2°	50	6	2	●	1	6.4	6.7	7.3	8.1
MP2XLBR0050N070	0.5	1	0.75	7	0.96	6.2°	50	4	2	●	1	7.4	7.8	8.5	9.4
MP2XLBR0050N080	0.5	1	0.75	8	0.96	5.8°	50	4	2	●	1	8.5	8.9	9.7	10.7
MP2XLBR0050N080S06	0.5	1	0.75	8	0.96	7.3°	50	6	2	●	1	8.5	8.9	9.7	10.7
MP2XLBR0050N090	0.5	1	0.75	9	0.96	5.5°	50	4	2	●	1	9.5	10.0	10.9	12.0
MP2XLBR0050N100	0.5	1	0.75	10	0.96	5.1°	50	4	2	●	1	10.6	11.1	12.1	13.4
MP2XLBR0050N100S06	0.5	1	0.75	10	0.96	6.7°	60	6	2	●	1	10.6	11.1	12.1	13.4
MP2XLBR0050N120	0.5	1	0.75	12	0.96	4.6°	50	4	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0050N120S06	0.5	1	0.75	12	0.96	6.1°	60	6	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0050N140	0.5	1	0.75	14	0.96	4.2°	55	4	2	●	1	14.8	15.4	16.9	18.7
MP2XLBR0050N160	0.5	1	0.75	16	0.96	3.8°	55	4	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0050N160S06	0.5	1	0.75	16	0.96	5.2°	65	6	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0050N180	0.5	1	0.75	18	0.96	3.5°	55	4	2	●	1	18.9	19.8	21.7	24.0
MP2XLBR0050N200	0.5	1	0.75	20	0.96	3.3°	55	4	2	●	1	21.0	22.0	24.1	26.6
MP2XLBR0050N200S06	0.5	1	0.75	20	0.96	4.6°	65	6	2	●	1	21.0	22.0	24.1	26.6
MP2XLBR0060N060	0.6	1.2	0.9	6	1.16	6.6°	50	4	2	●	1	6.4	6.7	7.3	8.0
MP2XLBR0060N060S06	0.6	1.2	0.9	6	1.16	8.1°	55	6	2	●	1	6.4	6.7	7.3	8.0
MP2XLBR0060N080	0.6	1.2	0.9	8	1.16	5.7°	50	4	2	●	1	8.5	8.9	9.7	10.7
MP2XLBR0060N080S06	0.6	1.2	0.9	8	1.16	7.3°	55	6	2	●	1	8.5	8.9	9.7	10.7

● : USA Stock

(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°
MP2XLBR0060N100	0.6	1.2	0.9	10	1.16	5°	50	4	2	●	1	10.6	11.0	12.1	13.3
MP2XLBR0060N100S06	0.6	1.2	0.9	10	1.16	6.6°	55	6	2	●	1	10.6	11.0	12.1	13.3
MP2XLBR0060N120	0.6	1.2	0.9	12	1.16	4.4°	50	4	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0060N120S06	0.6	1.2	0.9	12	1.16	6°	65	6	2	●	1	12.7	13.2	14.5	16.0
MP2XLBR0060N140	0.6	1.2	0.9	14	1.16	4°	55	4	2	●	1	14.8	15.4	16.9	18.7
MP2XLBR0060N160	0.6	1.2	0.9	16	1.16	3.7°	55	4	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0060N160S06	0.6	1.2	0.9	16	1.16	5.1°	65	6	2	●	1	16.9	17.6	19.3	21.3
MP2XLBR0060N180	0.6	1.2	0.9	18	1.16	3.4°	60	4	2	●	1	18.9	19.8	21.7	24.0
MP2XLBR0060N200	0.6	1.2	0.9	20	1.16	3.1°	60	4	2	●	1	21.0	21.9	24.0	26.6
MP2XLBR0060N240	0.6	1.2	0.9	24	1.16	2.7°	60	4	2	●	1	25.2	26.3	28.8	*
MP2XLBR0070N080	0.7	1.4	1.05	8	1.34	5.5°	50	4	2	●	1	8.4	8.8	9.6	10.6
MP2XLBR0070N120	0.7	1.4	1.05	12	1.34	4.3°	50	4	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0070N160	0.7	1.4	1.05	16	1.34	3.5°	50	4	2	●	1	16.8	17.5	19.2	21.2
MP2XLBR0075N030	0.75	1.5	1.1	3	1.44	8.6°	50	4	2	●	1	3.1	3.3	3.6	3.9
MP2XLBR0075N040	0.75	1.5	1.1	4	1.44	7.7°	50	4	2	●	1	4.2	4.4	4.8	5.2
MP2XLBR0075N060	0.75	1.5	1.1	6	1.44	6.3°	50	4	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0075N060S06	0.75	1.5	1.1	6	1.44	8°	50	6	2	●	1	6.3	6.6	7.2	7.9
MP2XLBR0075N080	0.75	1.5	1.1	8	1.44	5.4°	50	4	2	●	1	8.4	8.8	9.6	10.6
MP2XLBR0075N080S06	0.75	1.5	1.1	8	1.44	7.2°	60	6	2	●	1	8.4	8.8	9.6	10.6
MP2XLBR0075N100	0.75	1.5	1.1	10	1.44	4.7°	50	4	2	●	1	10.5	11.0	12.0	13.2
MP2XLBR0075N100S06	0.75	1.5	1.1	10	1.44	6.5°	60	6	2	●	1	10.5	11.0	12.0	13.2
MP2XLBR0075N120	0.75	1.5	1.1	12	1.44	4.2°	50	4	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0075N120S06	0.75	1.5	1.1	12	1.44	5.9°	60	6	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0075N140	0.75	1.5	1.1	14	1.44	3.8°	55	4	2	●	1	14.7	15.3	16.8	18.5
MP2XLBR0075N160	0.75	1.5	1.1	16	1.44	3.4°	55	4	2	●	1	16.8	17.5	19.2	21.2
MP2XLBR0075N160S06	0.75	1.5	1.1	16	1.44	5°	60	6	2	●	1	16.8	17.5	19.2	21.2
MP2XLBR0075N180	0.75	1.5	1.1	18	1.44	3.1°	60	4	2	●	1	18.9	19.7	21.6	23.8
MP2XLBR0075N200	0.75	1.5	1.1	20	1.44	2.9°	60	4	2	●	1	21.0	21.9	23.9	*
MP2XLBR0075N220	0.75	1.5	1.1	22	1.44	2.7°	60	4	2	●	1	23.0	24.0	26.3	*
MP2XLBR0080N080	0.8	1.6	1.2	8	1.54	5.3°	55	4	2	●	1	8.4	8.8	9.6	10.5
MP2XLBR0080N120	0.8	1.6	1.2	12	1.54	4.1°	55	4	2	●	1	12.6	13.1	14.4	15.9
MP2XLBR0080N160	0.8	1.6	1.2	16	1.54	3.3°	55	4	2	●	1	16.8	17.5	19.1	21.2
MP2XLBR0080N200	0.8	1.6	1.2	20	1.54	2.8°	55	4	2	●	1	21.0	21.9	23.9	*
MP2XLBR0090N080	0.9	1.8	1.4	8	1.74	5.1°	55	4	2	●	1	8.4	8.8	9.6	10.5
MP2XLBR0090N120	0.9	1.8	1.4	12	1.74	3.9°	55	4	2	●	1	12.6	13.1	14.3	15.8
MP2XLBR0090N160	0.9	1.8	1.4	16	1.74	3.1°	55	4	2	●	1	16.8	17.5	19.1	21.1
MP2XLBR0090N200	0.9	1.8	1.4	20	1.74	2.6°	55	4	2	●	1	20.9	21.8	23.9	*
MP2XLBR0100N040	1	2	1.5	4	1.94	7.2°	50	4	2	●	1	4.2	4.4	4.7	5.2
MP2XLBR0100N040S06	1	2	1.5	4	1.94	9°	50	6	2	●	1	4.2	4.4	4.7	5.2
MP2XLBR0100N060	1	2	1.5	6	1.94	5.8°	50	4	2	●	1	6.3	6.6	7.1	7.8
MP2XLBR0100N060S06	1	2	1.5	6	1.94	7.8°	50	6	2	●	1	6.3	6.6	7.1	7.8
MP2XLBR0100N080	1	2	1.5	8	1.94	4.8°	50	4	2	●	1	8.4	8.8	9.5	10.5
MP2XLBR0100N080S06	1	2	1.5	8	1.94	6.9°	50	6	2	●	1	8.4	8.8	9.5	10.5
MP2XLBR0100N100	1	2	1.5	10	1.94	4.2°	50	4	2	●	1	10.5	10.9	11.9	13.1
MP2XLBR0100N100S06	1	2	1.5	10	1.94	6.2°	50	6	2	●	1	10.5	10.9	11.9	13.1
MP2XLBR0100N120	1	2	1.5	12	1.94	3.6°	50	4	2	●	1	12.6	13.1	14.3	15.8
MP2XLBR0100N120S06	1	2	1.5	12	1.94	5.6°	60	6	2	●	1	12.6	13.1	14.3	15.8
MP2XLBR0100N140	1	2	1.5	14	1.94	3.2°	55	4	2	●	1	14.7	15.3	16.7	18.4

* No interference

MP2XLB

Ball nose, 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°
MP2XLBR0100N140S06	1	2	1.5	14	1.94	5.1°	60	6	2	●	1	14.7	15.3	16.7	18.4
MP2XLBR0100N160	1	2	1.5	16	1.94	2.9°	55	4	2	●	1	16.8	17.5	19.1	*
MP2XLBR0100N160S06	1	2	1.5	16	1.94	4.7°	65	6	2	●	1	16.8	17.5	19.1	21.1
MP2XLBR0100N180	1	2	1.5	18	1.94	2.7°	55	4	2	●	1	18.9	19.7	21.5	*
MP2XLBR0100N180S06	1	2	1.5	18	1.94	4.3°	65	6	2	●	1	18.9	19.7	21.5	23.8
MP2XLBR0100N200	1	2	1.5	20	1.94	2.4°	65	4	2	●	1	20.9	21.8	23.9	*
MP2XLBR0100N200S06	1	2	1.5	20	1.94	4°	65	6	2	●	1	20.9	21.8	23.9	26.4
MP2XLBR0100N220	1	2	1.5	22	1.94	2.3°	65	4	2	●	1	23.0	24.0	26.3	*
MP2XLBR0100N250	1	2	1.5	25	1.94	2°	65	4	2	●	1	26.2	27.3	*	*
MP2XLBR0100N250S06	1	2	1.5	25	1.94	3.5°	90	6	2	●	1	26.2	27.3	29.9	33
MP2XLBR0100N300	1	2	1.5	30	1.94	1.7°	80	4	2	●	1	31.4	32.7	*	*
MP2XLBR0100N300S06	1	2	1.5	30	1.94	3°	90	6	2	●	1	31.4	32.7	35.9	*
MP2XLBR0100N350	1	2	1.5	35	1.94	1.5°	80	4	2	●	1	36.6	38.2	*	*
MP2XLBR0100N350S06	1	2	1.5	35	1.94	2.7°	90	6	2	●	1	36.6	38.2	41.8	*
MP2XLBR0100N400	1	2	1.5	40	1.94	1.4°	80	4	2	●	1	41.8	43.6	*	*
MP2XLBR0100N400S06	1	2	1.5	40	1.94	2.4°	90	6	2	●	1	41.8	43.6	47.8	*
MP2XLBR0125N100	1.25	2.5	1.9	10	2.4	3.5°	55	4	2	●	1	10.4	10.8	11.8	12.9
MP2XLBR0125N150	1.25	2.5	1.9	15	2.4	2.5°	55	4	2	●	1	15.6	16.3	17.8	*
MP2XLBR0125N200	1.25	2.5	1.9	20	2.4	2°	55	4	2	●	1	20.8	21.7	*	*
MP2XLBR0125N250	1.25	2.5	1.9	25	2.4	1.6°	70	4	2	●	1	26.1	27.2	*	*
MP2XLBR0125N300	1.25	2.5	1.9	30	2.4	1.4°	70	4	2	●	1	31.3	32.6	*	*
MP2XLBR0125N350	1.25	2.5	1.9	35	2.4	1.2°	70	4	2	●	1	36.5	38.1	*	*
MP2XLBR0150N060S03	1.5	3	2.3	6	2.9	—	60	3	2	●	2	*	*	*	*
MP2XLBR0150N080	1.5	3	2.3	8	2.9	6.3°	60	6	2	●	1	8.3	8.6	9.3	10.2
MP2XLBR0150N100	1.5	3	2.3	10	2.9	5.5°	60	6	2	●	1	10.4	10.8	11.7	12.9
MP2XLBR0150N120	1.5	3	2.3	12	2.9	4.9°	60	6	2	●	1	12.5	13.0	14.1	15.5
MP2XLBR0150N140	1.5	3	2.3	14	2.9	4.4°	60	6	2	●	1	14.6	15.2	16.5	18.2
MP2XLBR0150N160	1.5	3	2.3	16	2.9	4°	70	6	2	●	1	16.7	17.3	18.9	20.8
MP2XLBR0150N200	1.5	3	2.3	20	2.9	3.4°	70	6	2	●	1	20.8	21.7	23.7	26.1
MP2XLBR0150N250	1.5	3	2.3	25	2.9	2.8°	70	6	2	●	1	26.1	27.2	29.7	*
MP2XLBR0150N300	1.5	3	2.3	30	2.9	2.5°	70	6	2	●	1	31.3	32.6	35.7	*
MP2XLBR0150N350	1.5	3	2.3	35	2.9	2.2°	90	6	2	●	1	36.5	38.0	41.7	*
MP2XLBR0150N400	1.5	3	2.3	40	2.9	1.9°	90	6	2	●	1	41.7	43.5	*	*
MP2XLBR0175N150	1.75	3.5	2.6	15	3.4	3.8°	65	6	2	●	1	15.6	16.2	17.7	19.4
MP2XLBR0175N250	1.75	3.5	2.6	25	3.4	2.5°	65	6	2	●	1	26.0	27.1	29.6	*
MP2XLBR0175N350	1.75	3.5	2.6	35	3.4	1.9°	90	6	2	●	1	36.5	38.0	*	*
MP2XLBR0175N450	1.75	3.5	2.6	45	3.4	1.5°	90	6	2	●	1	46.9	48.9	*	*
MP2XLBR0200N080S04	2	4	3	8	3.9	—	65	4	2	●	2	*	*	*	*
MP2XLBR0200N100	2	4	3	10	3.9	4.5°	65	6	2	●	1	10.4	10.8	11.6	12.7
MP2XLBR0200N120	2	4	3	12	3.9	3.9°	65	6	2	●	1	12.5	12.9	14.0	15.4
MP2XLBR0200N140	2	4	3	14	3.9	3.4°	65	6	2	●	1	14.6	15.1	16.4	18.0
MP2XLBR0200N160	2	4	3	16	3.9	3.1°	70	6	2	●	1	16.6	17.3	18.8	20.7
MP2XLBR0200N200	2	4	3	20	3.9	2.6°	70	6	2	●	1	20.8	21.7	23.6	*
MP2XLBR0200N250	2	4	3	25	3.9	2.1°	70	6	2	●	1	26.0	27.1	29.6	*
MP2XLBR0200N300	2	4	3	30	3.9	1.8°	80	6	2	●	1	31.2	32.6	*	*
MP2XLBR0200N350	2	4	3	35	3.9	1.6°	80	6	2	●	1	36.5	38.0	*	*
MP2XLBR0200N400	2	4	3	40	3.9	1.4°	90	6	2	●	1	41.7	43.5	*	*
MP2XLBR0200N450	2	4	3	45	3.9	1.2°	90	6	2	●	1	46.9	48.9	*	*

* No interference

● : USA Stock

(mm)

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

* No interference

MP2XLB

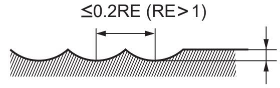
Ball nose, Short cut length, 2 flute, Long neck

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Carbon steel, Alloy steel (180–280HB) Alloy tool steel, Pre-hardened steel, Precipitation hardening stainless steel			Hardened steel (45–55HRC)			Copper, Copper alloy		
RE (mm)	LU (mm)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
0.05	**0.3**	50000	7.9	.00008	50000	7.9	.00008	50000	7.9	.00016
	0.5	50000	7.9	.00004	50000	7.9	.00008	50000	7.9	.00008
0.1	**0.5**	50000	15.7	.00012	50000	12.6	.00012	50000	12.6	.00024
	1	50000	15.7	.00008	50000	12.6	.00008	50000	12.6	.00016
	1.5	40000	11.8	.00004	40000	9.4	.00004	40000	9.4	.00008
	2	40000	7.9	.00004	40000	6.3	.00004	40000	6.3	.00008
	2.5	40000	3.9	.00004	40000	3.1	.00004	40000	3.1	.00008
0.15	**1**	50000	23.6	.00028	50000	18.9	.00028	50000	18.9	.00055
	1.5	50000	23.6	.00020	50000	18.9	.00020	50000	18.9	.00039
	2	50000	23.6	.00012	50000	18.9	.00012	50000	18.9	.00024
	2.5	40000	15.7	.00012	40000	12.6	.00012	40000	12.6	.00024
	3	40000	11.8	.00008	40000	9.4	.00008	40000	9.4	.00016
	3.5	30000	9.8	.00008	30000	7.9	.00008	30000	7.9	.00016
	4	30000	7.9	.00008	30000	6.3	.00008	30000	6.3	.00016
0.2	**1**	50000	70.9	.00059	50000	55.1	.00059	50000	55.1	.00118
	2	50000	51.2	.00039	50000	39.4	.00039	50000	39.4	.00079
	3	50000	35.4	.00020	50000	27.6	.00020	50000	27.6	.00039
	4	40000	23.6	.00016	40000	18.9	.00016	40000	18.9	.00031
	5	40000	15.7	.00012	40000	12.6	.00012	40000	12.6	.00024
	6	30000	7.9	.00008	30000	6.3	.00008	30000	6.3	.00016
0.25	**2**	50000	98.4	.00079	50000	78.7	.00079	50000	78.7	.00157
	3	50000	59.1	.00059	50000	47.2	.00059	50000	47.2	.00118
	4	45000	47.2	.00039	45000	37.4	.00039	45000	37.4	.00079
	5	45000	35.4	.00028	45000	27.6	.00028	45000	27.6	.00055
	6	36000	23.6	.00024	36000	18.9	.00024	36000	18.9	.00047
	7	32000	15.7	.00020	32000	12.6	.00020	32000	12.6	.00039
	8	32000	11.8	.00012	32000	9.4	.00012	32000	9.4	.00024
	10	26000	7.9	.00008	26000	6.3	.00008	26000	6.3	.00016
0.3	**2**	50000	137.8	.00118	50000	110.2	.00118	50000	110.2	.00236
	3	50000	137.8	.00118	50000	110.2	.00118	50000	110.2	.00236
	4	44000	98.4	.00079	44000	78.7	.00079	44000	78.7	.00157
	5	37000	47.2	.00039	37000	37.4	.00039	37000	37.4	.00079
	6	37000	39.4	.00031	37000	31.5	.00031	37000	31.5	.00063
	7	35000	29.5	.00031	35000	23.6	.00031	35000	23.6	.00063
	8	35000	23.6	.00024	35000	18.9	.00024	35000	18.9	.00047
	9	30000	19.7	.00016	30000	15.7	.00016	30000	15.7	.00031
	10	30000	19.7	.00012	30000	15.7	.00012	30000	15.7	.00024
	11	22000	11.8	.00008	22000	9.4	.00008	22000	9.4	.00016
	12	22000	7.9	.00008	22000	6.3	.00008	22000	6.3	.00016
0.4	**2**	50000	173.2	.00157	50000	137.8	.00157	50000	137.8	.00315
	3	50000	157.5	.00157	50000	126.0	.00157	50000	126.0	.00315
	4	50000	157.5	.00079	50000	126.0	.00079	50000	126.0	.00157
	5	35000	94.5	.00079	35000	74.8	.00079	35000	74.8	.00157
	6	35000	94.5	.00079	35000	74.8	.00079	35000	74.8	.00157
	7	30000	59.1	.00059	30000	47.2	.00059	30000	47.2	.00118
	8	30000	59.1	.00039	30000	47.2	.00039	30000	47.2	.00079
	10	30000	27.6	.00031	30000	22.0	.00031	30000	22.0	.00063
	12	22000	19.7	.00024	22000	15.7	.00024	22000	15.7	.00047

Depth of Cut

≤0.1RE (RE≤1)
≤0.2RE (RE>1)



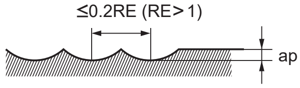
RE : Radius

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

Workpiece Material		Carbon steel, Alloy steel (180–280HB) Alloy tool steel, Pre-hardened steel, Precipitation hardening stainless steel			Hardened steel (45–55HRC)			Copper, Copper alloy		
RE (mm)	LU (mm)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
0.5	**3**	40000	157.5	.00197	40000	126.0	.00197	40000	126.0	.00394
	4	40000	157.5	.00197	40000	126.0	.00197	40000	126.0	.00394
	6	35000	118.1	.00118	35000	94.5	.00118	35000	94.5	.00236
	8	30000	78.7	.00079	30000	63.0	.00079	30000	63.0	.00157
	10	20000	39.4	.00039	20000	31.5	.00039	20000	31.5	.00079
	12	20000	39.4	.00039	20000	31.5	.00039	20000	31.5	.00079
	14	18000	23.6	.00031	18000	18.9	.00031	18000	18.9	.00063
	16	18000	19.7	.00031	18000	15.7	.00031	18000	15.7	.00063
	18	13000	11.8	.00020	13000	9.4	.00020	13000	9.4	.00039
	20	13000	9.8	.00020	13000	7.9	.00020	13000	7.9	.00039
0.6	**6**	40000	173.2	.0016	40000	137.8	.0016	40000	137.8	.0031
	8	40000	157.5	.0016	40000	126.0	.0016	40000	126.0	.0031
	10	27000	74.8	.0008	27000	59.1	.0008	27000	59.1	.0016
	12	16000	55.1	.0008	16000	43.3	.0008	16000	43.3	.0016
	18	15000	27.6	.0003	15000	22.0	.0003	15000	22.0	.0006
	24	11000	11.8	.0002	11000	9.4	.0002	11000	9.4	.0005
0.7	**8**	40000	157.5	.0020	40000	126.0	.0020	40000	100.8	.0039
	12	26000	78.7	.0016	26000	63.0	.0016	26000	50.4	.0031
	16	17000	55.1	.0012	17000	44.1	.0012	17000	35.3	.0024
0.75	**6**	40000	236.2	.0028	36000	169.3	.0028	36000	169.3	.0055
	8	40000	236.2	.0028	36000	169.3	.0028	36000	169.3	.0055
	10	40000	196.9	.0024	36000	141.7	.0024	36000	141.7	.0047
	12	32000	133.9	.0016	29000	94.5	.0016	29000	94.5	.0031
	16	15000	55.1	.0012	15000	43.3	.0012	15000	43.3	.0024
	20	12000	35.4	.0008	12000	28.3	.0008	12000	28.3	.0016
	30	9000	15.7	.0004	9000	12.6	.0004	9000	12.6	.0008
0.8	**8**	40000	236.2	.0031	32000	149.6	.0031	32000	149.6	.0063
	12	36000	177.2	.0024	29000	110.2	.0024	29000	110.2	.0047
	16	14000	55.1	.0016	14000	43.3	.0016	14000	43.3	.0031
	20	12000	39.4	.0012	12000	31.5	.0012	12000	31.5	.0024
0.9	**8**	40000	259.8	.0035	32000	165.4	.0035	32000	165.4	.0071
	12	40000	196.9	.0028	32000	126.0	.0028	32000	126.0	.0055
	16	28000	110.2	.0016	22000	70.9	.0016	22000	70.9	.0031
	20	10000	31.5	.0012	10000	25.2	.0012	10000	25.2	.0024
1	**4**	40000	315.0	.0039	32000	196.9	.0039	32000	196.9	.0079
	6	40000	315.0	.0039	32000	196.9	.0039	32000	196.9	.0079
	8	40000	236.2	.0039	32000	149.6	.0039	32000	149.6	.0079
	10	40000	196.9	.0031	32000	126.0	.0031	32000	126.0	.0063
	12	40000	196.9	.0031	32000	126.0	.0031	32000	126.0	.0063
	16	32000	137.8	.0020	26000	86.6	.0020	26000	86.6	.0039
	20	10000	39.4	.0016	10000	31.5	.0016	10000	31.5	.0031
	25	10000	39.4	.0016	10000	31.5	.0016	10000	31.5	.0031
	30	10000	31.5	.0008	10000	25.2	.0008	10000	25.2	.0016
	35	10000	23.6	.0008	10000	18.9	.0008	10000	18.9	.0016
	40	8000	15.7	.0004	8000	12.6	.0004	8000	12.6	.0008

Depth of Cut

≦0.1RE (RE≦1)
≦0.2RE (RE>1)



RE : Radius

Note 4) Cutting conditions may differ considerably due to the overhang, depth of cut and machine tool condition. Please use the table above as a reference starting point.
Note 5) For hardened steel over 55 HRC, use VF2XLB.
Note 6) For cutting conditions for austenitic stainless steel and titanium alloy, use the high hardness steel (45-55 HRC) table but reduce the spindle speed by 40% and the feed rate by 55%.

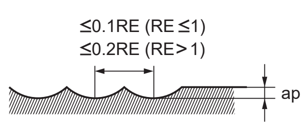
MP2XLB

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

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Carbon steel, Alloy steel (180–280HB) Alloy tool steel, Pre-hardened steel, Precipitation hardening stainless steel			Hardened steel (45—55HRC)			Copper, Copper alloy		
RE (mm)	LU (mm)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
1.25	**10**	36000	236.2	.0047	29000	149.6	.0047	29000	149.6	.0094
	15	32000	177.2	.0039	26000	114.2	.0039	26000	114.2	.0079
	20	26000	126.0	.0028	21000	78.7	.0028	21000	78.7	.0055
	25	12000	55.1	.0024	8000	28.3	.0024	8000	28.3	.0047
	30	8000	35.4	.0016	8000	27.6	.0016	8000	27.6	.0031
	35	8000	31.5	.0008	8000	25.2	.0008	8000	20.1	.0016
1.5	**6**	32000	275.6	.0059	26000	177.2	.0059	22000	149.6	.0118
	10	32000	275.6	.0059	26000	177.2	.0059	22000	149.6	.0118
	16	32000	196.9	.0039	26000	126.0	.0039	22000	106.3	.0079
	20	27000	149.6	.0039	22000	94.5	.0039	22000	94.5	.0079
	25	21000	106.3	.0031	17000	66.9	.0031	17000	66.9	.0063
	30	10000	27.6	.0031	6000	22.0	.0031	6000	22.0	.0063
	35	6000	27.6	.0024	6000	22.0	.0024	6000	22.0	.0047
	40	6000	23.6	.0016	6000	18.9	.0016	6000	18.9	.0031
1.75	**15**	27500	173.2	.0051	22000	110.2	.0051	18000	90.6	.0102
	25	23000	141.7	.0039	18000	86.6	.0039	18000	86.6	.0079
	35	10000	55.1	.0031	10000	43.3	.0031	10000	43.3	.0063
	45	7500	35.4	.0016	7500	28.3	.0016	7500	28.3	.0031
2	**10**	24000	236.2	.0079	19000	149.6	.0079	16000	126.0	.0157
	20	24000	149.6	.0059	19000	94.5	.0059	16000	78.7	.0118
	30	20000	118.1	.0039	16000	74.8	.0039	16000	74.8	.0079
	40	12000	66.9	.0039	12000	55.1	.0039	12000	55.1	.0079
	50	8000	39.4	.0020	8000	31.5	.0020	8000	31.5	.0039
2.5	**20**	22000	236.2	.0079	18000	149.6	.0079	13000	110.2	.0157
	25	22000	173.2	.0079	18000	110.2	.0079	13000	78.7	.0157
	30	22000	149.6	.0059	18000	94.5	.0059	13000	66.9	.0118
	40	22000	141.7	.0039	18000	90.6	.0039	13000	63.0	.0079
3	**20**	20000	236.2	.0079	16000	149.6	.0079	11000	102.4	.0157
	30	20000	236.2	.0079	16000	149.6	.0079	11000	102.4	.0157
	40	20000	177.2	.0059	16000	110.2	.0059	11000	78.7	.0118
	50	20000	118.1	.0059	16000	74.8	.0059	11000	51.2	.0118

Depth of cut



RE : Radius

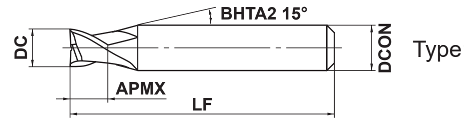
Note 1) When the inclination angle of machined surface is high, or when machining at high loads; such as in corners, reduce the revolution and feed rate.
Note 2) The use of oil mist is recommended when machining with small diameter.
Note 3) The revolution and feed rate can be increased at small depths of cut (ap).
Note 4) Cutting conditions may differ considerably due to the overhang, depth of cut and machine tool condition. Please use the table above as a reference starting point.
Note 5) For hardened steel over 55 HRC, use VF2XLB.
Note 6) For cutting conditions for austenitic stainless steel and titanium alloy, use the high hardness steel (45-55 HRC) table but reduce the spindle speed by 40% and the feed rate by 55%.

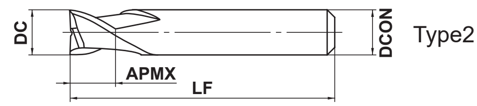
MP2ES NEW

End mill, 2 flute, For Swiss-Type lathe

UWC MS+ 30° DC<6 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	Aluminum Alloy
◎	◎	○		○	○	○	





3≤DC≤10				
- 0.010 - 0.030				
4≤DCON≤6	7≤DCON≤10			
0 - 0.008	0 - 0.009			

h6

● 2 flute end mill.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP2ESD0300S04	3	4.5	50	4	2	●	1
MP2ESD0400S04	4	6	50	4	2	●	2
MP2ESD0500S06	5	7.5	50	6	2	●	1
MP2ESD0600S06	6	9	50	6	2	★	2
MP2ESD0700S07	7	10.5	50	7	2	★	2
MP2ESD0800S08	8	12	50	8	2	★	2
MP2ESD1000S10	10	15	50	10	2	●	2

● : USA Stock ★ : Stocked in Japan

ISO13399 ➤ I002

MP2ES

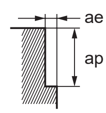
End mill, 2 flute, For Swiss-Type lathe

RECOMMENDED CUTTING CONDITIONS

Side Milling

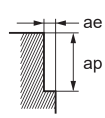
Workpiece Material		Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI No 35 B, AISI P20				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21				Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
3	**.118**	10000	23.6	.118	.024	7000	15.7	.118	.024	6000	11.8	.118	.024
4	**.157**	7500	23.6	.157	.024	5200	15.7	.157	.024	4500	11.8	.157	.024
5	**.197**	6000	23.6	.197	.024	4200	15.7	.197	.024	3600	11.8	.197	.024
6	**.236**	5000	23.6	.236	.024	3500	15.7	.236	.024	3000	11.8	.236	.024
7	**.276**	4500	22.0	.276	.024	3200	14.2	.276	.024	2700	11.0	.276	.024
8	**.315**	4000	20.5	.315	.024	2800	13.8	.315	.024	2400	10.2	.315	.024
10	**.394**	3200	17.7	.394	.024	2200	11.8	.394	.024	1900	9.1	.394	.024

Depth of Cut



Workpiece Material		Hardened steel (45−55HRC) AISI H13				Copper, Copper Alloy			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
3	**.118**	5000	4.7	.118	.008	13000	30.7	.118	.024
4	**.157**	4000	4.7	.157	.008	9500	29.9	.157	.024
5	**.197**	3200	4.7	.197	.008	7600	29.9	.197	.024
6	**.236**	2700	4.7	.236	.008	6400	30.3	.236	.024
7	**.276**	2300	4.3	.276	.008	5500	26.8	.276	.024
8	**.315**	2000	4.3	.315	.008	4800	24.4	.315	.024
10	**.394**	1600	3.9	.394	.008	3800	20.9	.394	.024

Depth of Cut

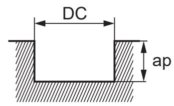


Note 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below the values above.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

■ Slotting

Workpiece 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			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
3	**.118**	10000	23.6	.024	7000	15.7	.024	6000	11.8	.024
4	**.157**	7500	23.6	.024	5200	15.7	.024	4500	11.8	.024
5	**.197**	6000	23.6	.024	4200	15.7	.024	3600	11.8	.024
6	**.236**	5000	23.6	.024	3500	15.7	.024	3000	11.8	.024
7	**.276**	4500	22.0	.024	3200	14.2	.024	2700	11.0	.024
8	**.315**	4000	20.5	.024	2800	13.8	.024	2400	10.2	.024
10	**.394**	3200	17.7	.024	2200	11.8	.024	1900	9.1	.024

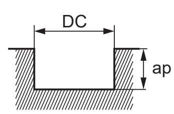
Depth of Cut



DC:Dia.

Workpiece Material		Hardened steel (45−55HRC) AISI H13			Copper, Copper Alloy		
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
3	**.118**	5000	4.7	.008	13000	30.7	.024
4	**.157**	4000	4.7	.008	9500	29.9	.024
5	**.197**	3200	4.7	.008	7600	29.9	.024
6	**.236**	2700	4.7	.008	6400	30.3	.024
7	**.276**	2300	4.3	.008	5500	26.8	.024
8	**.315**	2000	4.3	.008	4800	24.4	.024
10	**.394**	1600	3.9	.008	3800	20.9	.024

Depth of Cut



DC:Dia.

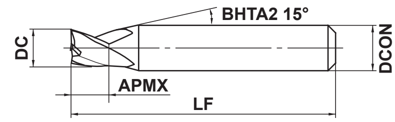
Note 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below the values above.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

MP3ES NEW

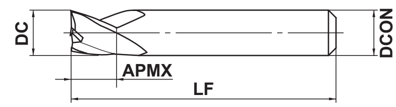
End mill, 3 flute, For Swiss-Type lathe

30° DC<6

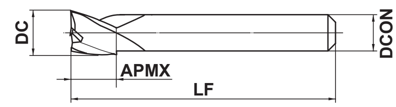
Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
◎	◎	○		○	○	○	



Type1



Type2



Type3

3≤DC≤12				
- 0.010 - 0.030				
4≤DCON≤6	7≤DCON≤10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

●3 flute end mill.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP3ESD0300S04	3	4.5	50	4	3	●	1
MP3ESD0400S04	4	6	50	4	3	★	2
MP3ESD0500S06	5	7.5	50	6	3	●	1
MP3ESD0600S06	6	9	50	6	3	★	2
MP3ESD0700S07	7	10.5	50	7	3	●	2
MP3ESD0800S08	8	12	50	8	3	★	2
MP3ESD0900S10	9	13.5	50	10	3	★	1
MP3ESD1000S10	10	15	50	10	3	●	2
MP3ESD1200S10	12	15	50	10	3	●	3
MP3ESD1200S12	12	15	50	12	3	★	2

● : USA Stock ★ : Stocked in Japan

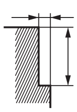
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side Milling

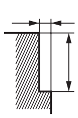
Workpiece Material		Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI No 35 B, AISI P20				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21				Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
3	**.118**	10000	28.3	.118	.024	7000	18.9	.118	.024	6000	14.2	.118	.024
4	**.157**	7500	28.3	.157	.024	5200	18.9	.157	.024	4500	14.2	.157	.024
5	**.197**	6000	28.3	.197	.024	4200	18.9	.197	.024	3600	14.2	.197	.024
6	**.236**	5000	28.3	.236	.024	3500	18.9	.236	.024	3000	14.2	.236	.024
7	**.276**	4500	26.4	.276	.024	3200	17.3	.276	.024	2700	13.4	.276	.024
8	**.315**	4000	24.4	.315	.024	2800	16.5	.315	.024	2400	12.2	.315	.024
9	**.354**	3500	22.8	.354	.024	2500	15.0	.354	.024	2100	11.4	.354	.024
10	**.394**	3200	21.3	.394	.024	2200	14.2	.394	.024	1900	11.0	.394	.024
12	**.472**	2700	19.3	.472	.024	1900	12.6	.472	.024	1600	9.8	.472	.024

Depth of Cut



Workpiece Material		Hardened steel (45−55HRC) AISI H13				Copper, Copper Alloy			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
3	**.118**	5000	5.5	.118	.008	13000	37.0	.118	.024
4	**.157**	4000	5.5	.157	.008	9500	35.8	.157	.024
5	**.197**	3200	5.5	.197	.008	7600	35.8	.197	.024
6	**.236**	2700	5.5	.236	.008	6400	36.2	.236	.024
7	**.276**	2300	5.1	.276	.008	5500	32.3	.276	.024
8	**.315**	2000	5.1	.315	.008	4800	29.1	.315	.024
9	**.354**	1800	5.1	.354	.008	4200	27.6	.354	.024
10	**.394**	1600	4.7	.394	.008	3800	25.2	.394	.024
12	**.472**	1300	4.7	.472	.008	3200	22.8	.472	.024

Depth of Cut



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

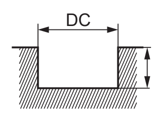
MP3ES

End mill, 3 flute, For Swiss-Type lathe

■Slotting

Workpiece 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			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
3	**.118**	10000	28.3	.024	7000	18.9	.024	6000	14.2	.024
4	**.157**	7500	28.3	.024	5200	18.9	.024	4500	14.2	.024
5	**.197**	6000	28.3	.024	4200	18.9	.024	3600	14.2	.024
6	**.236**	5000	28.3	.024	3500	18.9	.024	3000	14.2	.024
7	**.276**	4500	26.4	.024	3200	17.3	.024	2700	13.4	.024
8	**.315**	4000	24.4	.024	2800	16.5	.024	2400	12.2	.024
9	**.354**	3500	22.8	.024	2500	15.0	.024	2100	11.4	.024
10	**.394**	3200	21.3	.024	2200	14.2	.024	1900	11.0	.024
12	**.472**	2700	19.3	.024	1900	12.6	.024	1600	9.8	.024

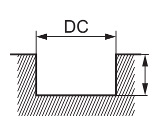
Depth of Cut



DC:Dia.

Workpiece Material		Hardened steel (45—55HRC) AISI H13			Copper, Copper Alloy		
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
3	**.118**	5000	5.5	.008	13000	37.0	.024
4	**.157**	4000	5.5	.008	9500	35.8	.024
5	**.197**	3200	5.5	.008	7600	35.8	.024
6	**.236**	2700	5.5	.008	6400	36.2	.024
7	**.276**	2300	5.1	.008	5500	32.3	.024
8	**.315**	2000	5.1	.008	4800	29.1	.024
9	**.354**	1800	5.1	.008	4200	27.6	.024
10	**.394**	1600	4.7	.008	3800	25.2	.024
12	**.472**	1300	4.7	.008	3200	22.8	.024

Depth of Cut



DC:Dia.

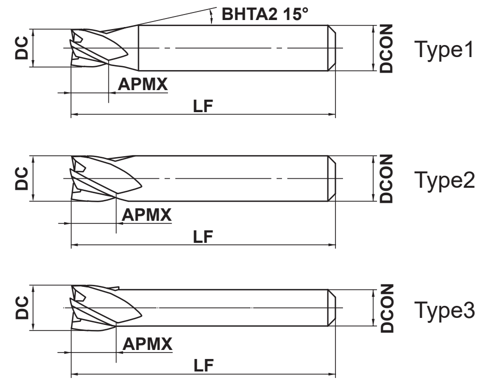
Note 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below the values above.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

MP4EC NEW

End mill, 4 flute, For Swiss-Type lathe

UWC MS+ 30° DC<6 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	Aluminum Alloy
◎	◎	○		○	○	○	



3≤DC≤12	DC=14			
-0.010 -0.030	-0.010 -0.040			
4≤DCON≤6	7≤DCON≤10	DCON=12		
0 -0.008	0 -0.009	0 -0.011		

●4 flute end mill.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
MP4ECD0300S04	3	4.5	50	4	4	●	1
MP4ECD0350S04	3.5	5	50	4	4	★	1
MP4ECD0400S04	4	6	50	4	4	●	2
MP4ECD0500S06	5	7.5	50	6	4	●	1
MP4ECD0600S06	6	9	50	6	4	●	2
MP4ECD0700S07	7	10.5	50	7	4	★	2
MP4ECD0800S07	8	12	50	7	4	★	3
MP4ECD0800S08	8	12	50	8	4	●	2
MP4ECD0900S10	9	13.5	50	10	4	●	1
MP4ECD1000S07	10	15	50	7	4	★	3
MP4ECD1000S10	10	15	50	10	4	●	2
MP4ECD1200S10	12	15	50	10	4	●	3
MP4ECD1200S12	12	15	50	12	4	★	2
MP4ECD1400S10	14	15	50	10	4	●	3

● : USA Stock ★ : Stocked in Japan

ISO13399 ➤ **I002**

MP4EC

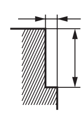
End mill, 4 flute, For Swiss-Type lathe

RECOMMENDED CUTTING CONDITIONS

■Side Milling

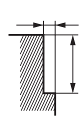
Workpiece Material		Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI No 35 B, AISI P20				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21				Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
3	**.118**	10000	35.4	.118	.024	7000	23.6	.118	.024	6000	17.7	.118	.024
3.5	**.138**	8500	35.4	.138	.024	6000	23.6	.138	.024	5100	17.7	.138	.024
4	**.157**	7500	35.4	.157	.024	5200	23.6	.157	.024	4500	17.7	.157	.024
5	**.197**	6000	35.4	.197	.024	4200	23.6	.197	.024	3600	17.7	.197	.024
6	**.236**	5000	35.4	.236	.024	3500	23.6	.236	.024	3000	17.7	.236	.024
7	**.276**	4500	33.1	.276	.024	3200	21.3	.276	.024	2700	16.5	.276	.024
8	**.315**	4000	30.7	.315	.024	2800	20.5	.315	.024	2400	15.4	.315	.024
9	**.354**	3500	28.3	.354	.024	2500	18.9	.354	.024	2100	14.2	.354	.024
10	**.394**	3200	26.8	.394	.024	2200	17.7	.394	.024	1900	13.4	.394	.024
12	**.472**	2700	24.4	.472	.024	1900	16.1	.472	.024	1600	12.2	.472	.024
14	**.551**	2300	21.7	.551	.024	1600	13.8	.551	.024	1400	11.0	.551	.024

Depth of Cut



Workpiece Material		Hardened steel (45−55HRC) AISI H13				Copper, Copper Alloy			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
3	**.118**	5000	7.1	.118	.008	13000	47.2	.118	.024
3.5	**.138**	4500	7.1	.138	.008	11000	47.2	.138	.024
4	**.157**	4000	7.1	.157	.008	9500	43.3	.157	.024
5	**.197**	3200	7.1	.197	.008	7600	43.3	.197	.024
6	**.236**	2700	7.1	.236	.008	6400	43.3	.236	.024
7	**.276**	2300	6.3	.276	.008	5500	39.4	.276	.024
8	**.315**	2000	6.3	.315	.008	4800	37.0	.315	.024
9	**.354**	1800	5.9	.354	.008	4200	33.9	.354	.024
10	**.394**	1600	5.5	.394	.008	3800	31.9	.394	.024
12	**.472**	1300	4.7	.472	.008	3200	28.7	.472	.024
14	**.551**	1200	4.7	.551	.008	2700	25.6	.551	.024

Depth of Cut

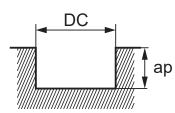


Note 1) When cutting austenitic stainless steels, the use of water-soluble cutting fluid is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) When drilling, please set the feed rate at 1/3 or below the values above.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

■Slotting

Workpiece 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			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
3	**.118**	10000	35.4	.024	7000	23.6	.024	6000	17.7	.024
3.5	**.138**	8500	35.4	.024	6000	23.6	.024	5100	17.7	.024
4	**.157**	7500	35.4	.024	5200	23.6	.024	4500	17.7	.024
5	**.197**	6000	35.4	.024	4200	23.6	.024	3600	17.7	.024
6	**.236**	5000	35.4	.024	3500	23.6	.024	3000	17.7	.024
7	**.276**	4500	33.1	.024	3200	21.3	.024	2700	16.5	.024
8	**.315**	4000	30.7	.024	2800	20.5	.024	2400	15.4	.024
9	**.354**	3500	28.3	.024	2500	18.9	.024	2100	14.2	.024
10	**.394**	3200	26.8	.024	2200	17.7	.024	1900	13.4	.024
12	**.472**	2700	24.4	.024	1900	16.1	.024	1600	12.2	.024
14	**.551**	2300	21.7	.024	1600	13.8	.024	1400	11.0	.024

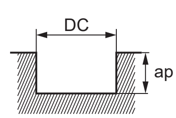
Depth of Cut



DC:Dia.

Workpiece Material		Hardened steel (45−55HRC) AISI H13			Copper, Copper Alloy		
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)
3	**.118**	5000	7.1	.008	13000	47.2	.024
3.5	**.138**	4500	7.1	.008	11000	47.2	.024
4	**.157**	4000	7.1	.008	9500	43.3	.024
5	**.197**	3200	7.1	.008	7600	43.3	.024
6	**.236**	2700	7.1	.008	6400	43.3	.024
7	**.276**	2300	6.3	.008	5500	39.4	.024
8	**.315**	2000	6.3	.008	4800	37.0	.024
9	**.354**	1800	5.9	.008	4200	33.9	.024
10	**.394**	1600	5.5	.008	3800	31.9	.024
12	**.472**	1300	4.7	.008	3200	28.7	.024
14	**.551**	1200	4.7	.008	2700	25.6	.024

Depth of Cut



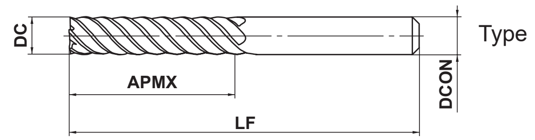
DC:Dia.

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) 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 workpiece material 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

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



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

● Ideal for tool steel and hardened materials machining

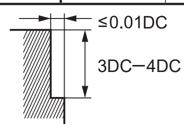
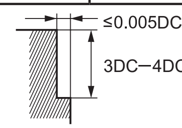
(mm)

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

★ : Stocked in Japan

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

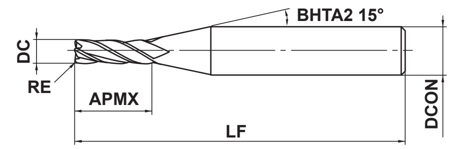
CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

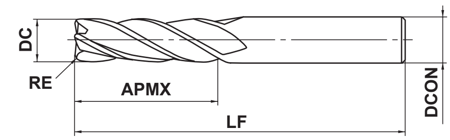
VC4JRB

Corner radius, Semi long cut length, 4 flute

UWC VC 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	Aluminum Alloy
○	◎	○		○	○		





	DC≤12	DC>12		
	0 - 0.020	0 - 0.030		
h6	DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

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

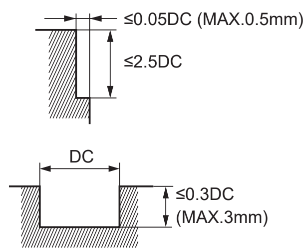
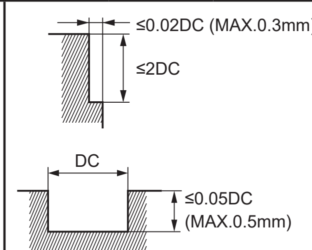
(mm)

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

★ : Stocked in Japan

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

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

DC : Dia.

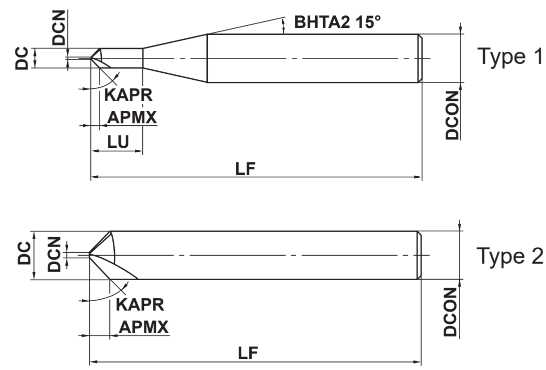
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) The above table shows cutting conditions for side milling. For slotting, please reduce the feed 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 steel.
Note 4) When drilling, please set the feed rate at 1/3 or below of the above value.
Note 5) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

VC2C

Chamfer cutter, 2 flute

UWC VC 5°

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



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

● 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

★ : Stocked in Japan

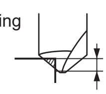
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

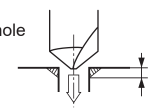
Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V etc.			Hardened steel (45−55HRC) AISI H13 etc.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

Depth of cut

Chamfering



Chamfering of hole



DC : Dia.

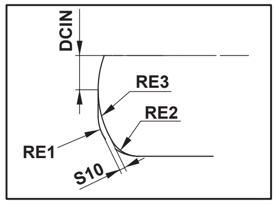
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

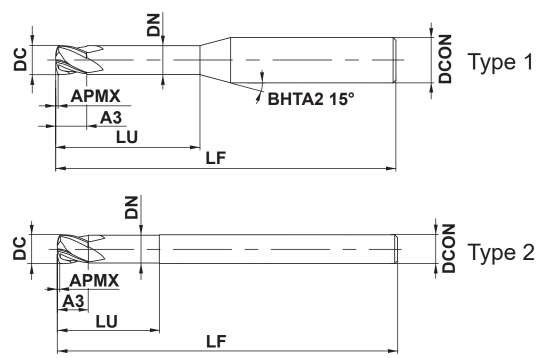
VQFDRB NEW

Duplex corner radius end mill for high speed cutting

UWC VQ 30°

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Precipitation Hardening Stainless Steel	Austenitic Stainless Steel	Cobalt Chrome Alloy, Heat Resistant Alloy	Titanium Alloy	Aluminum Alloy
			○		◎	○	





1≤DC≤4				
0 - 0.020				
DCON=6				
0 - 0.005				

h5

- Duplex corner radius type allows more efficient high feed.
- High feed cutting realized through use of multiple cuts.

(mm)

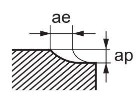
Order Number	DC	RE1 *1	APMX	A3 *3	LU	DN	LF	DCON	No. of Flutes	Multi-task radius part S10	DCIN	RE2	RE3	RMPX *2	Stock	Type
VQFDRBD0300N080	3	0.64	0.18	3	8	2.8	50	6	4	0.08	0.75	0.5	2	2.1°	●	1
VQFDRBD0300N120	3	0.64	0.18	3	12	2.8	55	6	4	0.08	0.75	0.5	2	2.1°	●	1
VQFDRBD0400N120	4	0.71	0.25	4	12	3.8	55	6	4	0.13	1.0	0.5	3	1.9°	●	1
VQFDRBD0400N160	4	0.71	0.25	4	16	3.8	60	6	4	0.13	1.0	0.5	3	1.9°	●	1
VQFDRBD0600N180	6	0.92	0.36	6	18	5.6	60	6	4	0.21	1.5	0.6	5	1.7°	●	2

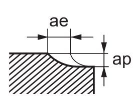
*1 RE1 : Approx. R
*2 RMPX : Max. Ramping Angle
*3 A3 : Cutting Edge Effective Length

CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Titanium Alloys Ti-6Al-4V ELI, ASTM F136, etc.					Cobalt Chromium Alloys Precipitation Hardening Stainless Steels ASTM F75:Casting, F1537:Wrought Bar, F799:Forgings, etc.				
DC											
(mm)	(inch)	Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Table Feed **vf** (IPM)	Depth of cut **ap** (inch)	Width of cut **ae** (inch)	Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Table Feed **vf** (IPM)	Depth of cut **ap** (inch)	Width of cut **ae** (inch)
3	**.118**	8500	260	82.7	.008	.051	6400	195	118.1	.008	.051
4	**.157**	6400	260	86.6	.008	.067	4800	195	106.3	.008	.067
6	**.236**	4200	260	55.1	.012	.079	3200	195	82.7	.012	.102
Depth of Cut											

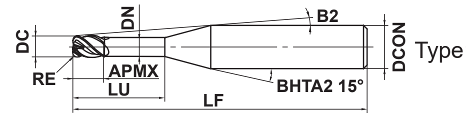
Workpiece Material		Heat Resistant Alloys Inconel 718 etc.				
DC						
(mm)	(inch)	Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Feed Rate **vf** (IPM)	Depth of cut **ap** (inch)	Width of cut **ae** (inch)
3	**.118**	3200	100	30.3	.008	.024
4	**.157**	2400	100	30.3	.008	.031
6	**.236**	1600	100	20.5	.012	.051
Depth of Cut						

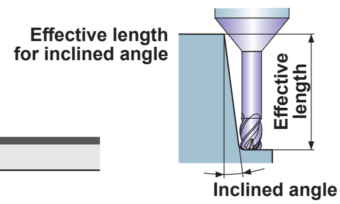
Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
Note 2) When cutting titanium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

VQHVRB NEW

Corner radius, 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)	Precipitation Hardening Stainless Steel	Austenitic Stainless Steel	Cobalt Chrome Alloy, Heat Resistant Alloy	Titanium Alloy	Aluminum Alloy
			○		◎	○	





0.1≤RE≤1			
±0.01			
1≤DC≤4			
0 - 0.02			
DCON=6			
0 - 0.005			

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

(mm)

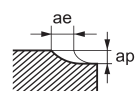
Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type
VQHVRBD0100R01N080	1	0.1	1	8	0.94	8.2°	50	6	4	●	1
VQHVRBD0100R01N120	1	0.1	1	12	0.94	6.7°	55	6	4	●	1
VQHVRBD0200R02N120	2	0.2	2	12	1.9	5.9°	55	6	4	●	1
VQHVRBD0200R02N160	2	0.2	2	16	1.9	4.9°	60	6	4	●	1
VQHVRBD0300R05N100	3	0.5	3	10	2.9	5.6°	55	6	4	●	1
VQHVRBD0300R05N180	3	0.5	3	18	2.9	3.7°	60	6	4	●	1
VQHVRBD0400R10N120	4	1.0	4	12	3.9	3.9°	55	6	4	●	1
VQHVRBD0400R10N200	4	1.0	4	20	3.9	2.5°	60	6	4	●	1

● : USA Stock

ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material				Titanium Alloys Ti-6Al-4V ELI, ASTM F136, etc.					Cobalt Chromium Alloys Precipitation Hardening Stainless Steels ASTM F75:Casting, F1537:Wrought Bar, F799:Forgings, etc.				
DC		LU		Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Table Feed **vf** (IPM)	Depth of cut **ap** (inch)	Width of cut **ae** (inch)	Revolution **n** (min^{-1})	Cutting Speed **vc** (SFM)	Table Feed **vf** (IPM)	Depth of cut **ap** (inch)	Width of cut **ae** (inch)
(mm)	(inch)	(mm)	(inch)										
1	**.039**	**8**	**.315**	2500	25	19.7	.001	.004	2500	25	19.7	.001	.004
1	**.039**	**12**	**.472**	2500	25	13.8	.001	.004	2500	25	13.8	.001	.004
2	**.079**	**12**	**.472**	4800	100	23.6	.003	.012	4800	100	23.6	.003	.012
2	**.079**	**16**	**.630**	4800	100	13.4	.003	.012	4800	100	13.8	.003	.012
3	**.118**	**10**	**.394**	8500	260	94.5	.007	.051	6400	195	86.6	.007	.051
3	**.118**	**18**	**.709**	8500	260	78.7	.007	.051	6400	195	63.0	.007	.051
4	**.157**	**12**	**.472**	6400	260	78.7	.010	.067	4800	195	70.9	.009	.067
4	**.157**	**20**	**.787**	6400	260	78.7	.010	.067	4800	195	70.9	.009	.067
Depth of Cut													

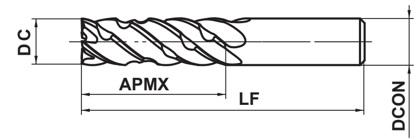
Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
Note 2) When cutting titanium alloys, the use of water-soluble cutting fluid is effective.
Note 3) If the depth of cut is smaller, the revolution and the feed rate can be increased.
Note 4) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abnormal sound can occur.
In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.

VQJCS NEW

End mill, Semi long cut length, 5 flute, Irregular pitch flutes, Chip breaker

UWC VQ 40°

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



Type1

DC≤12	DC>12			
0 - 0.030	0 - 0.040			
DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

h6

- Chip breaker type end mill for efficient chip breaking capabilities that also provides good surface finishes.
- A high rigidity Smart Miracle vibration damping end mill for high efficiency trochoidal milling.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQJCSD0600	6	18	70	6	5	●	1
VQJCSD0800	8	24	80	8	5	●	1
VQJCSD1000	10	30	90	10	5	●	1
VQJCSD1200	12	36	100	12	5	●	1
VQJCSD1600	16	48	110	16	5	●	1
VQJCSD2000	20	60	125	20	5	●	1

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

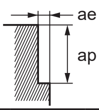
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Side milling

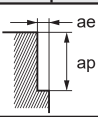
Workpiece Material		Carbon Steel, Alloy Steel, Mild Steel				Pre-hardened Steel, Carbon Steel, Alloy Steel, Alloy Tool Steel				Austenitic, Ferritic and Martensitic Stainless Steels, Titanium Alloys				Hardened Stainless Steels, Cobalt Chromium Alloys			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap (inch)	Width of Cut ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap (inch)	Width of Cut ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap (inch)	Width of Cut ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap (inch)	Width of Cut ae (inch)
6	**.236**	10600	70.9	.709	.035	9500	59.1	.709	.035	6400	39.4	.709	.018	5300	31.5	.709	.018
8	**.315**	8000	70.9	.945	.047	7200	59.1	.945	.047	4800	39.4	.945	.024	4000	31.5	.945	.024
10	**.394**	6400	66.9	1.181	.059	5700	55.1	1.181	.059	3800	35.4	1.181	.030	3200	31.5	1.181	.030
12	**.472**	5300	66.9	1.417	.071	4800	55.1	1.417	.071	3200	31.5	1.417	.035	2700	27.6	1.417	.035
16	**.630**	4000	55.1	1.890	.094	3600	47.2	1.890	.094	2400	27.6	1.890	.047	2000	23.6	1.890	.047
20	**.787**	3200	47.2	2.362	.118	2900	39.4	2.362	.118	1900	23.6	2.362	.059	1600	19.7	2.362	.059

Depth of Cut



Workpiece Material		Copper, Copper Alloys				Heat Resistant Alloys			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap (inch)	Width of Cut ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap (inch)	Width of Cut ae (inch)
6	**.236**	11700	82.7	.709	.035	2100	7.9	.709	.007
8	**.315**	8800	82.7	.945	.047	1600	7.9	.945	.009
10	**.394**	7000	70.9	1.181	.059	1300	7.9	1.181	.012
12	**.472**	5800	70.9	1.417	.071	1100	3.9	1.417	.014
16	**.630**	4400	59.1	1.890	.094	800	3.9	1.890	.019
20	**.787**	3500	55.1	2.362	.118	600	3.9	2.362	.024

Depth of Cut



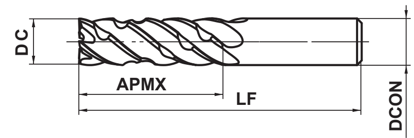
Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
Note 2) The irregular pitch flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abnormal sounds can occur. In that case, please adjust the revolution, feed rate and depth of cut.
Note 3) The revolution and feed rate can be increased with a smaller depth of cut.
Note 4) For stainless steel, titanium alloys and heat resistant alloys, the use of water-soluble coolant is effective.

VQLCS NEW

End mill, Long cut length, 5 flute, Irregular pitch flutes, Chip breaker

UWC VQ 40°

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



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

- Chip breaker type end mill for efficient chip breaking capabilities that also provides good surface finishes.
- A high rigidity Smart Miracle vibration damping end mill for high efficiency trochoidal milling.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQLCSD0600	6	24	70	6	5	●	1
VQLCSD0800	8	32	90	8	5	●	1
VQLCSD1000	10	40	100	10	5	●	1
VQLCSD1200	12	48	110	12	5	●	1

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

 ● : USA Stock

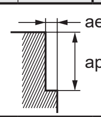
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

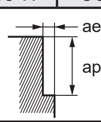
Workpiece Material		Carbon Steel, Alloy Steel, Mild Steel				Pre-hardened Steel, Carbon Steel, Alloy Steel, Alloy Tool Steel				Austenitic, Ferritic and Martensitic Stainless Steels, Titanium Alloys				Hardened Stainless Steels, Cobalt Chromium Alloys			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap(inch)	Width of Cut ae(inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap(inch)	Width of Cut ae(inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap(inch)	Width of Cut ae(inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap(inch)	Width of Cut ae(inch)
6	**.236**	9500	63.0	.945	.024	8500	47.2	.945	.024	5300	31.5	.945	.012	4800	27.6	.945	.012
8	**.315**	7200	63.0	1.260	.031	6400	51.2	1.260	.031	4000	31.5	1.260	.016	3600	27.6	1.260	.016
10	**.394**	5700	59.1	1.575	.039	5100	47.2	1.575	.039	3200	27.6	1.575	.020	2900	27.6	1.575	.020
12	**.472**	4800	59.1	1.890	.047	4200	47.2	1.890	.047	2700	27.6	1.890	.024	2400	23.6	1.890	.024

Depth of Cut



Workpiece Material		Copper, Copper Alloys				Heat Resistant Alloys			
DC (mm)	DC (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap(inch)	Width of Cut ae(inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of cut ap(inch)	Width of Cut ae(inch)
6	**.236**	10600	70.9	.945	.024	1600	3.9	.945	.005
8	**.315**	8000	70.9	1.260	.031	1200	3.9	1.260	.006
10	**.394**	6400	63.0	1.575	.039	1000	3.9	1.575	.008
12	**.472**	5300	63.0	1.890	.047	800	3.9	1.890	.009

Depth of Cut

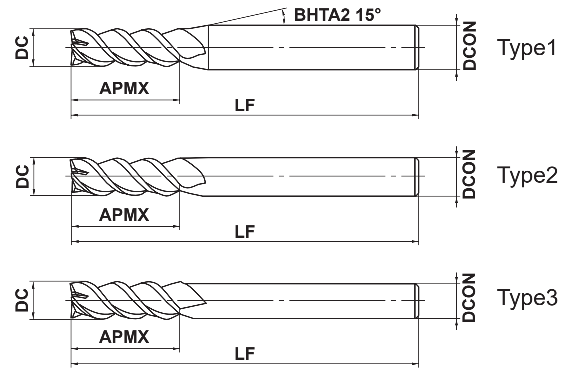


Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an electrical contact type of tool setter may not work. When measuring the tool length, please use a mechanical contact type or a laser tool setter.
Note 2) The irregular pitch flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abnormal sounds can occur. In that case, please adjust the revolution, feed rate and depth of cut.
Note 3) The revolution and feed rate can be increased with a smaller depth of cut.
Note 4) For stainless steel, titanium alloys and heat resistant alloys, the use of water-soluble coolant is effective.

VQMHZV

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

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



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

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

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHZVD0100	1	2	45	4	3	●	1
VQMHZVD0110	1.1	2.2	45	4	3	●	1
VQMHZVD0120	1.2	2.4	45	4	3	●	1
VQMHZVD0130	1.3	2.6	45	4	3	●	1
VQMHZVD0140	1.4	2.8	45	4	3	●	1
VQMHZVD0150	1.5	3	45	4	3	●	1
VQMHZVD0160	1.6	3.2	45	4	3	●	1
VQMHZVD0170	1.7	3.4	45	4	3	●	1
VQMHZVD0180	1.8	3.6	45	4	3	●	1
VQMHZVD0190	1.9	3.8	45	4	3	●	1
VQMHZVD0200	2	4	50	6	3	●	1
VQMHZVD0210	2.1	4.2	50	6	3	●	1
VQMHZVD0220	2.2	4.4	50	6	3	●	1
VQMHZVD0230	2.3	4.6	50	6	3	●	1
VQMHZVD0240	2.4	4.8	50	6	3	●	1
VQMHZVD0250	2.5	5	50	6	3	●	1
VQMHZVD0260	2.6	5.2	50	6	3	●	1
VQMHZVD0270	2.7	5.4	50	6	3	●	1
VQMHZVD0280	2.8	5.6	50	6	3	●	1
VQMHZVD0290	2.9	5.8	50	6	3	●	1
VQMHZVD0300	3	6	50	6	3	●	1
VQMHZVD0310	3.1	7	50	6	3	●	1
VQMHZVD0320	3.2	7	50	6	3	●	1
VQMHZVD0330	3.3	7	50	6	3	●	1
VQMHZVD0340	3.4	7	50	6	3	●	1
VQMHZVD0350	3.5	8	50	6	3	●	1
VQMHZVD0360	3.6	8	50	6	3	●	1
VQMHZVD0370	3.7	8	50	6	3	●	1
VQMHZVD0380	3.8	8	50	6	3	●	1
VQMHZVD0390	3.9	8	50	6	3	●	1

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

● : USA Stock ★ : Stocked in Japan

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHZVD0400	4	8	50	6	3	●	1
VQMHZVD0450	4.5	10	50	6	3	●	1
VQMHZVD0500	5	10	50	6	3	●	1
VQMHZVD0550	5.5	13	50	6	3	●	1
VQMHZVD0600	6	13	60	6	3	●	2
VQMHZVD0650	6.5	16	60	8	3	●	1
VQMHZVD0700	7	16	60	8	3	●	1
VQMHZVD0750	7.5	16	60	8	3	●	1
VQMHZVD0800	8	19	70	8	3	●	2
VQMHZVD0850	8.5	19	70	10	3	●	1
VQMHZVD0900	9	19	70	10	3	●	1
VQMHZVD0950	9.5	19	70	10	3	●	1
VQMHZVD1000	10	22	80	10	3	●	2
VQMHZVD1100	11	22	80	12	3	●	1
VQMHZVD1200	12	26	90	12	3	●	2
VQMHZVD1300	13	26	90	12	3	★	3
VQMHZVD1400	14	26	90	12	3	★	3
VQMHZVD1500	15	26	110	16	3	★	1
VQMHZVD1600	16	30	110	16	3	★	2
VQMHZVD2000	20	32	140	20	3	★	2

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

VQMHZV

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

RECOMMENDED CUTTING CONDITIONS

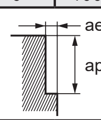
■Side milling

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

High efficiency cutting conditions

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

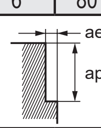
Depth of cut



General purpose cutting conditions

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

Depth of cut

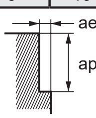


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

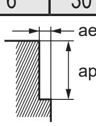
Side milling

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

High efficiency cutting conditions

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

General purpose cutting conditions

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

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

VQMHZV

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

RECOMMENDED CUTTING CONDITIONS

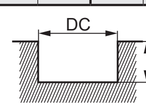
■Slotting

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

High efficiency cutting conditions

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

Depth of cut

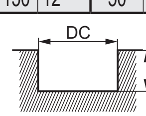


DC:Dia.

General purpose cutting conditions

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

Depth of cut



DC:Dia.

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

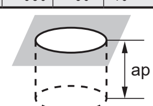
Plunging

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

High efficiency cutting conditions

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

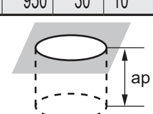
Depth of cut



General purpose cutting conditions

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

Depth of cut

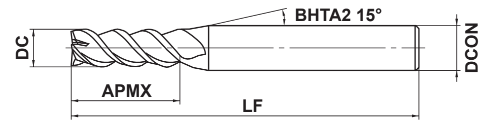


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

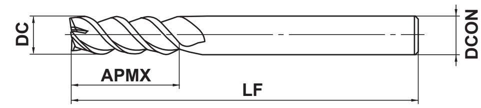
VQMHZV - Inch sizes

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

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



Type1



Type2

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

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

(inch)

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

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

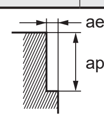
● : USA Stock
ISO13399
➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

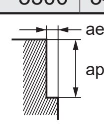
Workpiece Material	Carbon steel (—30HRC) AISI 1035, AISI 1050, ASTM 283						Alloy steel, Pre-hardened steel AISI H13, AISI 4140, AISI P21						Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.					
DC (inch)	High speed cutting		General purpose cutting		Depth of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

Depth of cut



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

Depth of cut



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

VQMHZV – Inch sizes

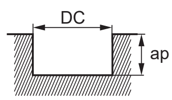
End mill, Medium cut length, 3 flute for drilling and slotting

RECOMMENDED CUTTING CONDITIONS

■Slotting

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

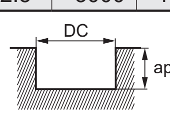
Depth of cut



DC : Dia.

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

Depth of cut



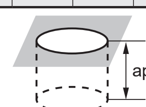
DC : Dia.

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

Drilling

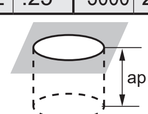
Workpiece Material	Carbon steel (−30HRC) AISI 1035, AISI 1050, ASTM 283							Alloy steel, Pre-hardened steel AISI H13, AISI 4140, AISI P21							Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.						
DC (inch)	High speed cutting			General purpose cutting			Hole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

Hole depth



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

Hole depth

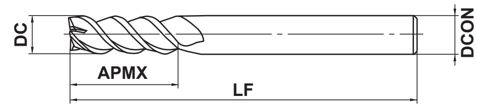


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQMHZVOH

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

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



Type1

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 peformance in slotting and pocketing with oil supply from the end cutting edge.

(mm)

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

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

RECOMMENDED CUTTING CONDITIONS

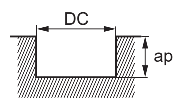
■ Slotting

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

High efficiency conditions

Workpiece Material	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 steel, Titanium alloy AISI 304, AISI 316, Ti-6Al-4V				Hardened stainless steel, Cobalt chromium alloy AISI 630, AISI 631 15-5PH, 17-4PH				Copper, Copper alloy				Heat resistant alloy Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)
6	150	8000	1400	6	120	6400	770	6	100	5300	560	6	60	3200	380	3	180	9500	1700	6	30	1600	130	1.8
8	150	6000	1300	8	120	4800	720	8	100	4000	600	8	60	2400	360	4	180	7200	1500	8	30	1200	140	2.4
10	150	4800	1200	10	120	3800	630	10	100	3200	670	10	60	1900	310	5	180	5700	1400	10	30	950	160	3
12	150	4000	960	12	120	3200	580	12	100	2700	650	12	60	1600	290	6	180	4800	1200	12	30	800	150	3.6
16	150	3000	810	12	120	2400	500	12	100	2000	480	12	60	1200	250	8	180	3600	970	12	30	600	120	4.8

Depth of cut

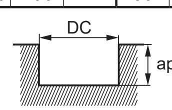


DC : Dia.

General-purpose conditions

Workpiece Material	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 steel, Titanium alloy AISI 304, AISI 316, Ti-6Al-4V				Hardened stainless steel, Cobalt chromium alloy AISI 630, AISI 631 15-5PH, 17-4PH				Copper, Copper alloy				Heat resistant alloy Inconel718			
DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)
6	100	5300	630	6	80	4200	330	6	60	3200	220	6	50	2700	210	3	120	6400	760	6	25	1300	72	1.8
8	100	4000	550	8	80	3200	320	8	60	2400	240	8	50	2000	200	4	120	4800	670	8	25	990	78	2.4
10	100	3200	510	10	80	2500	270	10	60	1900	260	10	50	1600	170	5	120	3800	600	10	25	800	89	3
12	100	2700	430	12	80	2100	250	12	60	1600	250	12	50	1300	150	6	120	3200	510	12	25	660	84	3.6
16	100	2000	360	12	80	1600	220	12	60	1200	190	12	50	990	140	8	120	2400	430	12	25	500	63	4.8

Depth of cut



DC : Dia.

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

VQMHZVOH

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

RECOMMENDED CUTTING CONDITIONS

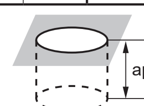
■Plunging

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

High efficiency conditions

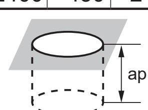
Workpiece Material	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340, SKD, SKT					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy AISI 304, AISI 316, Ti-6Al-4V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

Depth of cut



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

Depth of cut



Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.
Note 2) Effective cutting of stainless steel, titanium alloy and heat resistant alloy etc. can be achieved with the use of emulsion.
Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient.
In these cases the feed and speed should be reduced proportionately.

General-purpose conditions

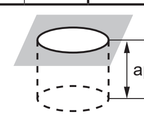
Workpiece Material	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table Feed (mm/min)	Hole Depth ap (mm)	Step (mm)
6	100	5300	950	9	0.6
8	100	4000	720	12	0.7
10	100	3200	580	15	0.75
12	100	2700	490	18	0.75
16	100	2000	360	24	0.75

Workpiece Material	Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340, SKD, SKT				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table Feed (mm/min)	Hole Depth ap (mm)	Step (mm)
6	70	3700	440	9	0.6
8	70	2800	340	12	0.7
10	70	2200	260	15	0.75
12	70	1900	230	18	0.75
16	70	1400	170	24	0.75

Workpiece Material	Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy AISI 304, AISI 316, Ti-6Al-4V				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table Feed (mm/min)	Hole Depth ap (mm)	Step (mm)
6	60	3200	100	6	0.3
8	60	2400	70	8	0.3
10	60	1900	60	10	0.3
12	60	1600	50	12	0.3
16	60	1200	40	16	0.3

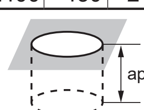
Workpiece Material	Hardened stainless steel, Cobalt chromium alloy AISI 630, AISI 631 15-5PH, 17-4PH				
Dia. DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table Feed (mm/min)	Hole Depth ap (mm)	Step (mm)
6	40	2100	60	6	0.3
8	40	1600	50	8	0.3
10	40	1300	40	10	0.3
12	40	1100	30	12	0.3
16	40	800	20	16	0.3

Depth of cut



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

Depth of cut

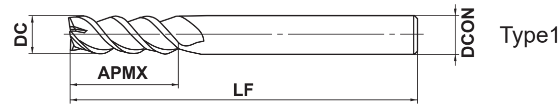


Note 1) SMART MIRACLE Coating is not energized because of its nature. Therefore, an external contact (voltaic type) tool setter cannot be used. An internal contact (non-voltaic) type or laser type tool setter is recommended to measure the length of the tool.
Note 2) Effective cutting of stainless steel, titanium alloy and heat resistant alloy etc. can be achieved with the use of emulsion.
Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient.
In these cases the feed and speed should be reduced proportionately.

VQMHZVOH –Inch sizes

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

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



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

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

(inch)

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

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

SQUARE BALL RADIUS TAPER BARREL ROUGHING CHAMFER
I
SOLID END MILLS

● : USA Stock

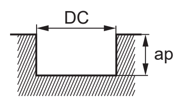
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Slotting

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

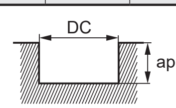
Depth of cut



DC : Dia.

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

Depth of cut



DC : Dia.

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

VQMHZVOH –Inch sizes

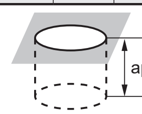
End mill, Medium cut length, 3 flute for drilling and slotting with thru-coolant

RECOMMENDED CUTTING CONDITIONS

Plunging

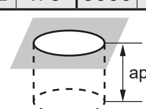
Workpiece Material	Carbon steel (—30HRC) AISI 1035, AISI 1050, ASTM 283							Alloy steel, Pre-hardened steel AISI H13, AISI 4140, AISI P21							Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.						
DC (inch)	High speed cutting			General purpose cutting			Hole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

Hole depth



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

Hole depth



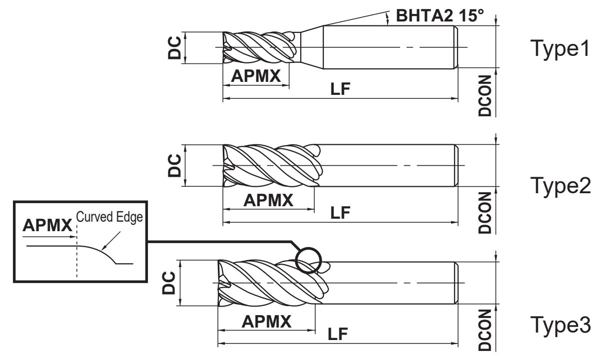
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQMHV

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

37°
40°

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



	DC≤12	DC>12		
	0 - 0.020	0 - 0.030		
h6	4≤DCON≤6	8≤DCON≤10	12≤DCON≤16	20≤DCON≤25
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

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

(mm)

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

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

● : USA Stock ★ : Stocked in Japan

VQMHV

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

RECOMMENDED CUTTING CONDITIONS

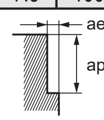
■Side milling

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

High efficiency conditions

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

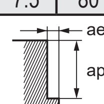
Depth of cut



General-purpose conditions

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

Depth of cut

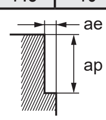


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

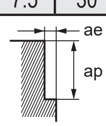
Side milling

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

High efficiency conditions

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

General-purpose conditions

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

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

VQMHV

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

RECOMMENDED CUTTING CONDITIONS

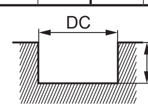
■Slotting

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

High efficiency conditions

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

Depth of cut

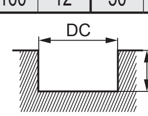


DC : Dia.

General-purpose conditions

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

Depth of cut



DC : Dia.

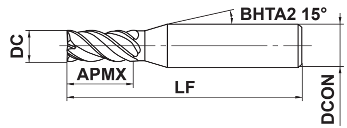
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQMHV - Inch sizes

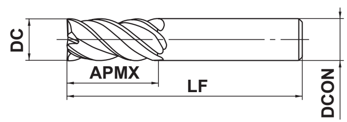
End mill, Medium cut length, 4 flute, Irregular helix flutes

37°
40°

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



Type1



Type2

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

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

(inch)

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

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

VQMHV – Inch sizes

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

RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material: Carbon steel (–30HRC) — AISI 1035, AISI 1050, ASTM 283

DC (inch)	High speed cutting Revolution (min^{-1})	High speed cutting Table feed (IPM)	General purpose cutting Revolution (min^{-1})	General purpose cutting Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/8	15000	102.0	12000	55.1	.19	.038
3/16	10000	99.2	8000	51.2	.28	.056
1/4	7500	99.2	6000	51.2	.38	.075
5/16	6000	99.2	4800	51.2	.47	.094
3/8	5000	90.6	4000	47.2	.56	.11
1/2	3800	74.8	3000	39.0	.75	.15

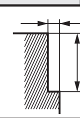
Workpiece Material: Alloy steel, Pre-hardened steel — AISI H13, AISI 4140, AISI P21

DC (inch)	High speed cutting Revolution (min^{-1})	High speed cutting Table feed (IPM)	General purpose cutting Revolution (min^{-1})	General purpose cutting Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/8	12000	49.1	10000	27.2	.19	.038
3/16	8000	50.4	6700	28.0	.28	.056
1/4	6000	52.0	5000	28.7	.38	.075
5/16	4800	52.9	4000	29.1	.47	.094
3/8	4000	49.1	3300	26.8	.56	.11
1/2	3000	43.5	2500	24.0	.75	.15

Workpiece Material: Austenitic stainless steel, Titanium alloy — AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.

DC (inch)	High speed cutting Revolution (min^{-1})	High speed cutting Table feed (IPM)	General purpose cutting Revolution (min^{-1})	General purpose cutting Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/8	10000	34.6	8000	18.1	.19	.038
3/16	6700	35.3	5300	18.5	.28	.056
1/4	5000	47.2	4000	24.8	.38	.075
5/16	4000	47.2	3200	24.8	.47	.094
3/8	3300	49.4	2700	26.8	.56	.11
1/2	2500	43.3	2000	22.8	.75	.15

Depth of cut



Workpiece Material: Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy — ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.

DC (inch)	High speed cutting Revolution (min^{-1})	High speed cutting Table feed (IPM)	General purpose cutting Revolution (min^{-1})	General purpose cutting Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/8	7500	30.7	7000	18.9	.19	.025
3/16	5000	31.5	4700	19.7	.28	.038
1/4	3800	32.9	3500	20.1	.38	.050
5/16	3000	33.1	2800	20.5	.47	.063
3/8	2500	30.7	2300	18.5	.56	.075
1/2	1900	27.5	1800	17.3	.75	.10

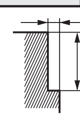
Workpiece Material: Copper, Copper alloy

DC (inch)	High speed cutting Revolution (min^{-1})	High speed cutting Table feed (IPM)	General purpose cutting Revolution (min^{-1})	General purpose cutting Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/8	18000	122.0	14000	63.0	.19	.038
3/16	12000	119.0	9400	63.0	.28	.056
1/4	9000	119.0	7000	63.0	.38	.075
5/16	7200	119.0	5600	63.0	.47	.094
3/8	6000	109.0	4700	55.1	.56	.11
1/2	4500	88.6	3500	47.2	.75	.15

Workpiece Material: Heat resistant alloy — Inconel718 etc.

DC (inch)	High speed cutting Revolution (min^{-1})	High speed cutting Table feed (IPM)	General purpose cutting Revolution (min^{-1})	General purpose cutting Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
1/8	4000	9.5	3000	4.7	.19	.013
3/16	2700	9.8	2000	4.7	.28	.019
1/4	2000	10.1	1500	5.1	.38	.025
5/16	1600	10.1	1200	5.1	.47	.031
3/8	1300	10.6	1000	5.5	.56	.038
1/2	1000	10.1	750	5.1	.75	.050

Depth of cut

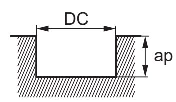


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

Slotting

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

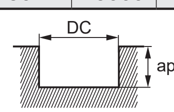
Depth of cut



DC : Dia.

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

Depth of cut



DC : Dia.

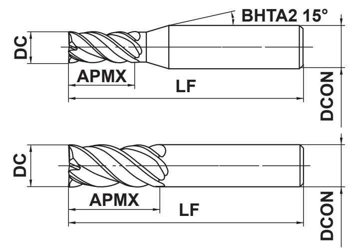
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQJHV

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

38° 40° DC≤6 · 37.5° 40° 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	Aluminum Alloy
◎	◎			◎	◎	○	



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

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

(mm)

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

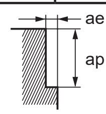
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.

RECOMMENDED CUTTING CONDITIONS

■Side milling

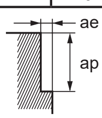
Workpiece Material	Carbon steel, Alloy steel, Mild steel AISI 1045, AISI 4140, ASTM A36, AISI 1010					Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI P21, AISI P20, AISI 4340					Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V	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

Depth of cut



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

Depth of cut



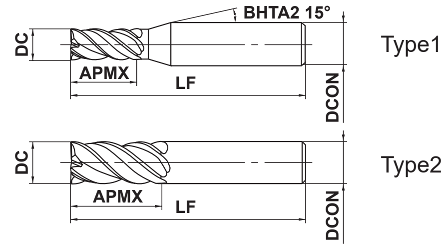
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQJHV - Inch sizes

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

38° 40° DC≦1/4 37.5° 40° DC>1/4

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	Aluminum Alloy
◎	◎			◎	◎	○	



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

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

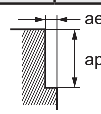
(inch)

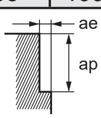
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VQJHVD1/8	.1250	.5000	2.5	.2500	4	●	1
VQJHVD3/16	.1875	.7500	2.5	.2500	4	●	1
VQJHVD1/4	.2500	1.0000	2.5	.2500	4	●	2
VQJHVD5/16	.3125	1.0900	3.25	.3125	4	●	2
VQJHVD3/8	.3750	1.3100	3.5	.3750	4	●	2
VQJHVD1/2	.5000	1.6500	4.0	.5000	4	●	2

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

RECOMMENDED CUTTING CONDITIONS

■ Side milling

Workpiece Material	Carbon steel, Alloy steel, Mild steel AISI 1035, AISI 1050, ASTM 283				Pre-hardened steel, Carbon steel, Alloy steel, Alloy tool steel AISI H13, AISI 4140, AISI P21				Austenitic, Ferritic and Martensitic stainless steel, Titanium alloy AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.				Hardened stainless steel, Cobalt chromium alloy ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.			
DC (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut ap (inch)	Depth of cut ae (inch)
1/8	13000	39	.313	.013	10000	26.8	.313	.013	8000	20.1	.313	.006	7500	18.9	.313	.006
3/16	8700	39.4	.469	.019	6700	27.6	.469	.019	5300	21.7	.469	.009	5000	20.5	.469	.009
1/4	6500	47.2	.625	.025	5000	32.3	.625	.025	4000	25.2	.625	.013	3800	24	.625	.013
5/16	5200	47.2	.781	.031	4000	33.5	.781	.031	3200	25.2	.781	.016	3000	23.6	.781	.016
3/8	4300	43.3	.938	.038	3300	31.9	.938	.038	2700	23.2	.938	.019	2500	22.4	.938	.019
1/2	3300	43.3	1.25	.05	2500	29.1	1.25	.05	2000	20.9	1.25	.025	1900	20.1	1.25	.025
Depth of cut	 ae ap															

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

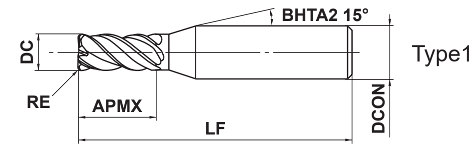
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

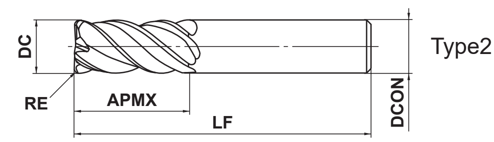
VQMHVRB

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

37°
40°

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





0.2≤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.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVRBD0200R020	2	0.2	4	45	4	4	●	1
VQMHVRBD0200R030	2	0.3	4	45	4	4	●	1
VQMHVRBD0300R020	3	0.2	8	45	6	4	●	1
VQMHVRBD0300R030	3	0.3	8	45	6	4	●	1
VQMHVRBD0300R050	3	0.5	8	45	6	4	●	1
VQMHVRBD0400R020	4	0.2	11	45	6	4	●	1
VQMHVRBD0400R030	4	0.3	11	45	6	4	●	1
VQMHVRBD0400R050	4	0.5	11	45	6	4	●	1
VQMHVRBD0500R020	5	0.2	13	50	6	4	●	1
VQMHVRBD0500R030	5	0.3	13	50	6	4	●	1
VQMHVRBD0500R050	5	0.5	13	50	6	4	●	1
VQMHVRBD0500R100	5	1	13	50	6	4	●	1
VQMHVRBD0600R030	6	0.3	13	50	6	4	●	2
VQMHVRBD0600R050	6	0.5	13	50	6	4	●	2
VQMHVRBD0600R100	6	1	13	50	6	4	●	2
VQMHVRBD0800R030	8	0.3	19	60	8	4	●	2
VQMHVRBD0800R050	8	0.5	19	60	8	4	●	2
VQMHVRBD0800R100	8	1	19	60	8	4	●	2
VQMHVRBD0800R150	8	1.5	19	60	8	4	●	2
VQMHVRBD1000R030	10	0.3	22	70	10	4	●	2
VQMHVRBD1000R050	10	0.5	22	70	10	4	●	2
VQMHVRBD1000R100	10	1	22	70	10	4	●	2
VQMHVRBD1000R150	10	1.5	22	70	10	4	●	2
VQMHVRBD1000R200	10	2	22	70	10	4	●	2
VQMHVRBD1200R050	12	0.5	26	75	12	4	●	2
VQMHVRBD1200R100	12	1	26	75	12	4	●	2
VQMHVRBD1200R150	12	1.5	26	75	12	4	●	2
VQMHVRBD1200R200	12	2	26	75	12	4	●	2
VQMHVRBD1200R250	12	2.5	26	75	12	4	●	2
VQMHVRBD1200R300	12	3	26	75	12	4	●	2

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

● : USA Stock ★ : Stocked in Japan

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVRBD1600R100	16	1	35	90	16	4	★	2
VQMHVRBD1600R150	16	1.5	35	90	16	4	★	2
VQMHVRBD1600R200	16	2	35	90	16	4	★	2
VQMHVRBD1600R250	16	2.5	35	90	16	4	★	2
VQMHVRBD1600R300	16	3	35	90	16	4	★	2
VQMHVRBD1600R400	16	4	35	90	16	4	★	2
VQMHVRBD1600R500	16	5	35	90	16	4	★	2
VQMHVRBD2000R100	20	1	45	110	20	4	★	2
VQMHVRBD2000R150	20	1.5	45	110	20	4	★	2
VQMHVRBD2000R200	20	2	45	110	20	4	★	2
VQMHVRBD2000R250	20	2.5	45	110	20	4	★	2
VQMHVRBD2000R300	20	3	45	110	20	4	★	2
VQMHVRBD2000R400	20	4	45	110	20	4	★	2
VQMHVRBD2000R500	20	5	45	110	20	4	★	2
VQMHVRBD2000R635	20	6.35	45	110	20	4	★	2

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

VQMHVRB

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

RECOMMENDED CUTTING CONDITIONS

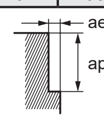
Side milling

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

High efficiency cutting conditions

Workpiece Material	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 steel, Titanium alloy AISI 304, AISI 316, Ti-6Al-4V					Hardened stainless steel, Cobalt chromium alloy AISI 630, AISI 631 15-5PH,17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
2	150	24000	2400	3	0.6	120	19000	1100	3	0.6	100	16000	830	3	0.6	75	12000	720	3	0.4
3	150	16000	2600	4.5	0.9	120	13000	1200	4.5	0.9	100	11000	880	4.5	0.9	75	8000	770	4.5	0.6
4	150	12000	2600	6	1.2	120	9500	1300	6	1.2	100	8000	900	6	1.2	75	6000	790	6	0.8
5	150	9500	2600	7.5	1.5	120	7600	1300	7.5	1.5	100	6400	900	7.5	1.5	75	4800	810	7.5	1
6	150	8000	2600	9	1.8	120	6400	1300	9	1.8	100	5300	1100	9	1.8	75	4000	810	9	1.2
8	150	6000	2500	12	2.4	120	4800	1300	12	2.4	100	4000	1200	12	2.4	75	3000	840	12	1.6
10	150	4800	2300	15	3	120	3800	1200	15	3	100	3200	1300	15	3	75	2400	770	15	2
12	150	4000	1900	18	3.6	120	3200	1200	18	3.6	100	2700	1200	18	3.6	75	2000	720	18	2.4
16	150	3000	1600	24	4.8	120	2400	960	24	4.8	100	2000	960	24	4.8	75	1500	600	24	3.2
20	150	2400	1300	30	6	120	1900	760	30	6	100	1600	770	30	6	75	1200	480	30	4

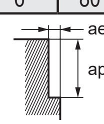
Depth of cut



General purpose cutting conditions

Workpiece Material	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 steel, Titanium alloy AISI 304, AISI 316, Ti-6Al-4V					Hardened stainless steel, Cobalt chromium alloy AISI 630, AISI 631 15-5PH,17-4PH				
DC (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Depth of cut ap (mm)	Width of cut ae (mm)
2	120	19000	1300	3	0.6	100	16000	630	3	0.6	80	13000	450	1.5	0.2	70	11000	440	3	0.4
3	120	13000	1400	4.5	0.9	100	11000	700	4.5	0.9	80	8500	450	2.2	0.3	70	7400	470	4.5	0.6
4	120	9500	1400	6	1.2	100	8000	700	6	1.2	80	6400	470	3	0.6	70	5600	490	6	0.8
5	120	7600	1400	7.5	1.5	100	6400	710	7.5	1.5	80	5100	470	4.5	0.9	70	4500	500	7.5	1
6	120	6400	1400	9	1.8	100	5300	710	9	1.8	80	4200	580	6	1.2	70	3700	500	9	1.2
8	120	4800	1300	12	2.4	100	4000	740	12	2.4	80	3200	630	7.5	1.5	70	2800	520	12	1.6
10	120	3800	1200	15	3	100	3200	680	15	3	80	2500	660	9	1.8	70	2200	460	15	2
12	120	3200	1000	18	3.6	100	2700	640	18	3.6	80	2100	610	12	2.4	70	1900	450	18	2.4
16	120	2400	860	24	4.8	100	2000	530	24	4.8	80	1600	510	15	3	70	1400	370	24	3.2
20	120	1900	680	30	6	100	1600	420	30	6	80	1300	410	18	3.6	70	1100	290	30	4

Depth of cut

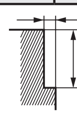


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

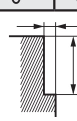
Side milling

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

High efficiency conditions

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

General-purpose conditions

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

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

VQMHVRB

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

RECOMMENDED CUTTING CONDITIONS

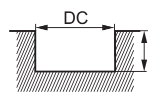
■Slotting

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

High efficiency conditions

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

Depth of cut

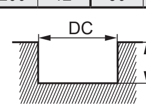


DC : Dia.

General-purpose conditions

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

Depth of cut



DC : Dia.

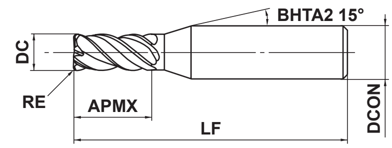
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQMHVRB – Inch sizes

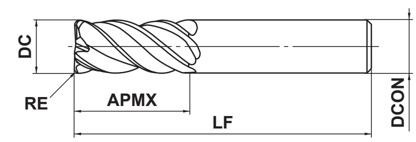
Corner radius, Medium cut length, 4 flute, Irregular helix flutes

37°
40°

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



Type1



Type2

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

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

(inch)

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

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

● : **USA Stock**

VQMHVRB – Inch sizes

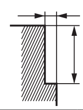
Corner radius, Medium cut length, 4 flute, Irregular helix flutes

RECOMMENDED CUTTING CONDITIONS

Side milling

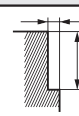
Workpiece Material	Carbon steel (–30HRC) AISI 1035, AISI 1050, ASTM 283						Alloy steel, Pre-hardened steel AISI H13, AISI 4140, AISI P21						Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, AISI 316L, Ti-6Al-4V etc.					
DC (inch)	High speed cutting		General purpose cutting		Depth of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

Depth of cut



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

Depth of cut

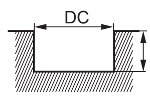


Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

Slotting

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

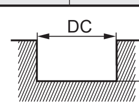
Depth of cut



DC : Dia.

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

Depth of cut



DC : Dia.

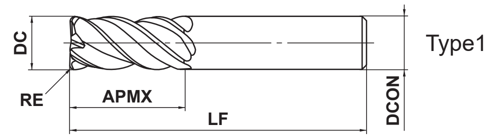
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQMHVRBF

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

UWC VQ 37° 40°

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



0.3≤RE≤3				
±0.015				
DC≤12	DC>12			
0 - 0.02	0 - 0.03			
DCON=6	8≤DCON≤10	12≤DCON≤16		
0 - 0.008	0 - 0.009	0 - 0.011		

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

(mm)

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

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

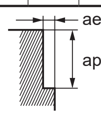
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

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

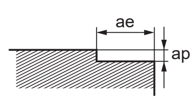
Depth of cut



■Bottom face milling

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

Depth of cut



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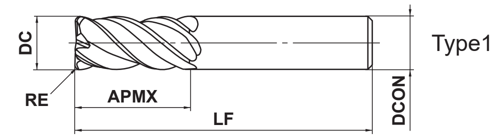
Note 2) Effective cutting of stainless steel, titanium alloy and heat resistant alloy etc. can be achieved with the use of emulsion.
Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
Note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

VQMHVRBF – Inch sizes

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

UWC VQ 37° 40°

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



.2500"≦RE≦.5000"			
±.0006"			
DC<.5000"	DC=.5000"		
0 - .0008"	0 - .0012"		
.250"≦DCON≦.375"	DCON=.500"		
h6 0 - .00035"	0 - .00043"		

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

(inch)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQMHVRBFD1/4R015	.2500	.0150	.6250	2.5	.2500	4	●	1
VQMHVRBFD1/4R030	.2500	.0300	.6250	2.5	.2500	4	●	1
VQMHVRBFD5/16R015	.3125	.0150	.7500	2.75	.3125	4	●	1
VQMHVRBFD5/16R030	.3125	.0300	.7500	2.75	.3125	4	●	1
VQMHVRBFD5/16R060	.3125	.0600	.7500	2.75	.3125	4	●	1
VQMHVRBFD3/8R015	.3750	.0150	.8750	3.0	.3750	4	●	1
VQMHVRBFD3/8R030	.3750	.0300	.8750	3.0	.3750	4	●	1
VQMHVRBFD3/8R060	.3750	.0600	.8750	3.0	.3750	4	●	1
VQMHVRBFD3/8R090	.3750	.0900	.8750	3.0	.3750	4	●	1
VQMHVRBFD1/2R030	.5000	.0300	1.1250	3.5	.5000	4	●	1
VQMHVRBFD1/2R060	.5000	.0600	1.1250	3.5	.5000	4	●	1
VQMHVRBFD1/2R090	.5000	.0900	1.1250	3.5	.5000	4	●	1
VQMHVRBFD1/2R120	.5000	.1200	1.1250	3.5	.5000	4	●	1

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● : USA Stock

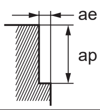
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

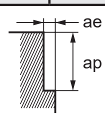
Workpiece Material	Carbon steel (—30HRC) AISI 1035, AISI 1050, ASTM 283				Alloy steel, Pre-hardened steel AISI H13, AISI 4140, AISI P21				Precipitation hardening martensitic stainless steel, Co-Cr-Mo alloy ASTM S 17400, ASTM S 17700, 17-4PH, 15-5PH etc.			
DC (inch)	Revolution (min^{-1})	Table feed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

Depth of cut



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

Depth of cut



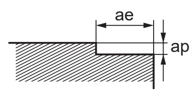
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting of stainless steel, titanium alloy, and heat resistant alloy can be achieved with the use of water-soluble cutting fluid.
Note 3) If the depth of cut is smaller than this table, feed rate can be increased.
Note 4) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

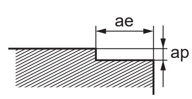
VQMHVRBF – Inch sizes

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

RECOMMENDED CUTTING CONDITIONS

Bottom face milling

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

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

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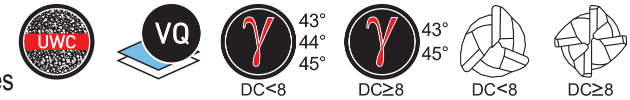
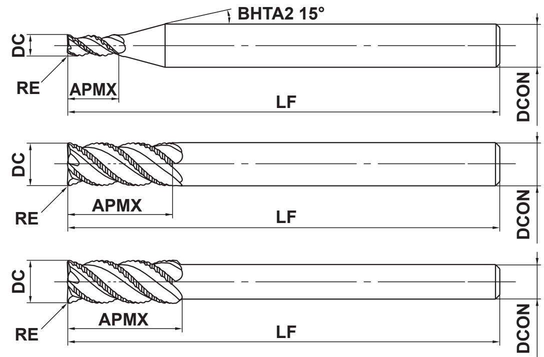
Note 2) Effective cutting of stainless steel, titanium alloy, and heat resistant alloy can be achieved with the use of water-soluble cutting fluid.
Note 3) Higher feeds and speeds can be used for smaller depth of cut.
Note 4) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VQSVR

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



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



Type1

Type2

Type3

h6

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)

(mm)

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

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

VQSVR

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

RECOMMENDED CUTTING CONDITIONS

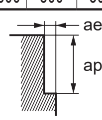
Side milling

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

High efficiency conditions

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

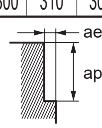
Depth of cut



General-purpose conditions

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

Depth of cut



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

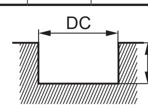
■Slotting

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

High efficiency conditions

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

Depth of cut

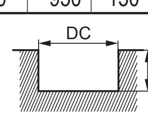


DC : Dia.

General-purpose conditions

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

Depth of cut



DC : Dia.

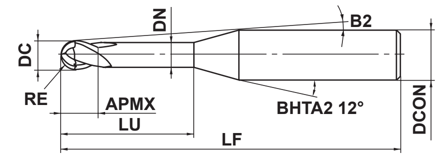
Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting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

VQ2XLB NEW

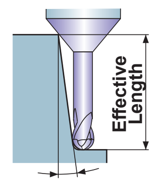
Ball nose, Short cut length, 2 flute, Long neck

UWC VQ 30°

Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Precipitation Hardening Stainless Steel	Austenitic Stainless Steel	Cobalt Chrome Alloy, Heat Resistant Alloy	Titanium Alloy	Aluminum Alloy
			○		◎	◎	



Type1



0.05≤RE≤1.5			
±0.005			
4≤DCON≤6			
0 - 0.005			

- Fracture resistance is improved by adopting a new S-shape, reinforced cutting edge geometry.
- SMART MIRACLE coating provides better wear resistance when machining difficult-to-cut materials.

(mm)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type
VQ2XLBR0050N080	0.5	1	0.75	8	0.94	6.4°	50	4	2	●	1
VQ2XLBR0050N100	0.5	1	0.75	10	0.94	5.6°	50	4	2	●	1
VQ2XLBR0050N080S06	0.5	1	0.75	8	0.94	8.3°	50	6	2	●	1
VQ2XLBR0050N100S06	0.5	1	0.75	10	0.94	7.5°	55	6	2	●	1
VQ2XLBR0050N120S06	0.5	1	0.75	12	0.94	6.8°	55	6	2	●	1
VQ2XLBR0075N100S06	0.75	1.5	1.1	10	1.44	7.2°	55	6	2	●	1
VQ2XLBR0075N120S06	0.75	1.5	1.1	12	1.44	6.5°	55	6	2	●	1
VQ2XLBR0100N100	1.0	2	1.5	10	1.9	4.5°	50	4	2	●	1
VQ2XLBR0100N100S06	1.0	2	1.5	10	1.9	6.9°	55	6	2	●	1
VQ2XLBR0100N120	1.0	2	1.5	12	1.9	3.9°	50	4	2	●	1
VQ2XLBR0100N120S06	1.0	2	1.5	12	1.9	6.1°	55	6	2	●	1
VQ2XLBR0150N120	1.5	3	2.3	12	2.9	5.3°	55	6	2	●	1
VQ2XLBR0150N140	1.5	3	2.3	14	2.9	4.7°	60	6	2	●	1
VQ2XLBR0150N160	1.5	3	2.3	16	2.9	4.3°	60	6	2	●	1

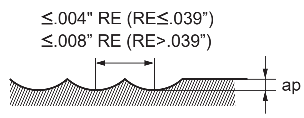
● : USA Stock

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material				Titanium Alloys Ti-6Al-4V ELI, ASTM F136, etc.					Cobalt Chromium Alloys Precipitation Hardening Stainless Steels ASTM F75:Casting, F1537:Wrought Bar, F799:Forgings, etc.				
RE		LU		Revolution	Cutting Speed	Table Feed	Depth of cut	Width of cut	Revolution	Cutting Speed	Table Feed	Depth of cut	Width of cut
(mm)	(inch)	(mm)	(inch)	**n** (min^{-1})	**vc** (SFM)	**vf** (IPM)	**ap** (inch)	**ae** (inch)	**n** (min^{-1})	**vc** (SFM)	**vf** (IPM)	**ap** (inch)	**ae** (inch)
0.5	**.020**	**8**	**.315**	32000	330	98.4	.002	.004	27000	260	78.7	.002	.004
0.5	**.020**	**10**	**.394**	24000	245	59.1	.002	.004	19000	195	59.1	.002	.004
0.5	**.020**	**12**	**.472**	24000	245	59.1	.001	.004	19000	195	59.1	.001	.004
0.75	**.030**	**10**	**.394**	21000	330	82.7	.005	.012	17000	260	66.9	.003	.004
0.75	**.030**	**12**	**.472**	16000	245	59.1	.005	.012	13000	195	47.2	.003	.004
1	**.039**	**10**	**.394**	16000	330	70.9	.008	.020	13000	260	59.1	.008	.020
1	**.039**	**12**	**.472**	16000	330	70.9	.008	.020	13000	260	59.1	.008	.020
1.5	**.059**	**12**	**.472**	10000	330	63.0	.012	.031	8500	260	51.2	.012	.031
1.5	**.059**	**14**	**.551**	10000	330	63.0	.012	.031	8500	260	51.2	.012	.031
1.5	**.059**	**16**	**.630**	10000	330	63.0	.012	.031	8500	260	51.2	.012	.031

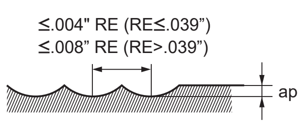
Depth of Cut



RE : Radius

Workpiece Material				Pure Titanium ASTM F67, etc.				
RE		LU		Revolution	Cutting Speed	Table Feed	Depth of cut	Width of cut
(mm)	(inch)	(mm)	(inch)	**n** (min^{-1})	**vc** (SFM)	**vf** (IPM)	**ap** (inch)	**ae** (inch)
0.5	**.020**	**8**	**.315**	27000	260	63.0	.003	.004
0.5	**.020**	**10**	**.394**	19000	195	47.2	.003	.004
0.5	**.020**	**12**	**.472**	19000	195	47.2	.002	.004
0.75	**.030**	**10**	**.394**	25000	395	78.7	.005	.008
0.75	**.030**	**12**	**.472**	21000	330	63.0	.005	.008
1	**.039**	**10**	**.394**	32000	655	98.4	.013	.031
1	**.039**	**12**	**.472**	29000	590	66.9	.013	.031
1.5	**.059**	**12**	**.472**	21000	655	63.0	.019	.047
1.5	**.059**	**14**	**.551**	21000	655	63.0	.019	.047
1.5	**.059**	**16**	**.630**	21000	655	63.0	.019	.047

Depth of Cut



RE : Radius

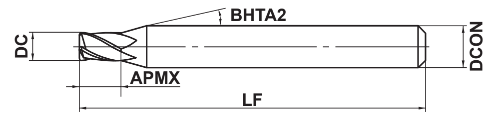
Note 1) The SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electrically transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electrical type) or a laser tool setter.
Note 2) When cutting titanium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

VQ4MRB-FB NEW

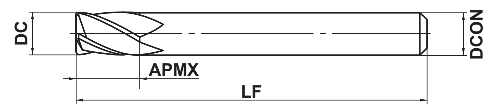
UWC VQ 30°

Corner radius end mill, Medium cut length, 4 flute, For Swiss-Type lathe

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



Type1



Type2

DC				
0 - 0.020				
DCON=6	8≤DCON≤10			
0 - 0.008	0 - 0.009			

- A corner radius end mill with high fracture resistance.
- A turn milling machine tool for Swiss-type automatic lathes for machining lobe surfaces.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQ4MRBD0400R030-FB	4	0.3	6	50	6	4	●	1
VQ4MRBD0600R030-FB	6	0.3	9	50	6	4	●	2
VQ4MRBD0800R030-FB	8	0.3	12	60	8	4	●	2
VQ4MRBD1000R050-FB	10	0.5	15	70	10	4	●	2

Note 1) SMART MIRACLE Coating is not conductive 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.

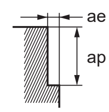
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Side Milling

Workpiece Material		Carbon Steels, Cast Irons, Alloy Steels (−30HRC) AISI 1050, AISI No 35 B, AISI P20				Alloy Steels, Tool Steels, Pre-hardened Steels AISI H13, AISI W1-10, AISI P21				Austenitic Stainless Steels, Titanium Alloys AISI 304, AISI 306, Ti-6Al-4V				Copper, Copper Alloys			
DC		Revolution	Table Feed	Depth of Cut	Width of Cut	Revolution	Table Feed	Depth of Cut	Width of Cut	Revolution	Table Feed	Depth of Cut	Width of Cut	Revolution	Table Feed	Depth of Cut	Width of Cut
(mm)	(inch)	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)
4	**.157**	7500	35.4	.157	.024	5200	23.6	.157	.024	4500	17.7	.157	.024	9500	43.3	.157	.024
6	**.236**	5000	35.4	.236	.024	3500	23.6	.236	.024	3000	17.7	.236	.024	6400	43.3	.236	.024
8	**.315**	4000	30.7	.315	.024	2800	20.5	.315	.024	2400	15.4	.315	.024	4800	37.0	.315	.024
10	**.394**	3200	26.8	.394	.024	2200	17.7	.394	.024	1900	13.4	.394	.024	3800	31.9	.394	.024

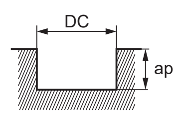
Depth of Cut



Slotting

Workpiece Material		Carbon Steels, Cast Irons, Alloy Steels (−30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy Steels, Tool Steels, Pre-hardened Steels AISI H13, AISI W1-10, AISI P21			Austenitic Stainless Steels, Titanium Alloys AISI 304, AISI 306, Ti-6Al-4V			Copper, Copper Alloys		
DC		Revolution	Table Feed	Depth of Cut	Revolution	Table Feed	Depth of Cut	Revolution	Table Feed	Depth of Cut	Revolution	Table Feed	Depth of Cut
(mm)	(inch)	(min^{-1})	(IPM)	**ap**	(min^{-1})	(IPM)	**ap**	(min^{-1})	(IPM)	**ap**	(min^{-1})	(IPM)	**ap**
4	**.157**	7500	35.4	.024	5200	23.6	.024	4500	17.7	.024	9500	43.3	.024
6	**.236**	5000	35.4	.024	3500	23.6	.024	3000	17.7	.024	6400	43.3	.024
8	**.315**	4000	30.7	.024	2800	20.5	.024	2400	15.4	.024	4800	37.0	.024
10	**.394**	3200	26.8	.024	2200	17.7	.024	1900	13.4	.024	3800	31.9	.024

Depth of Cut



DC:Dia.

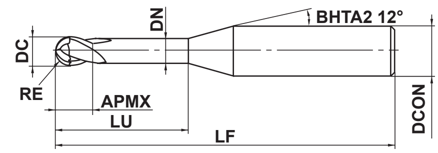
Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
Note 2) When cutting austenitic stainless steels and titanium alloys, the use of water-soluble cutting fluid is effective.
Note 3) If the depth of cut is shallow, the revolution and feed rate can be increased.
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 workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionally.

VQ4SVB

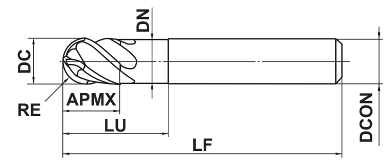
Ball nose, Medium cut length, 4 flute

45°

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



Type1



Type2

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

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

(mm)

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

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

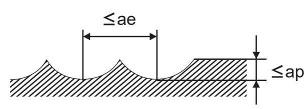
ISO13399 ➢ I002

RECOMMENDED CUTTING CONDITIONS

■ Shoulder milling (slotting)

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

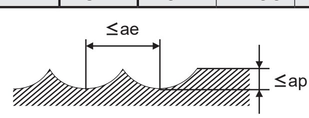
Depth of cut



RE : Radius

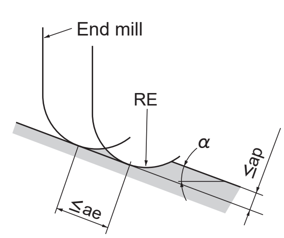
Workpiece Material	Copper, Copper alloy								Heat resistant alloy Inconel etc.							
RE (mm)	α≤15°			α>15°			Depth of cut ap (mm)	Depth of cut ae (mm)	α≤15°			α>15°			Depth of cut ap (mm)	Depth of cut ae (mm)
	Cutting speed (m/min)	Revolution (min^{-1})	Table feed (mm/min)	Cutting speed (m/min)	Revolution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

Depth of cut



RE : Radius

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting of stainless steel, titanium alloy and heat resistant alloy etc. can be achieved with the use of emulsion.
Note 3) Chattering can still occur if the machine rigidity and clamping method are insufficient. In these cases the feed and speed should be reduced proportionately.
Note 4) When the depth of cut is smaller than shown the revolution and feed rate can be increased.
Note 5) α is the inclination angle of the machined surface.

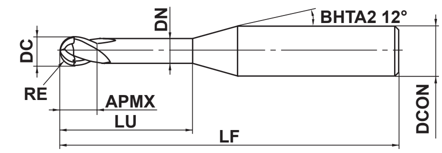


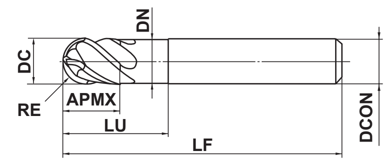
VQ4SVB -Inch sizes

Ball nose, Medium cut length, 4 flute

UWC VQ 45°

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





.0625"≤RE≤.2500"				
±.0004"				
.250"≤DCON≤.375"	DCON=.500"			
0 - .00035"	0 - .00043"			

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

(inch)

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

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

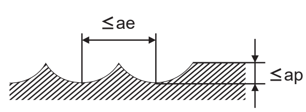
CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■Shoulder milling (Slotting)

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

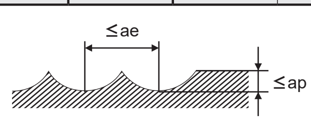
Depth of cut



RE : Radius

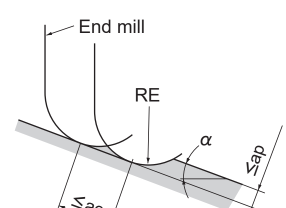
Workpiece Material	Copper, Copper alloy						Heat resistant alloy Inconel718 etc.					
RE (inch)	α≤15°		α>15°		Depth of cut ap (inch)	Depth of cut ae (inch)	α≤15°		α>15°		Depth of cut ap (inch)	Depth of cut ae (inch)
	Revolution (min^{-1})	Table feed (IPM)	Revolution (min^{-1})	Table feed (IPM)			Revolution (min^{-1})	Table feed (IPM)	Revolution (min^{-1})	Table feed (IPM)		
.0625	36000	338.6	24000	141.7	.0098	.0313	6000	25.2	4000	13.4	.0051	.0313
.0938	24000	263.8	16000	122.0	.0165	.0469	4000	20.9	2700	9.8	.0083	.0469
.1250	18000	212.6	12000	98.4	.0197	.0626	3000	19.7	2000	8.3	.0098	.0626
.1563	14000	196.9	9600	90.6	.0315	.0781	2400	16.9	1600	7.5	.0157	.0781
.1875	12000	192.9	8000	82.7	.0394	.0937	2000	16.5	1300	7.1	.0197	.0937
.2500	9100	181.1	6000	86.6	.0472	.125	1500	13.8	1000	5.9	.0236	.0125

Depth of cut



RE : Radius

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 3) If the depth of cut is smaller than this table, feed rate can be increased.
Note 4) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.
Note 5) α is the inclination of the machined surface.

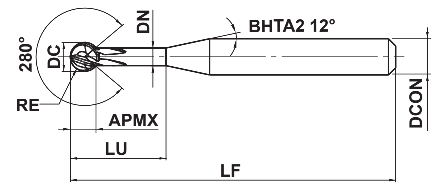


VQ4WB NEW

Lollipop, Short cut length, 4 flute

CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
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	Aluminum Alloy
◎	◎			◎	◎	○	



0.5≤RE≤3				
±0.01				
4≤DCON≤6				
0 - 0.008				

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

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock
VQ4WBR0050N06E280	0.5	1.0	0.88	6	0.61	50	4	4	●
VQ4WBR0065N08E280	0.65	1.3	1.14	8	0.80	50	4	4	●
VQ4WBR0090N06E280	0.9	1.8	1.58	6	1.11	50	4	4	●
VQ4WBR0100N06E280	1.0	2.0	1.76	6	1.24	60	6	4	●
VQ4WBR0140N16E280	1.4	2.8	2.47	16	1.74	60	6	4	●
VQ4WBR0150N08E280	1.5	3.0	2.64	8	1.87	60	6	4	●
VQ4WBR0190N12E280	1.9	3.8	3.35	12	2.37	60	6	4	●
VQ4WBR0200N12E280	2.0	4.0	3.53	12	2.50	60	6	4	●
VQ4WBR0240N16E280	2.4	4.8	4.23	16	3.00	70	6	4	●
VQ4WBR0250N12E280	2.5	5.0	4.41	12	3.13	80	6	4	●
VQ4WBR0300N12E280	3.0	6.0	5.29	12	3.76	80	6	4	●

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

<Order for Special Product>

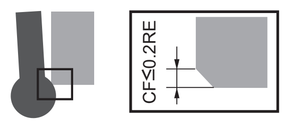
For special products other than the above tool specifications, please contact our sales department.

RECOMMENDED CUTTING CONDITIONS

Chamfering (Debarring)

Workpiece Material				Milld Steels, Carbon Steels, Copper Alloys, Pre-hardened Steels AISI 1045, 4140, 1010, P20, P21, 4340, ASTM A36 etc.			Austentic, Ferritic and Martensitic Stainless Steels, Precipitation Hardening Stainless Steels, Cobalt Chrome Alloys, Titanium Alloys AISI 304, 316, 630, 631, 431, 420, Ti-6Al-4V, 15-5PH, 17-4PH etc.		
DC		RE		Revolution	Table Feed	Depth of Cut	Revolution	Table Feed	Depth of Cut
(mm)	(inch)	(mm)	(inch)	**n** (min^{-1})	**vf** (IPM)	**Max.CF** (inch)	**n** (min^{-1})	**vf** (IPM)	**Max.CF** (inch)
1.0	**.039**	**0.5**	**.020**	19000	11.8	.004	14000	8.7	.004
1.3	**.051**	**0.65**	**.026**	15000	16.5	.005	11000	12.2	.005
1.8	**.071**	**0.9**	**.035**	11000	22.4	.007	8000	16.5	.007
2.0	**.079**	**1.0**	**.039**	9500	24.0	.008	7200	18.1	.008
2.8	**.110**	**1.4**	**.055**	6800	29.9	.011	5100	22.4	.011
3.0	**.118**	**1.5**	**.059**	6400	30.3	.012	4800	22.8	.012
3.8	**.150**	**1.9**	**.075**	5000	33.1	.015	3800	25.2	.015
4.0	**.157**	**2.0**	**.079**	4800	34.6	.016	3600	26.0	.016
4.8	**.189**	**2.4**	**.094**	4000	37.8	.019	3000	28.3	.019
5.0	**.197**	**2.5**	**.098**	3800	38.2	.020	2900	29.1	.020
6.0	**.236**	**3.0**	**.118**	3200	39.4	.024	2400	30.3	.024

Depth of Cut

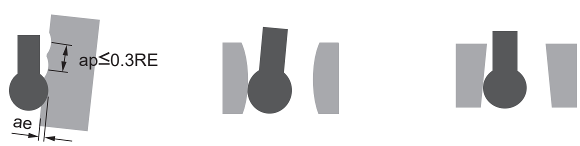


RE : Radius

Internal Profile / Undercut

Workpiece Material				Milld Steels, Carbon Steels, Copper Alloys, Pre-hardened Steels AISI 1045, 4140, 1010, P20, P21, 4340, ASTM A36 etc.			Austentic, Ferritic and Martensitic Stainless Steels, Precipitation Hardening Stainless Steels, Cobalt Chrome Alloys, Titanium Alloys AISI 304, 316, 630, 631, 431, 420, Ti-6Al-4V, 15-5PH, 17-4PH etc.		
DC		RE		Revolution	Table Feed	Depth of Cut	Revolution	Table Feed	Depth of Cut
(mm)	(inch)	(mm)	(inch)	**n** (min^{-1})	**vf** (IPM)	**ae** (inch)	**n** (min^{-1})	**vf** (IPM)	**ae** (inch)
2.0	**.079**	**1.0**	**.039**	9500	18.1	.001	7200	11.4	.001
3.0	**.118**	**1.5**	**.059**	6400	22.0	.004	4800	13.8	.004
4.0	**.157**	**2.0**	**.079**	4800	25.6	.006	3600	15.4	.006
5.0	**.197**	**2.5**	**.098**	3800	28.7	.007	2900	17.3	.007
6.0	**.236**	**3.0**	**.118**	3200	30.3	.009	2400	18.1	.009

Depth of Cut



RE : Radius

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) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.
Note 4) For sizes RE 0.5, 0.65, 0.9, 1.4, 1.9 and RE 2.4 which have long neck lengths, internal profile milling and round shape slotting are not recommended.

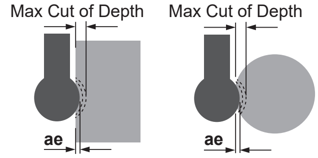
VQ4WB

Lollipop, Short cut length, 4 flute

Radiused Shape Slotting

Workpiece Material				Milld Steels, Carbon Steels, Copper Alloys, Pre-hardened Steels AISI 1045, 4140, 1010, P20, P21, 4340, ASTM A36 etc.				Austentic, Ferritic and Martensitic Stainless Steels, Precipitation Hardening Stainless Steels, Cobalt Chrome Alloys, Titanium Alloys AISI 304, 316, 630, 631, 431, 420, Ti-6Al-4V, 15-5PH, 17-4PH etc.			
DC		RE		Revolution n (min^{-1})	Table Feed vf (IPM)	Depth of Cut		Revolution n (min^{-1})	Feed Rate vf (IPM)	Depth of Cut	
(mm)	(inch)	(mm)	(inch)			ae (inch)	Max. ae (inch)			ae (inch)	Max. ae (inch)
2.0	**.079**	**1.0**	**.039**	9500	11.8	.001	.002	7200	5.5	.001	.002
3.0	**.118**	**1.5**	**.059**	6400	15.0	.004	.008	4800	7.5	.004	.008
4.0	**.157**	**2.0**	**.079**	4800	17.3	.006	.011	3600	9.1	.006	.011
5.0	**.197**	**2.5**	**.098**	3800	19.3	.007	.021	2900	10.2	.007	.021
6.0	**.236**	**3.0**	**.118**	3200	20.1	.009	.035	2400	10.6	.009	.035

Depth of Cut



RE : Radius

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) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.
Note 4) For sizes RE 0.5, 0.65, 0.9, 1.4, 1.9 and RE 2.4 which have long neck lengths, internal profile milling and round shape slotting are not recommended.
Note 5) Though max ae means stably machinable cutting condition, maximum depth of calculated by effective cutting edge angle is 0.3 times RE. (In that case please reduce the revolution and feed rate than this table.)

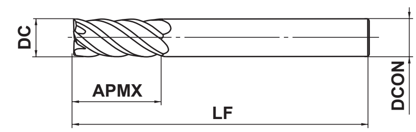
VQ5MHV – Inch sizes

NEW

39°
40°
41°

End mill, Medium cut length, 5 flute, Irregular helix flutes

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



.2500"≤DC≤.5000"				
0 - .0012"				
.2500"≤DCON≤.3750"	DCON=.5000"			
0 - .0002"	0 - .0003"			

● SMART MIRACLE irregular helix end mills for reducing vibration and for delivering stable performance on difficult-to-cut materials and long overhang applications.

(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock
VQ5MHVD1/4	.2500	.625	2.500	.2500	5	●
VQ5MHVD5/16	.3125	.750	2.750	.3125	5	●
VQ5MHVD3/8	.3750	.875	3.250	.3750	5	●
VQ5MHVD1/2	.5000	1.125	4.000	.5000	5	●

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

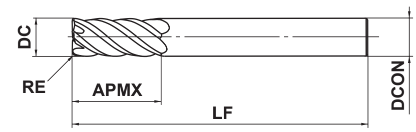
● : USA Stock

VQ5MHVRB – Inch sizes

NEW UWC VQ 39° 40° 41°

Corner radius, Medium cut length, 5 flute, Irregular helix flutes

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



.0010"≤RE≤.030"				
±.0006"				
.2500"≤DC≤.5000"				
0 - .0012"				
.2500"≤DCON≤.3750"	DCON=.5000"			
0 - .0002"	0 - .0003"			

● SMART MIRACLE corner radius, irregular helix end mills for reducing vibration and for delivering stable performance on difficult-to-cut materials and long overhang applications.

(inch)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock
VQ5MHVRBD1/4R010	.2500	.010	.625	2.500	.2500	5	●
VQ5MHVRBD5/16R015	.3125	.015	.750	2.750	.3125	5	●
VQ5MHVRBD3/8R030	.3750	.030	.875	3.250	.3750	5	●
VQ5MHVRBD1/2R030	.5000	.030	1.125	4.000	.5000	5	●

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

ISO13399 ➤ I002

VQ5MHV – Inch sizes NEW
End mill, Medium cut length, 5 flute, Irregular helix flutes

VQ5MHVRB – Inch sizes NEW
Corner radius, Medium cut length, 5 flute, Irregular helix flutes

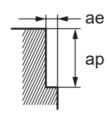
RECOMMENDED CUTTING CONDITIONS

Side milling

(inch)

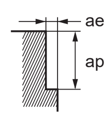
Workpiece Material		Carbon Steels(–30HRC)						Alloy Steels, Pre-hardened Steels					
DC		High Speed Cutting		General Purpose Cutting		Depth of Cut	Depth of Cut	High Speed Cutting		General Purpose Cutting		Depth of Cut	Depth of Cut
(mm)	(inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)	**ae** (inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)	**ae** (inch)
6.350	**.2500**	7500	90.6	6000	63.0	.375	.075	6000	47.2	5000	31.5	.375	.075
7.938	**.3125**	6000	90.6	4800	63.0	.469	.094	4800	51.2	4000	35.4	.469	.094
9.525	**.3750**	5000	90.6	4000	59.1	.563	.113	4000	51.2	3300	33.5	.563	.113
12.700	**.5000**	3800	66.9	3000	43.3	.750	.150	3000	43.3	2500	29.5	.750	.150

Depth of Cut



Workpiece Material		Austenitic Stainless Steels, Titanium Alloys						Precipitation Hardening Steinless Steels, Cobalt Chrome Alloys					
DC		High Speed Cutting		General Purpose Cutting		Depth of Cut	Depth of Cut	High Speed Cutting		General Purpose Cutting		Depth of Cut	Depth of Cut
(mm)	(inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)	**ae** (inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)	**ae** (inch)
6.350	**.2500**	5000	39.4	4000	25.6	.375	.050	3800	37.4	3500	21.7	.375	.050
7.938	**.3125**	4000	43.3	3200	29.5	.469	.063	3000	43.3	2800	25.6	.469	.063
9.525	**.3750**	3300	51.2	2700	33.5	.563	.075	2500	39.4	2300	23.6	.563	.075
12.700	**.5000**	2500	39.4	2000	27.6	.750	.100	1900	30.3	1800	19.7	.750	.100

Depth of Cut



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 workpiece material installation is poor, vibration or abnomal 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.

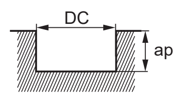
VQ5MHV – Inch sizes NEW
End mill, Medium cut length, 5 flute, Irregular helix flutes

VQ5MHVRB – Inch sizes NEW
Corner radius, Medium cut length, 5 flute, Irregular helix flutes

Slot Milling

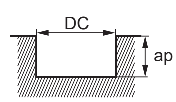
Workpiece Material		Carbon Steels(–30HRC)					Alloy Steels, Pre-hardened Steels				
DC		High Speed Cutting		General Purpose Cutting		Depth of Cut	High Speed Cutting		General Purpose Cutting		Depth of Cut
(mm)	(inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)
6.350	**.2500**	7500	55.1	5000	37.4	.250	6000	31.5	4000	19.7	.250
7.938	**.3125**	6000	55.1	4000	35.4	.312	4800	31.5	3200	19.7	.312
9.525	**.3750**	5000	51.2	3300	33.5	.375	4000	28.3	2700	17.7	.375
12.700	**.5000**	3800	39.4	2500	25.6	.500	3000	23.2	2000	13.8	.500

Depth of Cut



Workpiece Material		Austenitic Stainless Steels, Titanium Alloys					Precipitation Hardening Steinless Steels				
DC		High Speed Cutting		General Purpose Cutting		Depth of Cut	High Speed Cutting		General Purpose Cutting		Depth of Cut
(mm)	(inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	Revolution **n** (min^{-1})	Table Feed **vf** (IPM)	**ap** (inch)
6.350	**.2500**	5000	34.3	3000	13.8	.250	3000	23.6	2500	11.8	.250
7.938	**.3125**	4000	39.4	2400	15.7	.312	2400	23.6	2000	11.8	.312
9.525	**.3750**	3300	37.8	2000	17.7	.375	2000	21.7	1700	9.8	.375
12.700	**.5000**	2500	31.5	1500	13.8	.500	1500	17.7	1300	7.9	.500

Depth of Cut



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 compred to standard end mills.
However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abnomal 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.

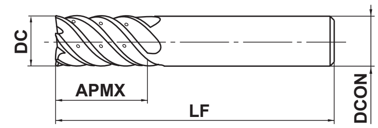
VQ6MHVCH

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

43.5°
45°

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

CoolStar



Type1

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

h6

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

(mm)

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

● : USA Stock

CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

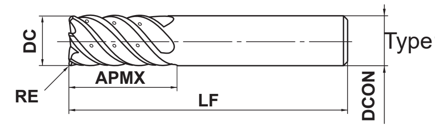
VQ6MHVRBCH

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

UWC VQ 43.5° 45°

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

CoolStar



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

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

(mm)

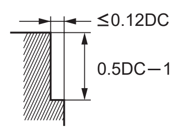
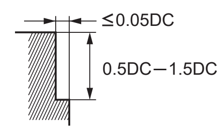
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQ6MHVRBCHD1000R050	10	0.5	22	70	10	6	●	1
VQ6MHVRBCHD1000R100	10	1	22	70	10	6	●	1
VQ6MHVRBCHD1200R050	12	0.5	26	75	12	6	●	1
VQ6MHVRBCHD1200R100	12	1	26	75	12	6	●	1
VQ6MHVRBCHD1600R100	16	1	32	90	16	6	●	1
VQ6MHVRBCHD1600R300	16	3	32	90	16	6	●	1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

VQ6MHVCH
End mill, Medium cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant

VQ6MHVRBCH
Corner radius, Medium cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant

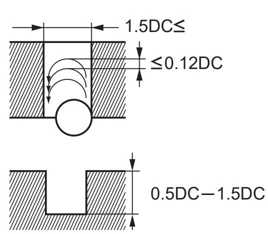
RECOMMENDED CUTTING CONDITIONS

Shoulder milling

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

DC : Dia.

Trochoid milling

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

DC : Dia.

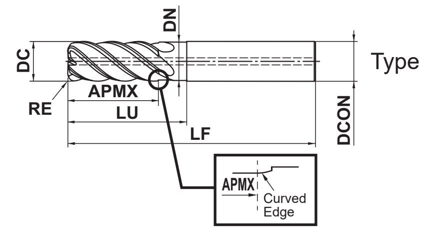
Note 1) If the depth of cut is smaller, the revolution and the feed rate can be increased.
Note 2) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.

VQT5MVRB

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

UWC VQT 40° 41.5° 43°

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



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

h6

● 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
NEW **VQT5MVRB160R100N48C**	16	1	34	48	15.5	120	16	5	●	1
NEW **VQT5MVRB160R300N48C**	16	3	34	48	15.5	120	16	5	●	1
NEW **VQT5MVRB160R400N48C**	16	4	34	48	15.5	120	16	5	●	1
NEW **VQT5MVRB200R100N60C**	20	1	44	60	19.5	135	20	5	●	1
NEW **VQT5MVRB200R300N60C**	20	3	44	60	19.5	135	20	5	●	1
NEW **VQT5MVRB200R400N60C**	20	4	44	60	19.5	135	20	5	●	1
NEW **VQT5MVRB200R600N60C**	20	6	44	60	19.5	135	20	5	●	1
NEW **VQT5MVRB250R100N75C**	25	1	54	75	24.5	155	25	5	●	1
NEW **VQT5MVRB250R300N75C**	25	3	54	75	24.5	155	25	5	●	1
NEW **VQT5MVRB250R400N75C**	25	4	54	75	24.5	155	25	5	●	1
NEW **VQT5MVRB250R600N75C**	25	6	54	75	24.5	155	25	5	●	1

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

ISO13399 ➤ I002

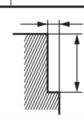
RECOMMENDED CUTTING CONDITIONS

■ Shoulder milling

Overhang Length DC×3 (DC=Dia.)

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

Depth of Cut

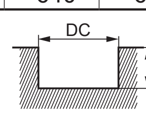


■ Slot milling

Depth of Cut DC×1

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

Depth of Cut

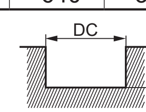


DC=Dia.

Depth of Cut DC×2

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

Depth of Cut



DC=Dia.

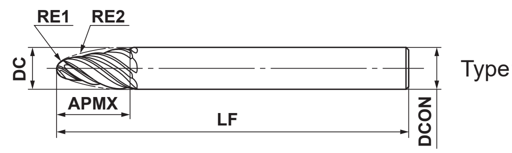
Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, please use an internal contact type (non-electricity type) or a laser tool setter.
Note 2) When cutting titanium alloy, the use of water-soluble cutting fluid is effective.
Note 3) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abnormal sound can occur.
In this case, please reduce the revolution and the feed rate proportionately, or set a lower depth of cut.
Note 4) If the depth of cut is smaller, the revolution and the feed rate can be increased.
Note 5) When machining a deep slot exceeding 1D, use a holder with a high gripping strength or an anti slippage mechanism.
Also, make sure that the clamping force and rigidity are sufficient before use.

VQT6UR

Barrel, Medium cut length, 6 flute

40°

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



RE1≦4	RE2≦100			
±0.01	±0.01			
DCON≦10	DCON=12			
0 / - 0.009	0 / - 0.011			

● Nose and tangential form part has two distinct radii.

● Irregular pitch design prevents chattering.

(mm)

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

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

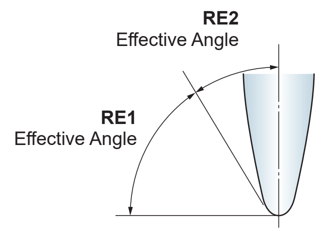
RECOMMENDED CUTTING CONDITIONS

■Effective Angle

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

(inch)

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



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

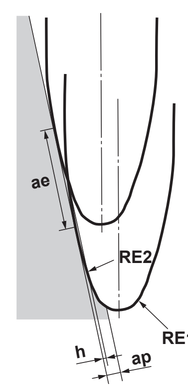
Workpiece Material				Mild steel (≦180HB) Carbon steel, Alloy steel (180－280HB)			Austenitic stainless steel (≦200HB) Titanium alloy			Aluminum alloy (Si＜5%)		
DC		RE2		Revolution (min^{-1})	Table feed (IPM)	Depth of cut **ap** (inch)	Revolution (min^{-1})	Table feed (IPM)	Depth of cut **ap** (inch)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

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

(inch)

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

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, an internal contact/non-electric type or laser tool setter is recommended.
Note 2) Recommended for finish cutting only.
Note 3) The tool contact part differs between the nose radius and tangential form radius depending on machining geometries and tilt angles. Select suitable cutting conditions according to tool contact parts.



VQT6UR

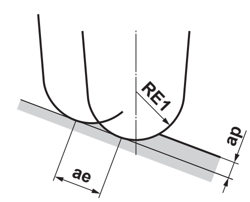
Barrel, Medium cut length, 6 flute

RECOMMENDED CUTTING CONDITIONS

■Fillet Milling with the Use of the Nose Radius (RE1)

Workpiece Material				Mild Steel (≤180HB) Carbon Steel, Alloy Steel (180—280HB)				Austenitic Stainless Steel (≤200HB) Titanium Alloy				Aluminum Alloy (Si<5%)			
DC		RE1		Revolution	Table feed	Depth of cut	Depth of cut	Revolution	Table feed	Depth of cut	Depth of cut	Revolution	Table feed	Depth of cut	Depth of cut
mm	inch	mm	inch	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)	(min^{-1})	(IPM)	**ap** (inch)	**ae** (inch)
8	**.315**	**2**	**.079**	16000	94.5	.016	.039	6400	22.8	.016	.039	32000	189.0	.016	.039
10	**.394**	**2**	**.079**	16000	94.5	.016	.039	6400	22.8	.016	.039	32000	189.0	.016	.039
10	**.394**	**3**	**.118**	11000	66.9	.024	.059	4200	15.0	.024	.059	21000	126.0	.024	.059
12	**.472**	**4**	**.157**	8000	47.2	.031	.079	3200	11.4	.031	.079	16000	94.5	.031	.079

Note 1) SMART MIRACLE coating has very low electrical conductivity; therefore, an external contact type of tool setter (electric transmitted) may not work.
When measuring the tool length, an internal contact/non-electric type or laser tool setter is recommended.
Note 2) Recommended for finish cutting only.
Note 3) The tool contact part differs between the nose radius and tangential form radius depending on machining geometries and tilt angles. Select suitable cutting conditions according to tool contact parts.



ae:Pick Feed

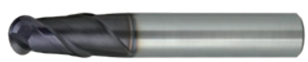
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

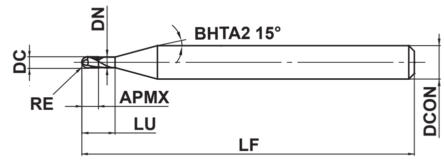
VQN2MB NEW

Ball nose, Medium cut length, 2 flute

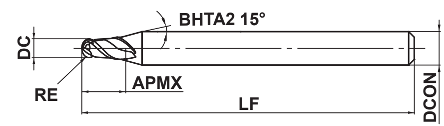
30° RE≤1.5 45° RE>1.5

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

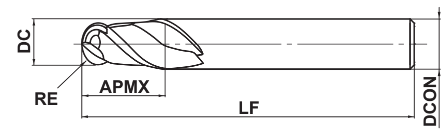




Type1



Type2



Type3

RE≤6		
±0.010		
DCON=6	8≤DCON≤10	DCON=12
0 - 0.005	0 - 0.006	0 - 0.008

● (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
● The R cutting edge rake angle and ball nose geometry have been optimised to improve strength.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQN2MBR0050	0.5	1	1	4	0.94	60	6	2	●	1
VQN2MBR0100	1.0	2	2	6	1.9	60	6	2	●	1
VQN2MBR0150	1.5	3	3	8	2.9	60	6	2	●	1
VQN2MBR0200	2.0	4	8	–	–	60	6	2	●	2
VQN2MBR0250	2.5	5	12	–	–	60	6	2	●	2
VQN2MBR0300	3.0	6	12	–	–	60	6	2	●	3
VQN2MBR0400	4.0	8	14	–	–	70	8	2	●	3
VQN2MBR0500	5.0	10	18	–	–	80	10	2	●	3
VQN2MBR0600	6.0	12	22	–	–	80	12	2	●	3

● : USA Stock

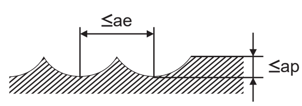
VQN2MB

Ball nose, Medium cut length, 2 flute

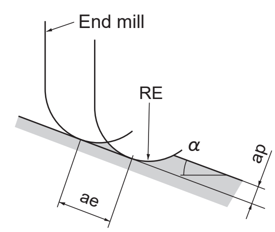
RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Nickel-based Heat Resistant Super Alloy Inconel718, Inconel713C, WASPALOY etc.					
RE		$\alpha \leq 15°$		$\alpha > 15°$		Depth of Cut ap (inch)	Depth of Cut ae (inch)
(mm)	(inch)	Revolution (SFM)	Table Feed (IPM)	Revolution (SFM)	Table Feed (IPM)		
0.5	**.020**	65	25.2	65	29.9	.004	.010
1.0	**.039**	65	12.6	65	15.0	.008	.020
1.5	**.059**	65	9.8	65	9.8	.012	.030
2.0	**.079**	65	7.5	65	8.7	.016	.039
2.5	**.098**	65	7.1	65	7.9	.020	.049
3.0	**.118**	65	6.7	65	8.3	.024	.059
4.0	**.157**	60	5.1	60	6.3	.031	.079
5.0	**.197**	60	5.1	60	5.5	.039	.098
6.0	**.236**	60	4.3	60	4.7	.047	.118

Depth of cut



Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) Vibration may occur if the rigidity of machine or workpiece is low. In this case, please reduce the revolution and feed rate proportionately.
Note 4) α is the inclination angle of the machined surface.

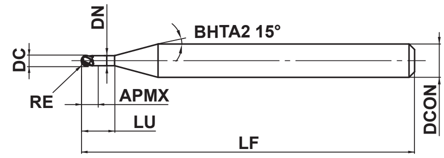


ae:Pick Feed

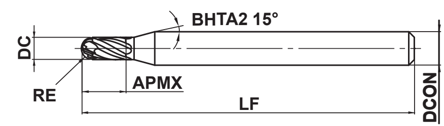
VQN4MB NEW

Ball nose, Medium cut length, 4 flute

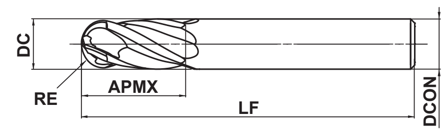
Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
					◎		



Type1



Type2



Type3

RE≤6		
±0.010		
DCON=6	8≤DCON≤10	DCON=12
0 / - 0.005	0 / - 0.006	0 / - 0.008

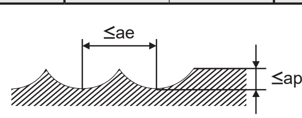
h5

- (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
- The 2-flute end cutting edge provides excellent chip evacuation and is ideal for rough machining.

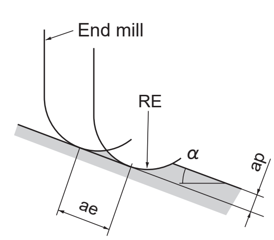
(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQN4MBR0100	1.0	2	2	6	1.9	60	6	4	●	1
VQN4MBR0150	1.5	3	3	8	2.9	60	6	4	●	1
VQN4MBR0200	2.0	4	8	–	–	60	6	4	●	2
VQN4MBR0250	2.5	5	12	–	–	60	6	4	●	2
VQN4MBR0300	3.0	6	12	–	–	60	6	4	●	3
VQN4MBR0400	4.0	8	14	–	–	70	8	4	●	3
VQN4MBR0500	5.0	10	18	–	–	80	10	4	●	3
VQN4MBR0600	6.0	12	22	–	–	80	12	4	●	3

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Nickel-based Heat Resistant Super Alloy Inconel718, Inconel713C, WASPALOY etc.					
RE		α≤15°		α>15°		Depth of Cut ap (inch)	Depth of Cut ae (inch)
(mm)	(inch)	Revolution (SFM)	Table Feed (IPM)	Revolution (SFM)	Table Feed (IPM)		
1.0	**.039**	65	15.0	65	20.1	.008	.020
1.5	**.059**	65	13.4	65	16.5	.012	.030
2.0	**.079**	65	12.6	65	15.0	.016	.039
2.5	**.098**	65	9.8	65	12.2	.020	.049
3.0	**.118**	65	8.3	65	9.8	.024	.059
4.0	**.157**	60	6.3	60	7.5	.031	.079
5.0	**.197**	60	5.9	60	7.9	.039	.098
6.0	**.236**	60	5.9	60	6.7	.047	.118
Depth of cut							

Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) Vibration may occur if the rigidity of machine or workpiece is low. In this case, please reduce the revolution and feed rate proportionally.
Note 4) α is the inclination angle of the machined surface.



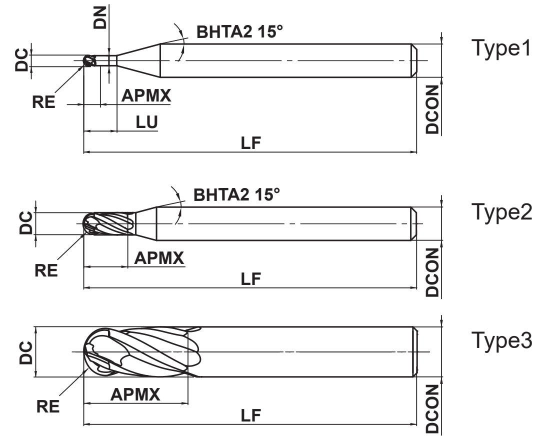
ae:Pick Feed

VQN4MBF NEW

Ball nose, Medium cut length, 4 flute

UWC VQN 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	Aluminum Alloy
					◎		



RE≤6		
±0.010		

DCON=6	8≤DCON≤10	DCON=12
0 - 0.005	0 - 0.006	0 - 0.008

h5

- (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
- The 4-flute end cutting edge is also ideal for 5-axis machining.

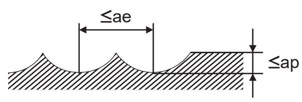
(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VQN4MBFR0100	1.0	2	2	6	1.9	60	6	4	●	1
VQN4MBFR0150	1.5	3	3	8	2.9	60	6	4	●	1
VQN4MBFR0200	2.0	4	8	–	–	60	6	4	●	2
VQN4MBFR0250	2.5	5	12	–	–	60	6	4	●	2
VQN4MBFR0300	3.0	6	12	–	–	60	6	4	●	3
VQN4MBFR0400	4.0	8	14	–	–	70	8	4	●	3
VQN4MBFR0500	5.0	10	18	–	–	80	10	4	●	3
VQN4MBFR0600	6.0	12	22	–	–	80	12	4	●	3

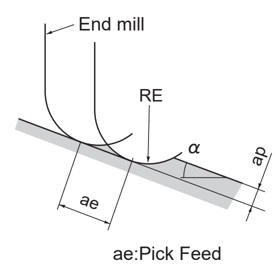
● : USA Stock

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Nickel-based Heat Resistant Super Alloy Inconel718, Inconel713C, WASPALOY etc.						
RE		$\alpha \leq 15°$			$\alpha > 15°$			Depth of Cut ap (inch)
(mm)	(inch)	Revolution (SFM)	Table Feed (IPM)	Depth of Cut ae (inch)	Revolution (SFM)	Table Feed (IPM)	Depth of Cut ae (inch)	
1.0	**.039**	65	7.1	.016	65	12.2	.020	.008
1.5	**.059**	65	6.7	.024	65	13.4	.030	.012
2.0	**.079**	65	7.5	.031	65	12.6	.039	.016
2.5	**.098**	65	5.9	.039	65	9.8	.049	.020
3.0	**.118**	65	6.7	.047	65	9.8	.059	.024
4.0	**.157**	60	5.1	.063	60	7.5	.079	.031
5.0	**.197**	60	3.9	.079	60	7.9	.098	.039
6.0	**.236**	60	5.1	.094	60	6.7	.118	.047
Depth of cut								

Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) Vibration may occur if the rigidity of machine or workpiece is low. In this case, please reduce the revolution and feed rate proportionately.
Note 4) α is the inclination angle of the machined surface.



VQN4/6MVRB

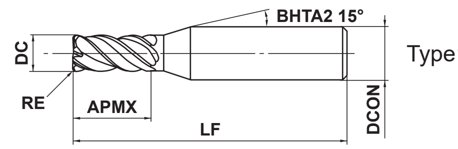
NEW

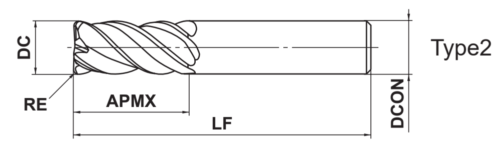
Corner Radius, Medium cut length, 4/6 flute

UWC VQN

VQN4 33° 37° | VQN6 34° 36° | VQN4 | VQN6

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





VQN4	VQN6			
±0.015	±0.02			
DC≤12				
0 / - 0.02				
DCON=6	8≤DCON≤10	DCON=12		
0 / - 0.008	0 / - 0.009	0 / - 0.011		

- (Al, Ti, Si) N-based coating exhibits excellent wear and chipping resistance when machining heat resistant super alloys.
- Optimized number of flutes for efficient and stable machining.

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VQN4MVRBD0300R030	3	0.3	7	45	6	4	●	1
VQN4MVRBD0300R050	3	0.5	7	45	6	4	●	1
VQN4MVRBD0400R030	4	0.3	10	45	6	4	●	1
VQN4MVRBD0400R050	4	0.5	10	45	6	4	●	1
VQN4MVRBD0500R050	5	0.5	12	50	6	4	●	1
VQN4MVRBD0600R050	6	0.5	13	50	6	4	●	2
VQN4MVRBD0600R100	6	1	13	50	6	4	●	2
VQN6MVRBD0800R050	8	0.5	19	60	8	6	●	2
VQN6MVRBD0800R100	8	1	19	60	8	6	●	2
VQN6MVRBD1000R050	10	0.5	22	70	10	6	●	2
VQN6MVRBD1000R100	10	1	22	70	10	6	●	2
VQN6MVRBD1200R050	12	0.5	26	75	12	6	●	2
VQN6MVRBD1200R100	12	1	26	75	12	6	●	2

● : USA Stock

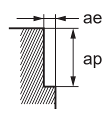
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■ Side milling

Workpiece Material			Nickel-based Heat Resistant Super Alloy Inconel718, Inconel713C, WASPALOY etc.			
DC (mm)	DC (inch)	Number of Flutes	Revolution (SFM)	Table Feed (IPM)	Depth of Cut ap (inch)	Depth of Cut ae (inch)
3	**.118**	**4**	4200	13.4	.177	.012
4	**.157**	**4**	3200	10.2	.236	.016
5	**.197**	**4**	2500	11.8	.295	.020
6	**.236**	**4**	2100	9.8	.354	.024
8	**.315**	**6**	1600	11.4	.472	.031
10	**.394**	**6**	1300	12.2	.591	.039
12	**.472**	**6**	1100	10.2	.709	.047

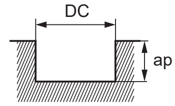
Depth of cut



■ Slot milling

Workpiece Material			Nickel-based Heat Resistant Super Alloy Inconel718, Inconel713C, WASPALOY etc.		
DC (mm)	DC (inch)	Number of Flutes	Revolution (SFM)	Table Feed (IPM)	Depth of Cut ap (inch)
3	**.118**	**4**	3200	10.2	.059
4	**.157**	**4**	2400	7.5	.079
5	**.197**	**4**	1900	9.1	.098
6	**.236**	**4**	1600	7.5	.118
8	**.315**	**6**	1200	5.5	.157
10	**.394**	**6**	1000	4.7	.197
12	**.472**	**6**	800	5.5	.236

Depth of cut



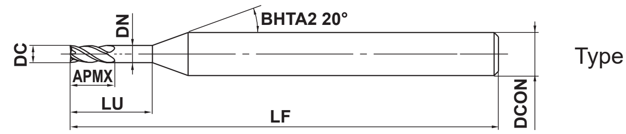
Note 1) For heat resistant super alloy, the use of water-soluble coolant is effective.
Note 2) Chattering can still occur if the machine rigidity and clamping method are insufficient.
In these cases the feed and speed should be reduced proportionately.
Note 3) If the depth of cut is shallow, the revolution and feed rate can be increased.

VQXL

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

UWC VQ 35° 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	Aluminum Alloy
◎	◎			◎	◎	○	



DC≤1				
0 - 0.010				
DCON=4				
0 - 0.005				

h6

- 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	0.46	40	4	4	●	1
VQXLD0050N025	0.5	0.7	2.5	0.46	40	4	4	●	1
VQXLD0050N030	0.5	0.7	3	0.46	40	4	4	●	1
VQXLD0060N030	0.6	0.9	3	0.57	40	4	4	●	1
VQXLD0070N035	0.7	1	3.5	0.67	40	4	4	●	1
VQXLD0080N024	0.8	1.2	2.4	0.77	40	4	4	●	1
VQXLD0080N030	0.8	1.2	3	0.77	40	4	4	●	1
VQXLD0080N040	0.8	1.2	4	0.77	40	4	4	●	1
VQXLD0100N050	1	1.5	5	0.96	40	4	4	●	1

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

TORX Chart

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

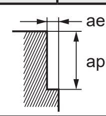
● : USA Stock

RECOMMENDED CUTTING CONDITIONS

■Side milling

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

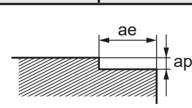
Depth of cut



■Bottom face milling

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

Depth of cut



Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting of stainless steel, titanium alloy and heat resistant alloy etc. can be achieved with the use of emulsion.
Note 3) When the depth of cut is smaller than shown the revolution and feed rate can be increased.

VQXL

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

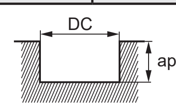
CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS

RECOMMENDED CUTTING CONDITIONS

■Slotting

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

Depth of cut



DC : Dia.

Note 1) SMART MIRACLE coating has reduced electric conductivity; therefore an external contact type (electric transmitted) tool setter may not work. When measuring the tool length, please use an internal contact type (non-electricity type) tool setter or a laser type tool setter.
Note 2) Effective cutting of stainless steel, titanium alloy and heat resistant alloy etc. can be achieved with the use of emulsion.
Note 3) When the depth of cut is smaller than shown the feed rate can be increased.

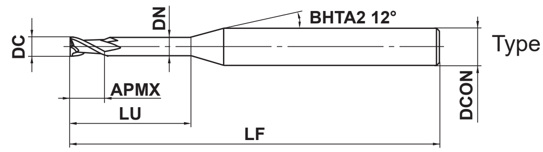
VF2XL

End mill, 2 flute, Long neck

UWC VF 30°

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	Aluminum Alloy
○	◎	◎	◎				



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

h6

● 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
VF2XLD0020N006	0.2	0.3	0.6	0.17	45	4	2	★	1
VF2XLD0030N010	0.3	0.5	1	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
VF2XLD0050N020	0.5	0.8	2	0.46	45	4	2	★	1
VF2XLD0050N040	0.5	0.8	4	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
VF2XLD0080N040	0.8	1.2	4	0.76	45	4	2	★	1
VF2XLD0080N060	0.8	1.2	6	0.76	45	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
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
VF2XLD0200N100	2	3	10	1.9	50	4	2	★	1
VF2XLD0200N120	2	3	12	1.9	50	4	2	★	1
VF2XLD0200N160	2	3	16	1.9	60	4	2	★	1
VF2XLD0200N200	2	3	20	1.9	60	4	2	★	1
VF2XLD0300N120	3	4.5	12	2.9	50	6	2	★	1
VF2XLD0300N200	3	4.5	20	2.9	60	6	2	★	1

★ : Stocked in Japan

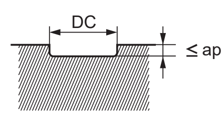
VF2XL

End mill, 2 flute, Long neck

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.			
DC (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut per pass ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut per pass ap (mm)
0.2	**0.6**	40000	400	15.7	0.004	40000	360	14.2	0.004
0.3	**1**	40000	500	19.7	0.006	40000	450	17.7	0.004
0.4	**1**	40000	800	31.5	0.008	36000	500	19.7	0.006
	2	40000	500	19.7	0.007	30000	350	13.8	0.005
0.5	**2**	40000	800	31.5	0.01	30000	600	23.6	0.009
	4	36000	600	23.6	0.008	27000	450	17.7	0.007
0.6	**2**	40000	1000	39.4	0.015	30000	700	27.6	0.012
	4	36000	800	31.5	0.01	27000	500	19.7	0.01
0.8	**4**	36000	1200	47.2	0.03	27000	900	35.4	0.02
	6	30000	900	35.4	0.02	22000	650	25.6	0.015
1	**4**	32000	1600	63.0	0.05	24000	1100	43.3	0.04
	6	32000	1400	55.1	0.04	24000	1000	39.4	0.03
	8	28000	1000	39.4	0.03	21000	750	29.5	0.02
	12	24000	500	19.7	0.02	18000	370	14.6	0.01
1.5	**6**	22000	1200	47.2	0.08	16000	900	35.4	0.06
	8	22000	1100	43.3	0.07	16000	800	31.5	0.05
	10	22000	1000	39.4	0.06	16000	750	29.5	0.04
	12	20000	800	31.5	0.05	15000	600	23.6	0.03
	16	18000	500	19.7	0.03	13000	350	13.8	0.02
2	**6**	16000	1000	39.4	0.15	12000	750	29.5	0.15
	10	16000	800	31.5	0.1	12000	600	23.6	0.08
	12	16000	800	31.5	0.08	12000	600	23.6	0.06
	16	15000	600	23.6	0.06	11000	450	17.7	0.05
	20	14000	500	19.7	0.05	10000	350	13.8	0.04
3	**12**	11000	800	31.5	0.2	8200	600	23.6	0.15
	20	11000	500	19.7	0.1	8200	350	13.8	0.1

Depth of cut



DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

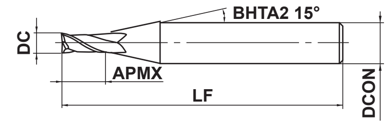
 ★ : Stocked in Japan

VF2MV

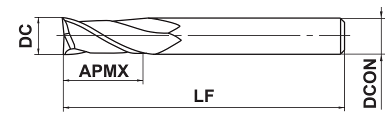
End mill, Medium cut length, 2 flute, Irregular helix flutes

UWC VF 32.5° 37.5°

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



Type1



Type2

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

h6

● An irregular helix 2 flute square end mill suitable for high-speed machining of hardened steel.

(mm)

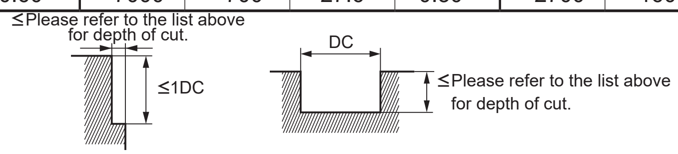
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF2MVD0050	0.5	1.3	40	4	2	●	1
VF2MVD0100	1	2.5	40	4	2	●	1
VF2MVD0150	1.5	3.8	40	4	2	●	1
VF2MVD0200	2	5	40	4	2	●	1
VF2MVD0250	2.5	6.3	40	4	2	●	1
VF2MVD0300	3	7.5	50	6	2	●	1
VF2MVD0400	4	10	50	6	2	●	1
VF2MVD0500	5	12.5	50	6	2	●	1
VF2MVD0600	6	15	50	6	2	●	2

VF2MV

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1−10, AISI P21 etc.				Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
0.5	40000	1000	39.4	0.015	40000	960	37.8	0.015	30000	600	23.6	0.01
1	40000	2000	78.7	0.06	32000	1600	63.0	0.06	16000	550	21.7	0.05
1.5	40000	3000	118.1	0.12	32000	1900	74.8	0.08	10600	500	19.7	0.08
2	30000	3000	118.1	0.18	24000	1900	74.8	0.10	8100	400	15.7	0.1
2.5	24000	2600	102.4	0.25	19000	1600	63.0	0.13	6400	350	13.8	0.13
3	20000	2300	90.6	0.30	16000	1400	55.1	0.15	5400	300	11.8	0.15
4	15000	2000	78.7	0.40	12000	1200	47.2	0.20	4000	240	9.4	0.2
5	12000	1600	63.0	0.50	9000	900	35.4	0.25	3200	190	7.5	0.2
6	10000	1400	55.1	0.60	7000	700	27.6	0.30	2700	160	6.3	0.2

Depth of cut



DC : Dia.

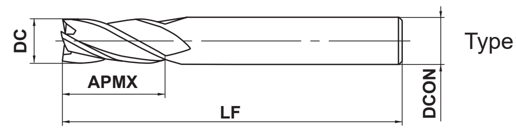
Note 1) When slotting, reduce the revolutions by 50 - 70% and the feed rate by 40 - 60%.
Note 2) For austenitic stainless steel, titanium and heat resistant alloys, VFMHV is recommended.
Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VF4MV

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

35°
38°

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



	DC≤12	DC>12			
	0 - 0.020	0 - 0.030			
h6	DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

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

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF4MVD0600	6	15	50	6	4	●	1
VF4MVD0800	8	20	60	8	4	●	1
VF4MVD1000	10	25	70	10	4	●	1
VF4MVD1200	12	30	90	12	4	●	1
VF4MVD1600	16	40	100	16	4	★	1
VF4MVD2000	20	50	110	20	4	★	1

● : USA Stock ★ : Stocked in Japan

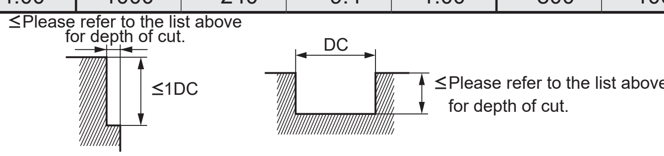
VF4MV

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

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.				Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
6	10000	2100	82.7	0.60	7000	1400	55.1	0.30	2700	320	12.6	0.20
8	8000	1500	59.1	0.80	5600	1100	43.3	0.40	2000	240	9.4	0.20
10	6400	1400	55.1	1.00	4500	950	37.4	0.50	1600	210	8.3	0.30
12	5400	1200	47.2	1.00	3800	860	33.9	0.50	1300	160	6.3	0.30
16	2400	550	21.7	3.00	1200	280	11.0	0.80	1000	130	5.1	0.30
20	1900	480	18.9	4.00	1000	240	9.4	1.00	800	100	3.9	0.30

Depth of cut



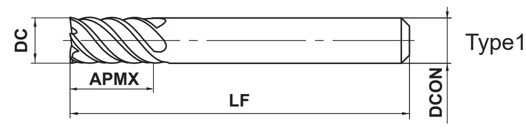
DC : Dia.

Note 1) When slotting, reduce the revolutions by 50 - 70% and the feed rate by 40 - 60%.
Note 2) For austenitic stainless steel, titanium and heat resistant alloys, VFMHV is recommended.
Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VF6MHV

End mill, Medium cut length, 6 flute, Irregular helix flutes

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



	DC≤12	DC>12			
	0 - 0.020	0 - 0.030			
h6	DCON=6	8≤DCON≤10	12≤DCON≤16	DCON=20	
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013	

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

(mm)

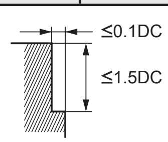
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6MHVD0600	6	13	50	6	6	★	1
VF6MHVD0800	8	19	60	8	6	★	1
VF6MHVD1000	10	22	70	10	6	★	1
VF6MHVD1200	12	26	75	12	6	★	1
VF6MHVD1600	16	32	90	16	6	★	1
VF6MHVD2000	20	38	100	20	6	★	1

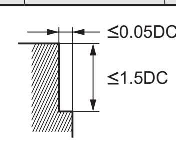
RECOMMENDED CUTTING CONDITIONS

■Side milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V etc.			Heat resistant alloy Inconel718 etc.		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
6	10600	2900	114.2	8000	2000	78.7	2100	320	12.6
8	8000	2900	114.2	6000	2000	78.7	1600	300	11.8
10	6400	2700	106.3	4800	2000	78.7	1300	260	10.2
12	5300	2700	106.3	4000	2000	78.7	1100	230	9.1
16	4000	2200	86.6	3000	1600	63.0	800	180	7.1
20	3200	1900	74.8	2400	1400	55.1	640	150	5.9

Depth of cut





DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

★ : Stocked in Japan

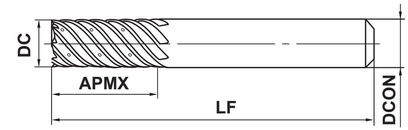
VF8MHVCH

End mill, Medium cut length, Irregular helix flutes, with multiple thru-coolant

UWC VF 44° 45°

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

CoolStar



16≤DC≤20				
0 - 0.03				
DCON=16	DCON=20			
0 - 0.011	0 - 0.013			

h6

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

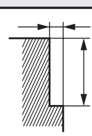
(mm)

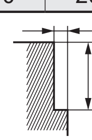
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF8MHVCHD1600	16	32	90	16	8	★	1
VF8MHVCHD2000	20	38	100	20	8	★	1

RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
DC (mm)	Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	4000	2400	94.5	3000	2100	82.7	800	240	9.4
20	3200	1900	74.8	2400	1900	74.8	640	200	7.9
Depth of cut	≤0.08DC 0.5DC−1.5DC						≤0.05DC 0.5DC−1.5DC		

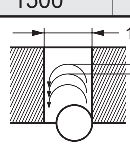


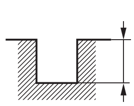


DC:Dia.

Trochoidal milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)
16	4000	1900	74.8	3000	1400	55.1
20	3200	1500	59.0	2400	1200	47.2
Depth of cut	1.5DC≤ ≤0.08DC			0.5DC−1.5DC		





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 material installation is poor, vibration or abonrmal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

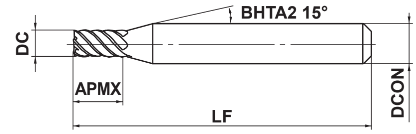
● : USA Stock ★ : Stocked in Japan

VFSD

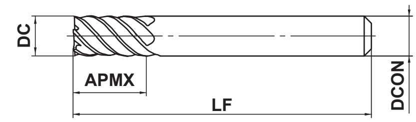
End mill, Short cut length, For hardened materials

UWC VF 30° DC<3 45° 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	Aluminum Alloy
	○	◎	◎				



Type 1



Type 2

	1≤DC≤12				
	0 - 0.02				
h6	DCON=6	8≤DCON≤10	DCON=12		
	0 - 0.008	0 - 0.009	0 - 0.011		

● End mills with Impact Miracle coating for high hardness materials.

(mm)

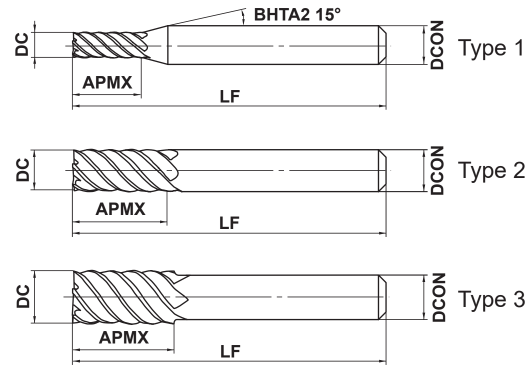
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSDD0100	1	2	45	6	4	●	1
VFSDD0150	1.5	3	45	6	4	●	1
VFSDD0200	2	4	45	6	4	●	1
VFSDD0250	2.5	5	45	6	4	●	1
VFSDD0300	3	6	45	6	6	●	1
VFSDD0350	3.5	7	45	6	6	●	1
VFSDD0400	4	8	45	6	6	●	1
VFSDD0500	5	10	50	6	6	●	1
VFSDD0600	6	12	50	6	6	●	2
VFSDD0800	8	16	60	8	6	●	2
VFSDD1000	10	20	70	10	6	●	2
VFSDD1200	12	24	75	12	6	●	2

VFMD

End mill, Medium cut length, For hardened materials

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

CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
SOLID END MILLS



	DC≤12	DC＞12		
	0 - 0.02	0 - 0.03		
h6	DCON=6	8≤DCON≤10	12≤DCON≤16	20≤DCON≤25
	0 - 0.008	0 - 0.009	0 - 0.011	0 - 0.013

● End mills with Impact Miracle coating for high hardness materials.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMDD0100	1	3.5	60	6	4	●	1
VFMDD0150	1.5	5	60	6	4	●	1
VFMDD0200	2	7	60	6	4	●	1
VFMDD0250	2.5	8	60	6	4	●	1
VFMDD0300	3	10	60	6	6	●	1
VFMDD0400	4	12	60	6	6	●	1
VFMDD0500	5	15	60	6	6	●	1
VFMDD0600	6	15	60	6	6	●	2
VFMDD0800	8	20	75	8	6	●	2
VFMDD1000	10	25	80	10	6	●	2
VFMDD1200	12	30	100	12	6	●	2
VFMDD1400	14	35	105	12	6	★	3
VFMDD1500	15	40	110	16	6	★	1
VFMDD1600	16	40	110	16	6	★	2
VFMDD1800	18	40	120	16	6	★	3
VFMDD2000	20	45	125	20	6	★	2
VFMDD2200	22	45	135	20	6	★	3
VFMDD2500	25	60	160	25	6	★	2

● : USA Stock ★ : Stocked in Japan

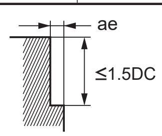
VFSD
End mill, Short cut length, For hardened materials

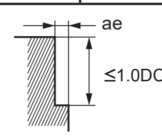
VFMD
End mill, Medium cut length, For hardened materials

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.				Hardened steel (62−70HRC) AISI W1, AISI M2 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut ae (mm)
1	40000	1200	47.2	0.05	40000	800	31.5	0.03	32000	500	19.7	0.02
2	40000	2000	78.7	0.1	24000	1000	39.4	0.05	16000	600	23.6	0.05
3	32000	3800	149.6	0.2	16000	1900	74.8	0.1	11000	1200	47.2	0.05
4	24000	4400	173.2	0.2	12000	2200	86.6	0.1	8000	1300	51.2	0.05
6	16000	5800	228.3	0.3	8000	2900	114.2	0.2	5300	1800	70.9	0.1
8	12000	5800	228.3	0.4	6000	2900	114.2	0.2	4000	1800	70.9	0.1
10	9600	5800	228.3	0.5	4800	2900	114.2	0.3	3200	1800	70.9	0.2
12	8000	4800	189.0	0.6	4000	2400	94.5	0.3	2700	1500	59.1	0.2
16	6000	3600	141.7	0.8	3000	1800	70.9	0.5	2000	1100	43.3	0.3
20	4800	2900	114.2	1.0	2400	1400	55.1	0.5	1600	880	34.6	0.3
25	3800	2300	90.6	1.0	1900	1100	43.3	0.5	1300	720	28.3	0.3

Depth of cut



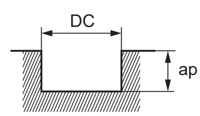


DC : Dia.

■Slot milling with small diameter tools

Workpiece Material	Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)
1	15000	300	11.8	0.1	9500	110	4.3	0.05
2	8000	320	12.6	0.2	4800	190	7.5	0.1

Depth of cut



DC : Dia.

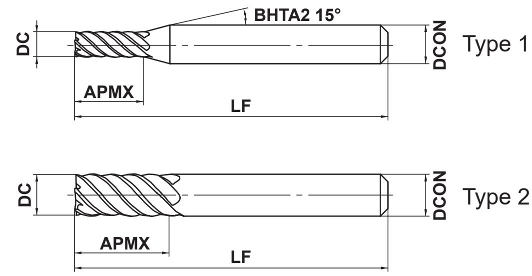
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

VFMD – Inch sizes

End mill, Medium cut length, For hardened materials

UWC VF 30° DC < 1/8 45° DC ≥ 1/8 DC < 1/8 DC ≥ 1/8

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	Aluminum Alloy
	○	◎	◎				



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

● End mills with Impact Miracle coating for high hardness materials.

(inch)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMDD1/32	.0313	.0938	2.5	.2500	4	●	1
VFMDD1/16	.0625	.1875	2.5	.2500	4	●	1
VFMDD3/32	.0938	.2813	2.5	.2500	4	●	1
VFMDD1/8	.1250	.3750	2.5	.2500	6	●	1
VFMDD5/32	.1563	.5000	2.5	.2500	6	●	1
VFMDD3/16	.1875	.5630	2.5	.2500	6	●	1
VFMDD1/4	.2500	.5630	3.5	.2500	6	●	2
VFMDD5/16	.3125	.6875	4.0	.3125	6	●	2
VFMDD3/8	.3750	.8125	4.0	.3750	6	●	2
VFMDD1/2	.5000	1.0938	4.5	.5000	6	●	2

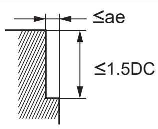
● : USA Stock

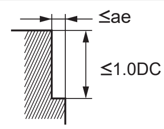
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.				Hardened steel (62−70HRC) AISI W1, AISI M2 etc.			
DC (inch)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut ae (inch)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut ae (inch)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Width of cut ae (inch)
.0313	40000	1100	43.3	.0016	40000	800	31.5	.00094	36000	500	19.6	.00063
.0625	40000	1800	70.8	.0031	30000	960	37.8	.0019	20000	560	22	.0013
.0938	40000	2600	102	.0047	20000	1100	43	.0028	13000	680	26.6	.0019
.1250	30000	4100	161	.0063	15000	2100	82	.0038	10000	1300	49.6	.0025
.1563	24000	4300	170	.0078	12000	2200	86	.0047	8000	1300	51	.0031
.1875	20000	4800	189	.0094	10000	2400	94.5	.0056	6700	1400	55	.0038
.2500	15000	5800	228	.013	7500	2900	114	.0075	5000	1800	70.8	.005
.3125	12000	5800	228	.016	6000	2900	114	.0094	4000	1800	70.8	.0063
.3750	10000	5800	228	.019	5000	2900	114	.011	3300	1800	70.8	.0075
.5000	7500	4500	177	.025	3800	2300	90.5	.015	2500	1400	55	.01

Depth of cut





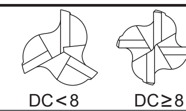
DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

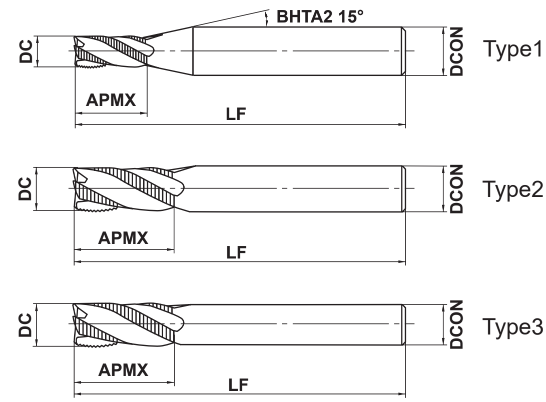
VFSFPR

Roughing end mill, Short cut length, 3−4 flute

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	Aluminum Alloy
○	○			◎	◎		



h6

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

● Impact Miracle roughing end mills for a wide range of workpiece materials from carbon and alloy steel through to difficult-to-cut materials.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSFPRD0300	3	6	50	6	3	★	1
VFSFPRD0400	4	8	50	6	3	★	1
VFSFPRD0500	5	10	50	6	3	★	1
VFSFPRD0600	6	12	50	6	3	★	2
VFSFPRD0700	7	17	60	8	3	★	1
VFSFPRD0800	8	17	60	8	4	★	2
VFSFPRD0900	9	22	70	10	4	★	1
VFSFPRD1000S08	10	22	90	8	4	★	3
VFSFPRD1000	10	22	70	10	4	★	2
VFSFPRD1200S10	12	27	100	10	4	★	3
VFSFPRD1200	12	27	75	12	4	★	2
VFSFPRD1400	14	27	75	12	4	★	3
VFSFPRD1600	16	33	90	16	4	★	2
VFSFPRD1800	18	33	90	16	4	★	3
VFSFPRD2000	20	38	100	20	4	★	2

★ : Stocked in Japan

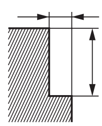
ISO13399 ➤ I002

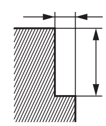
RECOMMENDED CUTTING CONDITIONS

■Side milling

Workpiece Material	Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti—6Al—4V etc.			Hardened steel (45—55HRC) AISI H13 etc.			Heat resistant alloy Inconel718 etc.		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
3	16000	960	37.8	13000	640	25.2	6400	260	10.2	5300	320	12.6	4200	70	2.8
4	12000	960	37.8	9500	640	25.2	4800	260	10.2	4000	320	12.6	3200	70	2.8
5	9500	960	37.8	7600	640	25.2	3800	260	10.2	3200	320	12.6	2500	70	2.8
6	8000	960	37.8	6400	680	26.8	3200	290	11.4	2700	340	13.4	2100	75	3.0
8	6000	1050	41.3	4800	760	29.9	2400	340	13.4	2000	400	15.7	1600	95	3.7
10	4800	1050	41.3	3800	760	29.9	1900	340	13.4	1600	400	15.7	1300	105	4.1
12	4000	960	37.8	3200	700	27.6	1600	320	12.6	1300	400	15.7	1100	110	4.3
16	3000	840	33.1	2400	620	24.4	1200	300	11.8	1000	360	14.2	800	110	4.3
20	2400	760	29.9	1900	560	22.0	1000	300	11.8	800	320	12.6	600	100	3.9

Depth of cut



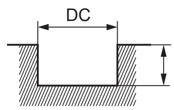


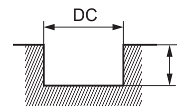
DC : Dia.

■Slotting

Workpiece Material	Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti—6Al—4V etc.			Hardened steel (45—55HRC) AISI H13 etc.			Heat resistant alloy Inconel718 etc.		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
3	13000	720	28.3	11000	480	18.9	4800	190	7.5	3200	190	7.5	2100	25	1.0
4	9500	720	28.3	8000	480	18.9	3600	190	7.5	2400	190	7.5	1600	25	1.0
5	7600	720	28.3	6400	480	18.9	3200	190	7.5	1900	190	7.5	1300	25	1.0
6	6400	720	28.3	5300	480	18.9	2700	200	7.9	1600	200	7.9	1100	30	1.2
8	4800	800	31.5	4000	520	20.5	2000	220	8.7	1200	220	8.7	800	35	1.4
10	3800	800	31.5	3200	520	20.5	1600	220	8.7	1000	220	8.7	600	35	1.4
12	3200	750	29.5	2700	520	20.5	1300	210	8.3	800	210	8.3	500	40	1.6
16	2400	620	24.4	2000	450	17.7	1000	180	7.1	600	180	7.1	400	45	1.8
20	1900	540	21.3	1600	400	15.7	800	160	6.3	500	160	6.3	300	40	1.6

Depth of cut





DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

IMPACT MIRACLE END MILLS

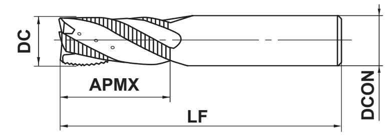
VFSFPRCH

Roughing end mill, Short cut length, 4 flute, with multiple thru-coolant

UWC VF 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	Aluminum Alloy
○	○			◎	◎		

CoolStar



Type1

h6

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

● Roughing end mill with multiple internal through coolant holes suitable for difficult-to-cut materials.

(mm)

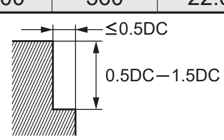
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFSFPRCHD1600	16	33	90	16	4	★	1
VFSFPRCHD2000	20	38	100	20	4	★	1

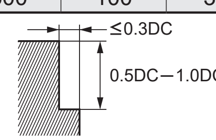
RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy steel, Tool steel, Pre-hardened steel (−45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
16	3000	840	33.1	2400	620	24.4	1200	300	11.8	800	110	4.3
20	2400	760	29.9	1900	560	22.0	1000	300	11.8	600	100	3.9

Depth of cut



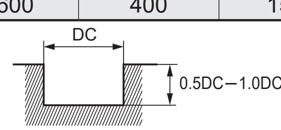


DC:Dia.

Slotting

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy steel, Tool steel, Pre-hardened steel (−45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
16	2400	620	24.4	2000	450	17.7	800	100	3.9
20	1900	540	21.3	1600	400	15.4	600	80	3.1

Depth of cut



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

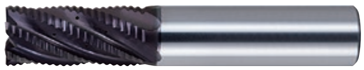
★ : Stocked in Japan

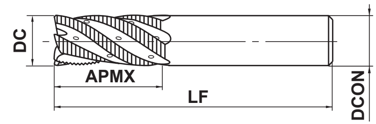
VF6SVRCH

Roughing end mill, Short cut length, 6 flute, Irregular helix flutes, with multiple thru-coolant

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

CoolStar





Type1

h6	DCON=16	DCON=20			
	0 - 0.011	0 - 0.013			

● Roughing end mill with multiple internal through coolant holes suitable for difficult-to-cut materials.

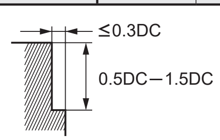
(mm)

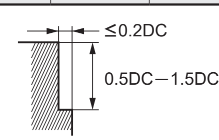
Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6SVRCHD1600	16	33	90	16	6	★	1
VF6SVRCHD2000	20	38	100	20	6	★	1

RECOMMENDED CUTTING CONDITIONS

■Side milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel (−45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
16	3000	1500	59.1	2400	1200	47.2	800	160	6.3
20	2400	1200	47.2	2000	1000	39.4	640	140	5.5
Depth of cut	≤0.3DC 0.5DC−1.5DC						≤0.2DC 0.5DC−1.5DC		





DC:Dia.

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

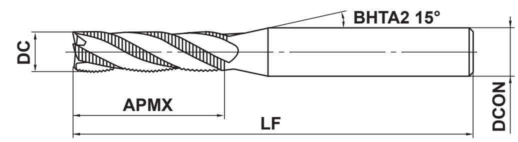
Note 2) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abonrmal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

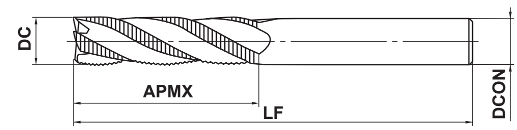
VFMFPR

Roughing end mill, Medium cut length, 4 flute

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	Aluminum Alloy
○	○			◎	◎		





h6

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

● Impact Miracle roughing end mills suitable for the machining of deep walled components.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMFPRD0500	5	15	60	6	4	★	1
VFMFPRD0600	6	17	60	6	4	★	2
VFMFPRD0700	7	22	75	8	4	★	1
VFMFPRD0800	8	28	75	8	4	★	2
VFMFPRD0900	9	28	100	10	4	★	1
VFMFPRD1000	10	34	100	10	4	★	2
VFMFPRD1200	12	40	110	12	4	★	2
VFMFPRD1600	16	48	125	16	4	★	2
VFMFPRD2000	20	57	140	20	4	★	2

★ : Stocked in Japan

ISO13399

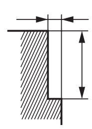
➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.			Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1−10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti−6Al−4V etc.			Hardened steel (45−55HRC) AISI H13 etc.			Heat resistant alloy Inconel718 etc.		
DC (mm)	Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
5	3800	360	14.2	3200	290	11.4	2500	150	5.9	2500	150	5.9	1900	50	2.0
6	3200	360	14.2	2700	290	11.4	2100	160	6.3	2100	160	6.3	1600	60	2.4
8	2400	450	17.7	2000	360	14.2	1600	160	6.3	1600	160	6.3	1200	70	2.8
10	1900	450	17.7	1600	360	14.2	1300	180	7.1	1300	180	7.1	1000	75	3.0
12	1600	400	15.7	1300	320	12.6	1100	180	7.1	1100	180	7.1	800	80	3.1
16	1200	360	14.2	1000	290	11.4	800	160	6.3	800	160	6.3	600	80	3.1
20	1000	340	13.4	800	270	10.6	600	150	5.9	600	150	5.9	500	80	3.1

Depth of cut



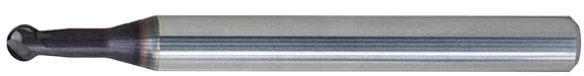
DC:Dia.

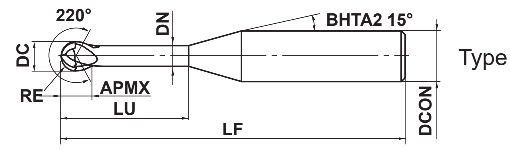
Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

VF2WB

Wide ball nose, Medium cut length, 2 flute

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





I≤RE≤3	
±0.01	
DCON=6	
0 - 0.008	

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

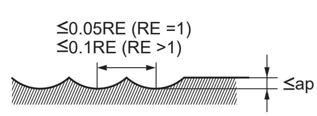
(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2WBR0100N060	1	2	1.5	6	1.6	60	6	2	★	1
VF2WBR0150N080	1.5	3	2	8	2.4	60	6	2	★	1
VF2WBR0200N100	2	4	3	10	3.2	60	6	2	★	1
VF2WBR0300N120	3	6	4	12	4.8	80	6	2	★	1

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1−10, AISI P21 etc.				Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti−6Al−4V etc.				Hardened steel (45−55HRC) AISI H13 etc.			
RE (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)
R1	40000	5000	196.9	0.07	40000	5000	196.9	0.06	32000	2500	98.4	0.05	32000	3000	118.1	0.03
R1.5	32000	5000	196.9	0.12	32000	5000	196.9	0.11	26000	2500	98.4	0.10	26000	3000	118.1	0.07
R2	24000	3800	149.6	0.15	24000	3800	149.6	0.13	20000	2000	98.4	0.12	20000	2800	110.2	0.10
R3	16000	2800	110.2	0.20	16000	2800	110.2	0.18	13000	1500	59.1	0.15	13000	2100	82.7	0.12

Depth of cut



RE : Radius

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.

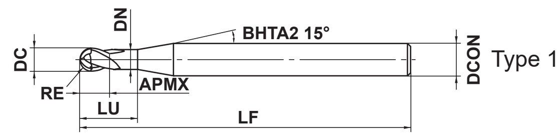
● : USA Stock ★ : Stocked in Japan

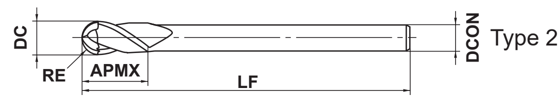
VF2SB – Inch sizes

Ball nose, Short cut length, 2 flute, For hardened materials

UWC VF 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	Aluminum Alloy
○	◎	◎	◎	○	○		





.0156"≤RE≤.2500"				
±.0002"				
.2500"≤DCON≤.3750"				
0 - .00024"				
DCON=.5000"				
0 - 0.00043"				

h5 h6

● 2 flute ball nose end mills with Impact Miracle coating for high hardness materials.

(inch)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VF2SBD1/32	.0156	.0313	.0313	.0625	.0296	2.5	.2500	2	●	1
VF2SBD1/16	.0313	.0625	.0625	.1250	.0601	2.5	.2500	2	●	1
VF2SBD3/32	.0469	.0938	.0938	.1875	.0898	2.5	.2500	2	●	1
VF2SBD1/8	.0625	.1250	.1250	.2500	.1211	3.0	.2500	2	●	1
VF2SBD3/16	.0938	.1875	.1875	.3750	.1835	3.0	.2500	2	●	1
VF2SBD1/4	.1250	.2500	.5000	–	–	3.5	.2500	2	●	2
VF2SBD5/16	.1563	.3125	.6250	–	–	4.0	.3125	2	●	2
VF2SBD3/8	.1875	.3750	.7500	–	–	4.0	.3750	2	●	2
VF2SBD1/2	.2500	.5000	1.0000	–	–	4.5	.5000	2	●	2

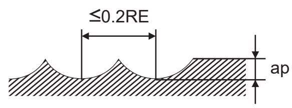
VF2SB – Inch sizes

Ball nose, Short cut length, 2 flute, For hardened materials

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened steel(45−55HRC) AISI H13 etc.							Hardened steel (55−62HRC) AISI D2 etc.						
RE (inch)	α≤15°			α>15°			Depth of cut ap (inch)	α≤15°			α>15°			Depth of cut ap (inch)
	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)		Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	
R .0156	40000	6400	252	40000	2400	94.5	.0020	40000	4000	157	40000	1600	63	.0016
R .0313	40000	9600	378	40000	4000	157	.0039	40000	8000	315	30000	2400	94.5	.0031
R .0469	40000	10000	394	33000	4600	182	.0047	36000	7900	312	20000	2400	94.5	.0043
R .0625	38000	11000	433	25000	4000	157	.0051	30000	7200	283	15000	2100	82.7	.0047
R .0938	27000	9700	383	17000	3100	122	.0067	20000	5600	220	10000	1800	70.9	.0055
R .1250	20000	8000	315	13000	2600	102	.0098	15000	4500	177	7500	1500	59.1	.0079
R .1563	16000	6400	252	10000	2000	78.7	.0118	12000	3600	142	6000	1200	47.2	.0079
R .1875	13000	5200	205	8400	1700	66.9	.0197	10000	3000	118	5000	1000	39.4	.0079
R .2500	8500	3400	134	5700	1100	43.3	.0197	6500	2100	82.7	3400	680	26.8	.0118

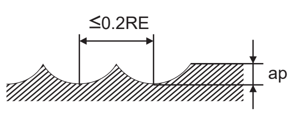
Depth of cut



RE : Radius

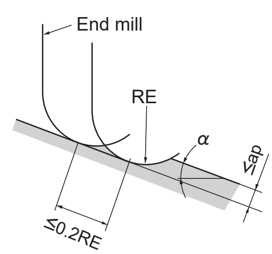
Workpiece Material	Hardened steel (62−70HRC) AISI W1, AISI M2 etc.						
RE (inch)	α≤15°			α>15°			Depth of cut ap (inch)
	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	
R .0156	40000	2800	110	40000	1600	63	.0012
R .0313	30000	4200	165	20000	1200	47.2	.0024
R .0469	20000	3600	142	13000	900	35.4	.0031
R .0625	15000	3000	118	10000	800	31.5	.0035
R .0938	10000	2200	86.6	6300	630	24.8	.0039
R .1250	7500	1700	66.9	4800	580	22.7	.0043
R .1563	6000	1400	55.1	4000	480	18.9	.0043
R .1875	5000	1100	43.3	3200	450	17.6	.0047
R .2500	3400	750	29.4	2000	280	11	.0047

Depth of cut



RE : Radius

Note 1) α is the inclination of the machined surface.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

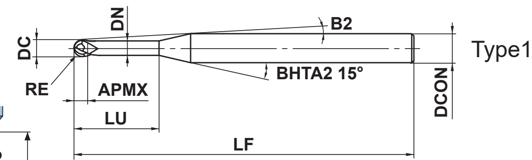


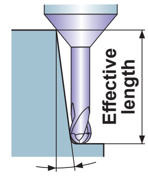
VF2XLBS

Ball nose, 2 flute, Long neck, Short shank

UWC VF 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	Aluminum Alloy
○	◎	◎	◎				





0.2≤RE≤1			
±0.007			
DCON=4			
0 - 0.008			

h6

- 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

★ : Stocked in Japan

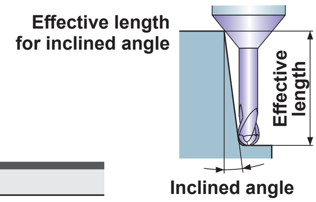
ISO13399 ➤ I002

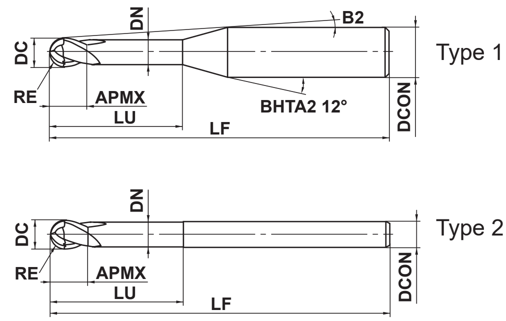
VF2XLB

Ball nose, 2 flute, Long neck

UWC VF 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	Aluminum Alloy
○	◎	◎	◎				





RE≤1	RE＞1		
±0.007	±0.010		
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

●: USA Stock ★: Stocked 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°
VF2XLBR0020N030S06	0.2	0.4	0.32	3	0.36	10°	50	6	2	●	1	3.1	3.2	3.5	3.9
VF2XLBR0020N040S04	0.2	0.4	0.32	4	0.36	8.4°	50	4	2	●	1	4.1	4.3	4.7	5.2
VF2XLBR0020N050S04	0.2	0.4	0.32	5	0.36	7.8°	50	4	2	●	1	5.2	5.4	5.9	6.6
VF2XLBR0025N015S04	0.25	0.5	0.4	1.5	0.46	10.5°	50	4	2	●	1	1.5	1.6	1.7	1.9
VF2XLBR0025N015S06	0.25	0.5	0.4	1.5	0.46	11°	50	6	2	●	1	1.5	1.6	1.7	1.9
VF2XLBR0025N020S04	0.25	0.5	0.4	2	0.46	10°	50	4	2	●	1	2.0	2.1	2.3	2.6
VF2XLBR0025N020S06	0.25	0.5	0.4	2	0.46	10.6°	50	6	2	●	1	2.0	2.1	2.3	2.6
VF2XLBR0025N025S04	0.25	0.5	0.4	2.5	0.46	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
VF2XLBR0025N030S04	0.25	0.5	0.4	3	0.46	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
VF2XLBR0025N030S06	0.25	0.5	0.4	3	0.46	10°	50	6	2	●	1	3.1	3.2	3.5	3.9
VF2XLBR0025N035S04	0.25	0.5	0.4	3.5	0.46	8.7°	50	4	2	●	1	3.6	3.8	4.1	4.5
VF2XLBR0025N040S04	0.25	0.5	0.4	4	0.46	8.3°	50	4	2	●	1	4.1	4.3	4.7	5.2
VF2XLBR0025N040S06	0.25	0.5	0.4	4	0.46	9.4°	50	6	2	●	1	4.1	4.3	4.7	5.2
VF2XLBR0025N050S04	0.25	0.5	0.4	5	0.46	7.7°	50	4	2	●	1	5.2	5.4	5.9	6.5
VF2XLBR0025N050S06	0.25	0.5	0.4	5	0.46	8.9°	50	6	2	●	1	5.2	5.4	5.9	6.5
VF2XLBR0025N060S04	0.25	0.5	0.4	6	0.46	7.2°	50	4	2	●	1	6.2	6.5	7.1	7.9
VF2XLBR0025N060S06	0.25	0.5	0.4	6	0.46	8.4°	60	6	2	●	1	6.2	6.5	7.1	7.9
VF2XLBR0030N020S04	0.3	0.6	0.48	2	0.56	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0030N020S06	0.3	0.6	0.48	2	0.56	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
VF2XLBR0030N025S04	0.3	0.6	0.48	2.5	0.56	9.4°	50	4	2	●	1	2.6	2.7	3.0	3.3
VF2XLBR0030N030S04	0.3	0.6	0.48	3	0.56	9°	50	4	2	●	1	3.1	3.3	3.6	3.9
VF2XLBR0030N030S06	0.3	0.6	0.48	3	0.56	9.9°	50	6	2	●	1	3.1	3.3	3.6	3.9
VF2XLBR0030N035S04	0.3	0.6	0.48	3.5	0.56	8.6°	50	4	2	●	1	3.6	3.8	4.2	4.6
VF2XLBR0030N040S04	0.3	0.6	0.48	4	0.56	8.3°	50	4	2	●	1	4.2	4.4	4.8	5.2
VF2XLBR0030N040S06	0.3	0.6	0.48	4	0.56	9.3°	50	6	2	●	1	4.2	4.4	4.8	5.2
VF2XLBR0030N050S04	0.3	0.6	0.48	5	0.56	7.6°	50	4	2	●	1	5.2	5.4	6.0	6.6
VF2XLBR0030N050S06	0.3	0.6	0.48	5	0.56	8.8°	50	6	2	●	1	5.2	5.4	6.0	6.6
VF2XLBR0030N060S04	0.3	0.6	0.48	6	0.56	7.1°	50	4	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0030N060S06	0.3	0.6	0.48	6	0.56	8.4°	50	6	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0030N070S04	0.3	0.6	0.48	7	0.56	6.6°	50	4	2	●	1	7.3	7.6	8.3	9.2
VF2XLBR0030N080S04	0.3	0.6	0.48	8	0.56	6.2°	50	4	2	●	1	8.3	8.7	9.5	10.6
VF2XLBR0030N080S06	0.3	0.6	0.48	8	0.56	7.6°	60	6	2	●	1	8.3	8.7	9.5	10.6
VF2XLBR0040N020S04	0.4	0.8	0.64	2	0.76	9.9°	50	4	2	●	1	2.1	2.2	2.3	2.6
VF2XLBR0040N020S06	0.4	0.8	0.64	2	0.76	10.6°	50	6	2	●	1	2.1	2.2	2.3	2.6
VF2XLBR0040N030S04	0.4	0.8	0.64	3	0.76	8.9°	50	4	2	●	1	3.1	3.3	3.5	3.9
VF2XLBR0040N030S06	0.4	0.8	0.64	3	0.76	9.9°	50	6	2	●	1	3.1	3.3	3.5	3.9
VF2XLBR0040N040S04	0.4	0.8	0.64	4	0.76	8.2°	50	4	2	●	1	4.2	4.3	4.7	5.2
VF2XLBR0040N040S06	0.4	0.8	0.64	4	0.76	9.3°	50	6	2	●	1	4.2	4.3	4.7	5.2
VF2XLBR0040N050S04	0.4	0.8	0.64	5	0.76	7.5°	50	4	2	●	1	5.2	5.4	5.9	6.5
VF2XLBR0040N060S04	0.4	0.8	0.64	6	0.76	7°	50	4	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0040N060S06	0.4	0.8	0.64	6	0.76	8.3°	50	6	2	●	1	6.3	6.5	7.1	7.9
VF2XLBR0040N070S04	0.4	0.8	0.64	7	0.76	6.5°	50	4	2	●	1	7.3	7.6	8.3	9.2
VF2XLBR0040N080S04	0.4	0.8	0.64	8	0.76	6.1°	50	4	2	●	1	8.3	8.7	9.5	10.5
VF2XLBR0040N080S06	0.4	0.8	0.64	8	0.76	7.5°	50	6	2	●	1	8.3	8.7	9.5	10.5
VF2XLBR0040N100S04	0.4	0.8	0.64	10	0.76	5.4°	50	4	2	●	1	10.4	10.9	11.9	13.2
VF2XLBR0040N100S06	0.4	0.8	0.64	10	0.76	6.8°	60	6	2	●	1	10.4	10.9	11.9	13.2
VF2XLBR0050N030S04	0.5	1	0.8	3	0.94	8.8°	50	4	2	●	1	3.2	3.3	3.6	4.0
VF2XLBR0050N030S06	0.5	1	0.8	3	0.94	9.8°	50	6	2	●	1	3.2	3.3	3.6	4.0
VF2XLBR0050N040S04	0.5	1	0.8	4	0.94	8°	50	4	2	●	1	4.2	4.4	4.8	5.3
VF2XLBR0050N040S06	0.5	1	0.8	4	0.94	9.2°	50	6	2	●	1	4.2	4.4	4.8	5.3
VF2XLBR0050N050S04	0.5	1	0.8	5	0.94	7.3°	50	4	2	●	1	5.3	5.5	6.0	6.7

ISO13399 ➤ I002

VF2XLB

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°
VF2XLBR0050N050S06	0.5	1	0.8	5	0.94	8.7°	50	6	2	●	1	5.3	5.5	6.0	6.7
VF2XLBR0050N060S04	0.5	1	0.8	6	0.94	6.8°	50	4	2	●	1	6.3	6.6	7.2	8.0
VF2XLBR0050N060S06	0.5	1	0.8	6	0.94	8.2°	50	6	2	●	1	6.3	6.6	7.2	8.0
VF2XLBR0050N070S04	0.5	1	0.8	7	0.94	6.3°	50	4	2	●	1	7.4	7.7	8.4	9.3
VF2XLBR0050N080S04	0.5	1	0.8	8	0.94	5.9°	50	4	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0050N080S06	0.5	1	0.8	8	0.94	7.4°	50	6	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0050N090S04	0.5	1	0.8	9	0.94	5.5°	50	4	2	●	1	9.5	9.9	10.8	12.0
VF2XLBR0050N100S04	0.5	1	0.8	10	0.94	5.2°	50	4	2	●	1	10.5	11.0	12.0	13.3
VF2XLBR0050N100S06	0.5	1	0.8	10	0.94	6.7°	50	6	2	●	1	10.5	11.0	12.0	13.3
VF2XLBR0050N120S04	0.5	1	0.8	12	0.94	4.6°	50	4	2	●	1	12.6	13.2	14.4	15.9
VF2XLBR0050N120S06	0.5	1	0.8	12	0.94	6.1°	60	6	2	●	1	12.6	13.2	14.4	15.9
VF2XLBR0050N140S04	0.5	1	0.8	14	0.94	4.2°	60	4	2	★	1	14.7	15.3	16.8	18.6
VF2XLBR0050N160S04	0.5	1	0.8	16	0.94	3.8°	60	4	2	★	1	16.8	17.5	19.2	21.3
VF2XLBR0050N160S06	0.5	1	0.8	16	0.94	5.3°	70	6	2	★	1	16.8	17.5	19.2	21.3
VF2XLBR0050N180S04	0.5	1	0.8	18	0.94	3.5°	60	4	2	★	1	18.9	19.7	21.6	23.9
VF2XLBR0050N200S04	0.5	1	0.8	20	0.94	3.3°	60	4	2	★	1	21.0	21.9	24.0	26.6
VF2XLBR0050N200S06	0.5	1	0.8	20	0.94	4.6°	70	6	2	★	1	21.0	21.9	24.0	26.6
VF2XLBR0060N060S04	0.6	1.2	0.96	6	1.14	6.6°	50	4	2	★	1	6.3	6.6	7.2	8.0
VF2XLBR0060N060S06	0.6	1.2	0.96	6	1.14	8.1°	50	6	2	★	1	6.3	6.6	7.2	8.0
VF2XLBR0060N080S04	0.6	1.2	0.96	8	1.14	5.7°	50	4	2	★	1	8.4	8.8	9.6	10.6
VF2XLBR0060N080S06	0.6	1.2	0.96	8	1.14	7.3°	50	6	2	★	1	8.4	8.8	9.6	10.6
VF2XLBR0060N100S04	0.6	1.2	0.96	10	1.14	5°	50	4	2	★	1	10.5	11.0	12.0	13.3
VF2XLBR0060N100S06	0.6	1.2	0.96	10	1.14	6.6°	50	6	2	★	1	10.5	11.0	12.0	13.3
VF2XLBR0060N120S04	0.6	1.2	0.96	12	1.14	4.5°	50	4	2	★	1	12.6	13.2	14.4	15.9
VF2XLBR0060N120S06	0.6	1.2	0.96	12	1.14	6°	50	6	2	★	1	12.6	13.2	14.4	15.9
VF2XLBR0060N140S04	0.6	1.2	0.96	14	1.14	4°	60	4	2	★	1	14.7	15.3	16.8	18.6
VF2XLBR0060N160S04	0.6	1.2	0.96	16	1.14	3.7°	60	4	2	★	1	16.8	17.5	19.2	21.2
VF2XLBR0060N160S06	0.6	1.2	0.96	16	1.14	5.2°	70	6	2	★	1	16.8	17.5	19.2	21.2
VF2XLBR0070N080S04	0.7	1.4	1.12	8	1.34	5.5°	50	4	2	★	1	8.4	8.8	9.6	10.6
VF2XLBR0070N120S04	0.7	1.4	1.12	12	1.34	4.3°	50	4	2	★	1	12.6	13.1	14.4	15.9
VF2XLBR0070N160S04	0.7	1.4	1.12	16	1.34	3.5°	60	4	2	★	1	16.8	17.5	19.2	21.2
VF2XLBR0075N060S04	0.75	1.5	1.2	6	1.44	6.3°	50	4	2	●	1	6.3	6.6	7.2	7.9
VF2XLBR0075N060S06	0.75	1.5	1.2	6	1.44	8°	50	6	2	●	1	6.3	6.6	7.2	7.9
VF2XLBR0075N080S04	0.75	1.5	1.2	8	1.44	5.4°	50	4	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0075N080S06	0.75	1.5	1.2	8	1.44	7.2°	50	6	2	●	1	8.4	8.8	9.6	10.6
VF2XLBR0075N100S04	0.75	1.5	1.2	10	1.44	4.7°	50	4	2	●	1	10.5	11.0	12.0	13.2
VF2XLBR0075N100S06	0.75	1.5	1.2	10	1.44	6.5°	50	6	2	●	1	10.5	11.0	12.0	13.2
VF2XLBR0075N120S04	0.75	1.5	1.2	12	1.44	4.2°	50	4	2	●	1	12.6	13.1	14.4	15.9
VF2XLBR0075N120S06	0.75	1.5	1.2	12	1.44	5.9°	50	6	2	●	1	12.6	13.1	14.4	15.9
VF2XLBR0075N140S04	0.75	1.5	1.2	14	1.44	3.8°	50	4	2	●	1	14.7	15.3	16.8	18.5
VF2XLBR0075N140S06	0.75	1.5	1.2	14	1.44	5.4°	50	6	2	●	1	14.7	15.3	16.8	18.5
VF2XLBR0075N160S04	0.75	1.5	1.2	16	1.44	3.4°	60	4	2	●	1	16.8	17.5	19.2	21.2
VF2XLBR0075N160S06	0.75	1.5	1.2	16	1.44	5°	60	6	2	●	1	16.8	17.5	19.2	21.2
VF2XLBR0075N180S04	0.75	1.5	1.2	18	1.44	3.1°	60	4	2	●	1	18.9	19.7	21.6	23.8
VF2XLBR0075N200S04	0.75	1.5	1.2	20	1.44	2.9°	60	4	2	★	1	21.0	21.9	23.9	*
VF2XLBR0075N200S06	0.75	1.5	1.2	20	1.44	4.3°	70	6	2	★	1	21.0	21.9	23.9	26.5
VF2XLBR0080N080S04	0.8	1.6	1.28	8	1.54	5.3°	50	4	2	★	1	8.4	8.8	9.6	10.5
VF2XLBR0080N120S04	0.8	1.6	1.28	12	1.54	4.1°	50	4	2	★	1	12.6	13.1	14.4	15.9
VF2XLBR0080N160S04	0.8	1.6	1.28	16	1.54	3.3°	60	4	2	★	1	16.8	17.5	19.1	21.2
VF2XLBR0080N200S04	0.8	1.6	1.28	20	1.54	2.8°	60	4	2	★	1	21.0	21.9	23.9	*
VF2XLBR0090N080S04	0.9	1.8	1.44	8	1.74	5.1°	50	4	2	★	1	8.4	8.8	9.6	10.5

* No interference

●: USA Stock ★: Stocked 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°
VF2XLBR0090N120S04	0.9	1.8	1.44	12	1.74	3.9°	50	4	2	★	1	12.6	13.1	14.3	15.8
VF2XLBR0090N160S04	0.9	1.8	1.44	16	1.74	3.1°	60	4	2	★	1	16.8	17.5	19.1	21.1
VF2XLBR0090N200S04	0.9	1.8	1.44	20	1.74	2.6°	60	4	2	★	1	20.9	21.8	23.9	*
VF2XLBR0100N060S04	1	2	1.6	6	1.9	5.8°	50	4	2	●	1	6.2	6.5	7.0	7.7
VF2XLBR0100N060S06	1	2	1.6	6	1.9	7.9°	50	6	2	●	1	6.2	6.5	7.0	7.7
VF2XLBR0100N080S04	1	2	1.6	8	1.9	4.9°	50	4	2	●	1	8.3	8.7	9.4	10.4
VF2XLBR0100N080S06	1	2	1.6	8	1.9	6.9°	50	6	2	●	1	8.3	8.7	9.4	10.4
VF2XLBR0100N100S04	1	2	1.6	10	1.9	4.2°	50	4	2	●	1	10.4	10.9	11.8	13.0
VF2XLBR0100N100S06	1	2	1.6	10	1.9	6.2°	50	6	2	●	1	10.4	10.9	11.8	13.0
VF2XLBR0100N120S04	1	2	1.6	12	1.9	3.7°	50	4	2	●	1	12.5	13.0	14.2	15.7
VF2XLBR0100N120S06	1	2	1.6	12	1.9	5.6°	50	6	2	●	1	12.5	13.0	14.2	15.7
VF2XLBR0100N140S04	1	2	1.6	14	1.9	3.3°	50	4	2	●	1	14.6	15.2	16.6	18.3
VF2XLBR0100N140S06	1	2	1.6	14	1.9	5.1°	50	6	2	●	1	14.6	15.2	16.6	18.3
VF2XLBR0100N160S04	1	2	1.6	16	1.9	2.9°	60	4	2	●	1	16.7	17.4	19.0	*
VF2XLBR0100N160S06	1	2	1.6	16	1.9	4.7°	60	6	2	●	1	16.7	17.4	19.0	21.0
VF2XLBR0100N180S04	1	2	1.6	18	1.9	2.7°	60	4	2	●	1	18.8	19.6	21.4	*
VF2XLBR0100N180S06	1	2	1.6	18	1.9	4.4°	60	6	2	●	1	18.8	19.6	21.4	23.6
VF2XLBR0100N200S04	1	2	1.6	20	1.9	2.5°	60	4	2	●	1	20.9	21.8	23.8	*
VF2XLBR0100N200S06	1	2	1.6	20	1.9	4.1°	60	6	2	●	1	20.9	21.8	23.8	26.3
VF2XLBR0100N220S04	1	2	1.6	22	1.9	2.3°	60	4	2	●	1	22.9	23.9	26.2	*
VF2XLBR0100N250S04	1	2	1.6	25	1.9	2°	70	4	2	★	1	26.1	27.2	*	*
VF2XLBR0100N250S06	1	2	1.6	25	1.9	3.5°	70	6	2	★	1	26.1	27.2	29.8	32.9
VF2XLBR0100N300S04	1	2	1.6	30	1.9	1.7°	70	4	2	★	1	31.3	32.6	*	*
VF2XLBR0100N300S06	1	2	1.6	30	1.9	3°	80	6	2	★	1	31.3	32.6	35.8	*
VF2XLBR0100N350S04	1	2	1.6	35	1.9	1.5°	80	4	2	★	1	36.5	38.1	*	*
VF2XLBR0125N100S06	1.25	2.5	2	10	2.4	5.9°	60	6	2	★	1	10.4	10.8	11.8	12.9
VF2XLBR0125N150S06	1.25	2.5	2	15	2.4	4.6°	60	6	2	★	1	15.6	16.3	17.8	19.6
VF2XLBR0125N200S06	1.25	2.5	2	20	2.4	3.7°	70	6	2	★	1	20.8	21.7	23.8	26.2
VF2XLBR0125N250S06	1.25	2.5	2	25	2.4	3.2°	70	6	2	★	1	26.1	27.2	29.7	32.9
VF2XLBR0125N300S06	1.25	2.5	2	30	2.4	2.8°	80	6	2	★	1	31.3	32.6	35.7	*
VF2XLBR0125N350S06	1.25	2.5	2	35	2.4	2.4°	80	6	2	★	1	36.5	38.1	41.7	*
VF2XLBR0150N080S06	1.5	3	2.4	8	2.9	6.3°	60	6	2	●	1	8.3	8.6	9.3	10.2
VF2XLBR0150N100S06	1.5	3	2.4	10	2.9	5.5°	60	6	2	●	1	10.4	10.8	11.7	12.9
VF2XLBR0150N120S06	1.5	3	2.4	12	2.9	4.9°	60	6	2	●	1	12.5	13.0	14.1	15.5
VF2XLBR0150N140S06	1.5	3	2.4	14	2.9	4.4°	60	6	2	●	1	14.6	15.2	16.5	18.2
VF2XLBR0150N160S06	1.5	3	2.4	16	2.9	4°	60	6	2	●	1	16.7	17.3	18.9	20.8
VF2XLBR0150N200S06	1.5	3	2.4	20	2.9	3.4°	70	6	2	●	1	20.8	21.7	23.7	26.1
VF2XLBR0150N250S06	1.5	3	2.4	25	2.9	2.8°	70	6	2	●	1	26.1	27.2	29.7	*
VF2XLBR0150N300S06	1.5	3	2.4	30	2.9	2.5°	70	6	2	●	1	31.3	32.6	35.7	*
VF2XLBR0150N350S06	1.5	3	2.4	35	2.9	2.2°	80	6	2	★	1	36.5	38.0	41.7	*
VF2XLBR0150N400S06	1.5	3	2.4	40	2.9	1.9°	90	6	2	★	1	41.7	43.5	*	*
VF2XLBR0175N160S06	1.75	3.5	2.8	16	3.4	3.6°	60	6	2	★	1	16.7	17.3	18.9	20.8
VF2XLBR0175N200S06	1.75	3.5	2.8	20	3.4	3°	70	6	2	★	1	20.8	21.7	23.7	*
VF2XLBR0175N250S06	1.75	3.5	2.8	25	3.4	2.5°	70	6	2	★	1	26.0	27.1	29.6	*
VF2XLBR0175N300S06	1.75	3.5	2.8	30	3.4	2.1°	80	6	2	★	1	31.3	32.6	35.6	*
VF2XLBR0175N350S06	1.75	3.5	2.8	35	3.4	1.9°	80	6	2	★	1	36.5	38.0	*	*
VF2XLBR0175N400S06	1.75	3.5	2.8	40	3.4	1.7°	90	6	2	★	1	41.7	43.5	*	*
VF2XLBR0200N100S06	2	4	3.2	10	3.9	4.5°	70	6	2	●	1	10.4	10.8	11.6	12.7
VF2XLBR0200N120S06	2	4	3.2	12	3.9	3.9°	70	6	2	●	1	12.5	12.9	14.0	15.4
VF2XLBR0200N140S06	2	4	3.2	14	3.9	3.4°	70	6	2	●	1	14.6	15.1	16.4	18.0
VF2XLBR0200N160S06	2	4	3.2	16	3.9	3.1°	70	6	2	●	1	16.6	17.3	18.8	20.7

* No interference

VF2XLB

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°
VF2XLBR0200N200S06	2	4	3.2	20	3.9	2.6°	70	6	2	●	1	20.8	21.7	23.6	*
VF2XLBR0200N250S06	2	4	3.2	25	3.9	2.1°	70	6	2	●	1	26.0	27.1	29.6	*
VF2XLBR0200N300S06	2	4	3.2	30	3.9	1.8°	70	6	2	●	1	31.2	32.6	*	*
VF2XLBR0200N350S06	2	4	3.2	35	3.9	1.6°	80	6	2	●	1	36.5	38.0	*	*
VF2XLBR0200N400S06	2	4	3.2	40	3.9	1.4°	90	6	2	★	1	41.7	43.5	*	*
VF2XLBR0200N450S06	2	4	3.2	45	3.9	1.2°	90	6	2	★	1	46.9	48.9	*	*
VF2XLBR0200N500S06	2	4	3.2	50	3.9	1.1°	100	6	2	★	1	52.1	54.3	*	*
VF2XLBR0250N200S06	2.5	5	4	20	4.9	1.5°	70	6	2	★	1	20.8	21.6	*	*
VF2XLBR0250N250S06	2.5	5	4	25	4.9	1.2°	70	6	2	★	1	26.0	27.1	*	*
VF2XLBR0250N300S06	2.5	5	4	30	4.9	1°	80	6	2	★	1	31.2	*	*	*
VF2XLBR0250N350S06	2.5	5	4	35	4.9	0.9°	80	6	2	★	1	36.4	*	*	*
VF2XLBR0300N300S06	3	6	4.8	30	5.85	—	80	6	2	●	2	*	*	*	*
VF2XLBR0300N400S06	3	6	4.8	40	5.85	—	90	6	2	●	2	*	*	*	*
VF2XLBR0300N500S06	3	6	4.8	50	5.85	—	100	6	2	●	2	*	*	*	*

* No interference

●: USA Stock ★: Stocked in Japan

ISO13399 ➤ I002

VF2XLBS
Ball nose, 2 flute, Long neck, Short shank

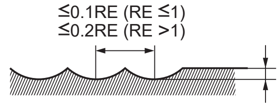
VF2XLB
Ball nose, 2 flute, Long neck

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.			
RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)
R 0.1	0.5	40000	300	11.8	0.003	40000	300	11.8	0.002
	1	40000	300	11.8	0.002	40000	300	11.8	0.002
	1.5	40000	300	11.8	0.001	40000	200	7.9	0.001
	2	40000	200	7.9	0.001	40000	100	3.9	0.001
	2.5	40000	100	3.9	0.001	40000	60	2.4	0.001
R 0.15	1	40000	500	19.7	0.007	40000	500	19.7	0.005
	1.5	40000	500	19.7	0.005	40000	500	19.7	0.003
	2	40000	500	19.7	0.003	40000	500	19.7	0.002
	2.5	40000	400	15.7	0.003	40000	400	15.7	0.002
	3	40000	300	11.8	0.002	40000	300	11.8	0.001
	4	30000	200	7.9	0.002	30000	200	7.9	0.001
R 0.2	1	40000	1400	55.1	0.015	40000	1400	55.1	0.01
	1.5	40000	1000	39.4	0.01	40000	1000	39.4	0.006
	2	40000	1000	39.4	0.01	40000	1000	39.4	0.006
	2.5	40000	700	27.6	0.005	40000	700	27.6	0.003
	3	40000	700	27.6	0.005	40000	700	27.6	0.003
	4	40000	600	23.6	0.004	40000	500	19.7	0.003
	5	40000	400	15.7	0.003	40000	300	11.8	0.002
R 0.25	1.5	40000	2000	78.7	0.02	40000	2000	78.7	0.015
	2	40000	2000	78.7	0.02	40000	2000	78.7	0.015
	3	40000	1200	47.2	0.015	40000	1200	47.2	0.01
	4	36000	900	35.4	0.01	36000	900	35.4	0.007
	5	36000	700	27.6	0.007	36000	600	23.6	0.005
	6	36000	600	23.6	0.006	36000	500	19.7	0.004
R 0.3	2	40000	2800	110.2	0.03	40000	2800	110.2	0.02
	3	40000	2800	110.2	0.03	40000	2800	110.2	0.02
	4	35000	2000	78.7	0.02	35000	2000	78.7	0.015
	5	30000	1000	39.4	0.01	30000	1000	39.4	0.007
	6	30000	800	31.5	0.008	30000	800	31.5	0.005
	7	30000	600	23.6	0.008	30000	600	23.6	0.005
	8	25000	400	15.7	0.006	25000	400	15.7	0.004
R 0.4	2	40000	3500	137.8	0.04	40000	3500	137.8	0.03
	3	40000	3000	118.1	0.04	40000	3000	118.1	0.03
	4	40000	3000	118.1	0.02	40000	3000	118.1	0.015
	6	30000	1600	63.0	0.02	30000	1600	63.0	0.01
	8	25000	1000	39.4	0.01	25000	1000	39.4	0.007
	10	25000	600	23.6	0.008	25000	600	23.6	0.005
R 0.5	3	40000	4000	157.5	0.05	40000	4000	157.5	0.04
	4	40000	4000	157.5	0.05	40000	4000	157.5	0.04
	5	40000	3000	118.1	0.03	40000	3000	118.1	0.02
	6	35000	2000	78.7	0.03	35000	2000	78.7	0.02
	8	30000	1600	63.0	0.02	30000	1600	63.0	0.01
	10	20000	1000	39.4	0.01	20000	1000	39.4	0.01
	12	20000	1000	39.4	0.01	18000	800	31.5	0.008
	14	18000	600	23.6	0.008	18000	480	18.9	0.008
	16	18000	500	19.7	0.008	18000	400	15.7	0.006
	18	13000	300	11.8	0.005	13000	240	9.4	0.004
	20	13000	250	9.8	0.005	13000	200	7.9	0.004
R 0.6	6	40000	4000	157.5	0.05	35000	3500	137.8	0.04
	8	40000	3000	118.1	0.05	27000	2000	78.7	0.04
	10	27000	1900	74.8	0.03	24000	1700	66.9	0.02
	12	16000	1100	43.3	0.02	16000	1000	39.4	0.01
	14	16000	850	33.5	0.01	16000	780	30.7	0.01
	16	15000	500	19.7	0.01	14000	400	15.7	0.006
R 0.7	8	40000	4500	177.2	0.06	28000	3200	126.0	0.05
	12	32000	3000	118.1	0.03	19000	1800	70.9	0.02
	16	15000	1000	39.4	0.02	14000	800	31.5	0.01
R 0.75	6	40000	5000	196.9	0.07	32000	4000	157.5	0.06
	8	40000	5000	196.9	0.07	28000	3500	137.8	0.06
	10	40000	4500	117.2	0.06	21000	2400	94.5	0.04
	12	32000	3400	133.9	0.04	19000	2000	78.7	0.03
	14	16000	1500	59.1	0.04	13000	1200	47.2	0.03
	16	13000	1200	47.2	0.03	13000	1200	47.2	0.02

Workpiece Material		Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.			
RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)
R 0.75	18	13000	1100	43.3	0.02	10000	800	31.5	0.02
	20	12000	900	35.4	0.02	9000	700	27.6	0.01
R 0.8	8	40000	5000	196.9	0.08	26000	3200	126.0	0.07
	12	35000	3800	149.6	0.05	20000	2100	82.7	0.03
	16	13000	1200	47.2	0.04	12000	1100	43.3	0.02
	20	10000	750	29.5	0.02	8000	600	23.6	0.01
R 0.9	8	40000	5000	196.9	0.09	25000	3100	122.0	0.08
	12	36000	3800	149.6	0.06	18000	1900	74.8	0.04
	16	25000	2500	98.4	0.04	14000	1300	51.2	0.025
	20	10000	1000	39.4	0.03	8000	800	31.5	0.02
R 1	6	40000	6000	236.2	0.1	24000	3400	133.9	0.1
	8	40000	5000	196.9	0.1	24000	3000	118.1	0.1
	10	40000	5000	196.9	0.08	24000	3000	118.1	0.07
	12	40000	5000	196.9	0.08	24000	2600	102.4	0.05
	14	40000	5000	196.9	0.06	21000	2300	90.6	0.05
	16	32000	3500	137.8	0.05	16000	1700	66.9	0.03
	18	24000	2400	94.5	0.04	13000	1300	51.2	0.03
	20	10000	1000	39.4	0.04	10000	1000	39.4	0.03
	22	10000	1000	39.4	0.04	10000	1000	39.4	0.02
	25	10000	1000	39.4	0.04	8000	800	31.5	0.02
	30	10000	800	31.5	0.02	8000	800	31.5	0.015
	35	10000	500	19.7	0.02	8000	400	15.7	0.01
R 1.25	10	36000	5000	196.9	0.12	20000	2600	102.4	0.11
	15	36000	4600	181.1	0.08	18000	2000	78.7	0.075
	20	26000	3000	118.1	0.07	13000	1400	55.1	0.05
	25	10000	1100	43.3	0.06	8000	800	31.5	0.04
	30	8000	800	31.5	0.05	7000	700	27.6	0.03
	35	8000	500	19.7	0.03	5000	400	15.7	0.03
R 1.5	8	32000	6400	252.0	0.15	16000	3000	118.1	0.15
	10	32000	5100	200.8	0.15	16000	2200	86.6	0.15
	12	32000	5100	200.8	0.13	16000	2200	86.6	0.13
	14	32000	4500	177.2	0.13	16000	2200	86.6	0.1
	16	32000	4500	177.2	0.1	16000	1800	70.9	0.1
	20	27000	3800	149.6	0.1	14000	1600	63.0	0.06
	25	21000	2700	106.3	0.08	11000	1200	47.2	0.06
	30	9000	1000	39.4	0.08	7000	700	27.6	0.05
	35	6000	700	27.6	0.06	6000	600	23.6	0.04
	40	6000	600	23.6	0.04	5000	400	15.7	0.03
R 1.75	16	28000	4200	165.4	0.13	14000	1600	63.0	0.13
	20	26000	3800	149.6	0.13	13000	1600	63.0	0.11
	25	23000	3300	129.9	0.12	11000	1200	47.2	0.08
	30	13000	1900	74.8	0.09	9000	1000	39.4	0.07
	35	9000	1200	47.2	0.08	6000	600	23.6	0.06
	40	8500	1100	43.3	0.07	5500	500	19.7	0.04
R 2	10	24000	4800	189.0	0.2	12000	2200	86.6	0.2
	12	24000	4800	189.0	0.2	12000	2200	86.6	0.2
	14	24000	3800	149.6	0.15	12000	1500	59.1	0.15
	16	24000	3800	149.6	0.15	12000	1500	59.1	0.15
	20	24000	3800	149.6	0.15	12000	1500	59.1	0.15
	25	24000	3800	149.6	0.15	10000	1100	43.3	0.1
	30	20000	3000	118.1	0.1	10000	1100	43.3	0.08
	35	12000	1700	66.9	0.1	8000	900	35.4	0.08
	40	11000	1500	59.1	0.1	5000	500	19.7	0.06
	45	10000	1300	51.2	0.08	5000	500	19.7	0.05
	50	8000	1000	39.4	0.05	4000	400	15.7	0.04
R 2.5	20	19000	3400	133.9	0.2	10000	1400	55.1	0.2
	25	19000	3400	133.9	0.2	10000	1400	55.1	0.2
	30	19000	3200	126.0	0.15	8000	1000	39.4	0.15
	35	16000	2700	106.3	0.1	8000	900	35.4	0.1
R 3	30	16000	3500	137.8	0.2	8000	1000	39.4	0.2
	40	16000	3000	118.1	0.15	8000	800	31.5	0.15
	50	16000	2700	106.3	0.15	6000	500	19.7	0.15

Depth of cut



RE : Radius

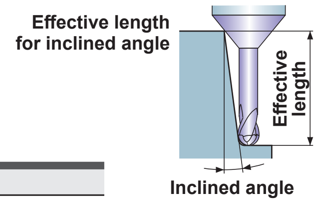
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

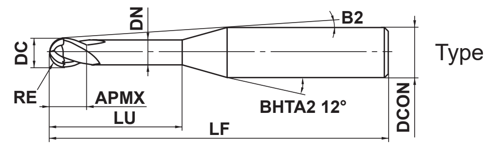
VF2XLB – Inch sizes

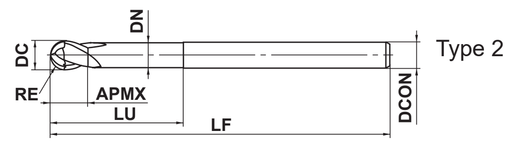
Ball nose, 2 flute, Long neck

UWC VF 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	Aluminum Alloy
○	◎	◎	◎				







.0156"≤RE≤.1250"		
±0.002"		
DCON=.2500"		
h5: 0 / - 0.00024"		

● 2 flute long neck ball nose end mill with Impact Miracle coating for high hardened materials.

(inch)

Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 0.5°	1°	2°	3°
VF2XLB D1/32N4D	.0156	.0313	.0313	.1250	.0296	9.9°	2.5	.2500	2	●	1	.130	.134	.146	.161
VF2XLB D1/32N6D	.0156	.0313	.0313	.1875	.0296	9.1°	2.5	.2500	2	●	1	.197	.205	.221	.244
VF2XLB D1/16N4D	.0313	.0625	.0625	.2500	.0601	8.0°	2.5	.2500	2	●	1	.264	.276	.299	.331
VF2XLB D1/16N6D	.0313	.0625	.0625	.3750	.0601	6.8°	2.5	.2500	2	●	1	.394	.409	.449	.496
VF2XLB D3/32N4D	.0469	.0938	.0938	.3750	.0898	6.4°	2.5	.2500	2	●	1	.390	.406	.441	.484
VF2XLB D3/32N6D	.0469	.0938	.0938	.5625	.0898	5.1°	2.5	.2500	2	●	1	.587	.610	.665	.736
VF2XLB D1/8N4D	.0625	.1250	.1250	.5000	.1211	4.9°	3.0	.2500	2	●	1	.520	.539	.591	.646
VF2XLB D1/8N6D	.0625	.1250	.1250	.7500	.1211	3.7°	3.0	.2500	2	●	1	.780	.815	.886	.980
VF2XLB D3/16N4D	.0938	.1875	.1875	.7500	.1835	2.3°	3.0	.2500	2	●	1	.780	.811	.882	*
VF2XLB D3/16N6D	.0938	.1875	.1875	1.1250	.1835	1.6°	3.0	.2500	2	●	1	1.169	1.221	*	*
VF2XLB D1/4N4D	.1250	.2500	.2500	1.0000	.2441	–	3.5	.2500	2	●	2	*	*	*	*
VF2XLB D1/4N6D	.1250	.2500	.2500	1.5000	.2441	–	3.5	.2500	2	●	2	*	*	*	*

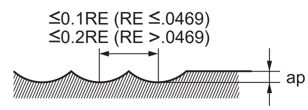
* No interference

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
RE (inch)	**LU** (inch)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)
R .0156	**.1250**	40000	3000	118	.0016	40000	3000	118	.0012
R .0156	**.1875**	32000	1700	67	.0012	32000	1700	67	.0004
R .0313	**.2500**	40000	5000	197	.0031	26000	3300	129	.0028
R .0313	**.3750**	36000	3900	153	.0024	20000	2200	86	.0012
R .0469	**.3750**	37000	5200	204	.0047	20000	2600	102	.0043
R .0469	**.5625**	37000	4800	189	.0031	20000	2200	86.6	.0030
R .0625	**.5000**	30000	4800	189	.0051	15000	2100	82.6	.0051
R .0625	**.7500**	30000	4200	165	.0039	13000	1500	59	.0024
R .0938	**.7500**	20000	3600	142	.0079	10000	1400	55.1	.0071
R .0938	**1.1250**	20000	3400	134	.0059	8400	1100	43.3	.0055
R .1250	**1.0000**	15000	3300	130	.0079	7500	950	37.2	.0079
R .1250	**1.5000**	15000	3000	118	.0059	7500	750	29.5	.0059

Depth of cut



RE : Radius

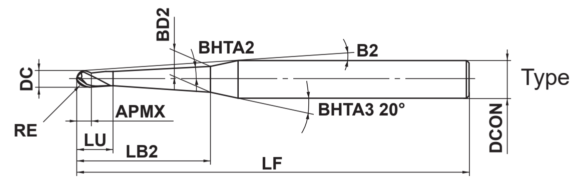
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Cutting conditions may differ considerably due to the overhang, depth of cut, and machine tool conditions. Please use the above table as a start reference point.

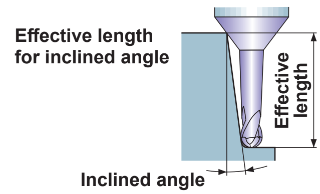
VF3XB

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

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	Aluminum Alloy
○	◎	◎	◎				





0.4≤RE≤2.5				
±0.01				
4≤DCON≤6	DCON=8			
0 - 0.008	0 - 0.009			

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

(mm)

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	BD2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 0.5°	1°	2°	3°
VF3XBR0040T0024L006	0.4	0.8	0.4°	0.5	6	1.5	8.9°	0.82	60	4	3	★	1	6.3	6.6	6.9	7.3
VF3XBR0040T0024L008	0.4	0.8	0.4°	0.5	8	1.5	7.5°	0.85	60	4	3	★	1	8.4	8.6	9.1	9.5
VF3XBR0040T0024L012	0.4	0.8	0.4°	0.5	12	1.5	5.7°	0.91	60	4	3	★	1	12.4	12.7	13.4	14.1
VF3XBR0040T0054L008	0.4	0.8	0.9°	0.5	8	1.5	7.6°	0.96	60	4	3	★	1	—	8.4	8.9	9.3
VF3XBR0040T0054L012	0.4	0.8	0.9°	0.5	12	1.5	5.8°	1.09	60	4	3	★	1	—	12.4	13.1	13.8
VF3XBR0040T0054L016	0.4	0.8	0.9°	0.5	16	1.5	4.7°	1.22	60	4	3	★	1	—	16.5	17.3	18.3
VF3XBR0050T0024L008	0.5	1	0.4°	0.8	8	2.3	9.6°	1.02	60	6	3	●	1	8.5	8.8	9.3	9.8
VF3XBR0050T0024L010	0.5	1	0.4°	0.8	10	2.3	8.5°	1.05	60	6	3	●	1	10.5	10.9	11.4	12.1
VF3XBR0050T0024L012	0.5	1	0.4°	0.8	12	2.3	7.6°	1.08	60	6	3	●	1	12.6	13.0	13.6	14.4
VF3XBR0050T0024L016	0.5	1	0.4°	0.8	16	2.3	6.3°	1.13	70	6	3	●	1	16.6	17.1	18.0	18.9
VF3XBR0050T0024L020	0.5	1	0.4°	0.8	20	2.3	5.4°	1.19	70	6	3	★	1	20.6	21.2	22.3	23.5
VF3XBR0050T0024L025	0.5	1	0.4°	0.8	25	2.3	4.6°	1.26	70	6	3	★	1	25.7	26.3	27.7	29.3
VF3XBR0050T0024L030	0.5	1	0.4°	0.8	30	2.3	4.0°	1.33	80	6	3	★	1	30.7	31.5	33.1	35.0
VF3XBR0050T0024L035	0.5	1	0.4°	0.8	35	2.3	3.5°	1.40	80	6	3	★	1	35.7	36.6	38.6	40.7
VF3XBR0050T0054L008	0.5	1	0.9°	0.8	8	2.3	9.7°	1.12	60	6	3	●	1	—	8.6	9.1	9.6
VF3XBR0050T0054L012	0.5	1	0.9°	0.8	12	2.3	7.7°	1.24	60	6	3	●	1	—	12.6	13.3	14.1
VF3XBR0050T0054L016	0.5	1	0.9°	0.8	16	2.3	6.4°	1.37	70	6	3	●	1	—	16.7	17.6	18.5
VF3XBR0050T0054L020	0.5	1	0.9°	0.8	20	2.3	5.5°	1.50	70	6	3	●	1	—	20.7	21.8	23.0
VF3XBR0050T0054L025	0.5	1	0.9°	0.8	25	2.3	4.7°	1.65	70	6	3	★	1	—	25.7	27.1	28.6
VF3XBR0050T0054L030	0.5	1	0.9°	0.8	30	2.3	4.0°	1.81	80	6	3	★	1	—	30.8	32.4	34.2
VF3XBR0050T0054L035	0.5	1	0.9°	0.8	35	2.3	3.6°	1.97	80	6	3	★	1	—	35.8	37.7	39.8
VF3XBR0050T0054L040	0.5	1	0.9°	0.8	40	2.3	3.2°	2.12	80	6	3	★	1	—	40.8	43.0	45.4
VF3XBR0050T0054L050	0.5	1	0.9°	0.8	50	2.3	2.7°	2.44	110	6	3	★	1	—	50.9	53.6	*
VF3XBR0050T0054L060	0.5	1	0.9°	0.8	60	2.3	2.3°	2.75	110	6	3	★	1	—	60.9	64.1	*
VF3XBR0050T0054L070	0.5	1	0.9°	0.8	70	2.3	2.0°	3.07	110	6	3	★	1	—	71.0	74.7	*
VF3XBR0050T0130L012	0.5	1	1.5°	0.8	12	2.3	7.9°	1.45	60	6	3	★	1	—	—	13.0	13.7
VF3XBR0050T0130L016	0.5	1	1.5°	0.8	16	2.3	6.5°	1.66	70	6	3	★	1	—	—	17.1	18.0
VF3XBR0050T0130L020	0.5	1	1.5°	0.8	20	2.3	5.6°	1.87	70	6	3	★	1	—	—	21.2	22.4
VF3XBR0050T0130L025	0.5	1	1.5°	0.8	25	2.3	4.8°	2.13	70	6	3	★	1	—	—	26.3	27.8
VF3XBR0050T0130L030	0.5	1	1.5°	0.8	30	2.3	4.1°	2.39	80	6	3	★	1	—	—	31.5	33.2
VF3XBR0050T0130L035	0.5	1	1.5°	0.8	35	2.3	3.7°	2.65	80	6	3	★	1	—	—	36.6	38.6

* No interference

(mm)

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	BD2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
VF3XBR0075T0024L010	0.75	1.5	0.4°	1.3	10	2.8	8.1°	1.54	60	6	3	●	1	10.6	10.9	11.4	12.0
VF3XBR0075T0024L015	0.75	1.5	0.4°	1.3	15	2.8	6.2°	1.61	60	6	3	●	1	15.6	16.0	16.9	17.8
VF3XBR0075T0024L020	0.75	1.5	0.4°	1.3	20	2.8	5.0°	1.68	70	6	3	●	1	20.6	21.2	22.3	23.5
VF3XBR0075T0024L030	0.75	1.5	0.4°	1.3	30	2.8	3.7°	1.82	80	6	3	●	1	30.7	31.5	33.1	35.0
VF3XBR0075T0054L015	0.75	1.5	0.9°	1.3	15	2.8	6.3°	1.82	60	6	3	●	1	—	15.7	16.5	17.4
VF3XBR0075T0054L020	0.75	1.5	0.9°	1.3	20	2.8	5.1°	1.98	70	6	3	●	1	—	20.7	21.8	23.0
VF3XBR0075T0054L030	0.75	1.5	0.9°	1.3	30	2.8	3.7°	2.29	80	6	3	●	1	—	30.8	32.4	34.2
VF3XBR0075T0054L040	0.75	1.5	0.9°	1.3	40	2.8	3.0°	2.61	80	6	3	★	1	—	40.8	43.0	45.3
VF3XBR0075T0130L015	0.75	1.5	1.5°	1.3	15	2.8	6.4°	2.08	60	6	3	★	1	—	—	16.1	17.0
VF3XBR0075T0130L020	0.75	1.5	1.5°	1.3	20	2.8	5.2°	2.34	70	6	3	★	1	—	—	21.2	22.4
VF3XBR0075T0130L030	0.75	1.5	1.5°	1.3	30	2.8	3.8°	2.86	80	6	3	★	1	—	—	31.5	33.2
VF3XBR0100T0024L016	1	2	0.4°	1.6	16	3.6	5.5°	2.07	70	6	3	●	1	16.7	17.1	18.0	19.0
VF3XBR0100T0024L020	1	2	0.4°	1.6	20	3.6	4.6°	2.13	70	6	3	●	1	20.7	21.3	22.3	23.5
VF3XBR0100T0024L025	1	2	0.4°	1.6	25	3.6	3.9°	2.20	70	6	3	●	1	25.8	26.4	27.8	29.3
VF3XBR0100T0024L030	1	2	0.4°	1.6	30	3.6	3.4°	2.27	80	6	3	●	1	30.8	31.6	33.2	35.0
VF3XBR0100T0024L035	1	2	0.4°	1.6	35	3.6	2.9°	2.34	80	6	3	●	1	35.8	36.7	38.6	*
VF3XBR0100T0024L040	1	2	0.4°	1.6	40	3.6	2.6°	2.41	80	6	3	●	1	40.8	41.9	44.0	*
VF3XBR0100T0054L020	1	2	0.9°	1.6	20	3.6	4.7°	2.42	70	6	3	●	1	—	20.8	21.9	23.0
VF3XBR0100T0054L025	1	2	0.9°	1.6	25	3.6	4.0°	2.57	70	6	3	●	1	—	25.8	27.2	28.6
VF3XBR0100T0054L030	1	2	0.9°	1.6	30	3.6	3.4°	2.73	80	6	3	●	1	—	30.9	32.5	34.2
VF3XBR0100T0054L035	1	2	0.9°	1.6	35	3.6	3.0°	2.89	80	6	3	●	1	—	35.9	37.7	39.8
VF3XBR0100T0054L040	1	2	0.9°	1.6	40	3.6	2.7°	3.04	80	6	3	●	1	—	40.9	43.0	*
VF3XBR0100T0054L050	1	2	0.9°	1.6	50	3.6	2.2°	3.36	110	6	3	★	1	—	51.0	53.6	*
VF3XBR0100T0054L060	1	2	0.9°	1.6	60	3.6	1.9°	3.67	110	6	3	★	1	—	61.0	*	*
VF3XBR0100T0054L070	1	2	0.9°	1.6	70	3.6	1.6°	3.99	110	6	3	★	1	—	71.1	*	*
VF3XBR0100T0130L025	1	2	1.5°	1.6	25	3.6	4.1°	3.02	70	6	3	★	1	—	—	26.4	27.9
VF3XBR0100T0130L030	1	2	1.5°	1.6	30	3.6	3.5°	3.28	80	6	3	★	1	—	—	31.6	33.3
VF3XBR0100T0130L035	1	2	1.5°	1.6	35	3.6	3.1°	3.54	80	6	3	★	1	—	—	36.7	38.7
VF3XBR0100T0130L040	1	2	1.5°	1.6	40	3.6	2.7°	3.81	80	6	3	★	1	—	—	41.8	*
VF3XBR0125T0054L020	1.25	2.5	0.9°	2	20	4.5	4.3°	2.89	60	6	3	★	1	—	20.8	21.9	23.1
VF3XBR0125T0054L030	1.25	2.5	0.9°	2	30	4.5	3.1°	3.20	80	6	3	★	1	—	30.9	32.5	34.2
VF3XBR0125T0054L040	1.25	2.5	0.9°	2	40	4.5	2.4°	3.52	80	6	3	★	1	—	40.9	43.1	*
VF3XBR0125T0130L020	1.25	2.5	1.5°	2	20	4.5	4.4°	3.21	60	6	3	★	1	—	—	21.4	22.5
VF3XBR0125T0130L030	1.25	2.5	1.5°	2	30	4.5	3.1°	3.74	80	6	3	★	1	—	—	31.6	33.3
VF3XBR0125T0130L040	1.25	2.5	1.5°	2	40	4.5	2.5°	4.26	80	6	3	★	1	—	—	41.9	*
VF3XBR0150T0024L020	1.5	3	0.4°	2	20	5	3.8°	3.11	60	6	3	●	1	20.7	21.3	22.3	23.5
VF3XBR0150T0024L025	1.5	3	0.4°	2	25	5	3.1°	3.18	80	6	3	●	1	25.8	26.4	27.7	29.2
VF3XBR0150T0024L030	1.5	3	0.4°	2	30	5	2.7°	3.25	80	6	3	●	1	30.8	31.6	33.2	*
VF3XBR0150T0024L040	1.5	3	0.4°	2	40	5	2.1°	3.39	80	6	3	●	1	40.9	41.9	44.0	*
VF3XBR0150T0024L050	1.5	3	0.4°	2	50	5	1.7°	3.53	100	6	3	●	1	50.9	52.2	*	*
VF3XBR0150T0054L020	1.5	3	0.9°	2	20	5	3.8°	3.37	60	6	3	●	1	—	20.9	21.9	23.0
VF3XBR0150T0054L030	1.5	3	0.9°	2	30	5	2.7°	3.69	80	6	3	●	1	—	30.9	32.5	*
VF3XBR0150T0054L040	1.5	3	0.9°	2	40	5	2.1°	4.00	80	6	3	●	1	—	41.0	43.1	*
VF3XBR0150T0054L050	1.5	3	0.9°	2	50	5	1.7°	4.31	100	6	3	●	1	—	51.0	*	*
VF3XBR0150T0054L060	1.5	3	0.9°	2	60	5	2.3°	4.63	110	8	3	●	1	—	61.1	64.2	*
VF3XBR0150T0054L070	1.5	3	0.9°	2	70	5	2.0°	4.94	120	8	3	●	1	—	71.1	74.8	*
VF3XBR0150T0130L040	1.5	3	1.5°	2	40	5	2.2°	4.73	80	6	3	★	1	—	—	41.9	*
VF3XBR0150T0130L050	1.5	3	1.5°	2	50	5	2.8°	5.26	110	8	3	★	1	—	—	52.2	*
VF3XBR0150T0130L060	1.5	3	1.5°	2	60	5	2.4°	5.78	110	8	3	★	1	—	—	62.4	*
VF3XBR0150T0130L070	1.5	3	1.5°	2	70	5	2.1°	6.30	120	8	3	★	1	—	—	72.7	*
VF3XBR0200T0054L030	2	4	0.9°	3	30	6	3.5°	4.65	90	8	3	●	1	—	30.9	32.5	34.2

* No interference

VF3XB

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

(mm)

Order Number	RE	DC	BHTA2	APMX	LB2	LU	B2	BD2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle			
														0.5°	1°	2°	3°
VF3XBR0200T0054L040	2	4	0.9°	3	40	6	2.7°	4.97	90	8	3	●	1	—	41.0	43.0	*
VF3XBR0200T0054L050	2	4	0.9°	3	50	6	2.2°	5.28	110	8	3	●	1	—	51.0	53.6	*
VF3XBR0200T0054L060	2	4	0.9°	3	60	6	1.9°	5.60	110	8	3	●	1	—	61.1	*	*
VF3XBR0250T0054L035	2.5	5	0.9°	3.5	35	6.5	2.4°	5.80	90	8	3	●	1	—	35.9	37.7	*
VF3XBR0250T0054L040	2.5	5	0.9°	3.5	40	6.5	2.2°	5.95	90	8	3	●	1	—	41.0	43.0	*
VF3XBR0250T0054L050	2.5	5	0.9°	3.5	50	6.5	1.8°	6.27	110	8	3	●	1	—	51.0	*	*
VF3XBR0250T0054L060	2.5	5	0.9°	3.5	60	6.5	1.5°	6.58	110	8	3	●	1	—	61.1	*	*

* No interference

● : USA Stock

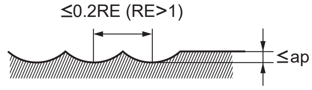
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material			Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.				Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
RE (mm)	BHTA2	LB2 (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
R0.4	**0.4°**	**6**	34000	2700	106.3	0.03	31000	2200	86.6	0.025	24000	1700	66.9	0.02	19000	1400	55.1	0.015
		8	31000	2100	82.7	0.02	29000	1700	66.9	0.02	22000	1300	51.2	0.015	18000	1000	39.4	0.01
		12	28000	2000	78.7	0.015	26000	1600	63.0	0.01	20000	1200	47.2	0.01	16000	960	37.8	0.007
	0.9°	**8**	31000	2200	86.6	0.02	29000	1800	70.9	0.02	22000	1400	55.1	0.015	18000	1100	43.3	0.01
		12	28000	2100	82.7	0.015	26000	1700	66.9	0.01	20000	1300	51.2	0.01	16000	1000	39.4	0.007
		16	25000	1100	43.3	0.01	23000	910	35.8	0.01	18000	700	27.6	0.008	14000	560	22.0	0.006
R0.5	**0.4°**	**8**	27000	2700	106.3	0.04	25000	2200	86.6	0.04	19000	1700	66.9	0.03	15000	1400	55.1	0.02
		10	24000	2200	86.6	0.03	22000	1800	70.9	0.025	17000	1400	55.1	0.02	14000	1100	43.3	0.015
		12	24000	2200	86.6	0.03	22000	1800	70.9	0.025	17000	1400	55.1	0.02	14000	1100	43.3	0.015
		16	22000	2100	82.7	0.03	21000	1700	66.9	0.025	16000	1300	51.2	0.02	13000	1000	39.4	0.015
		20	20000	1400	55.1	0.015	18000	1200	47.2	0.01	14000	900	35.4	0.01	11000	720	28.3	0.007
		25	18000	1300	51.2	0.015	17000	1000	39.4	0.01	13000	800	31.5	0.009	10000	640	25.2	0.006
		30	15000	960	37.8	0.01	14000	780	30.7	0.01	11000	600	23.6	0.008	8800	480	18.9	0.006
		35	14000	800	31.5	0.008	13000	650	25.6	0.007	10000	500	19.7	0.006	8000	400	15.7	0.004
	0.9°	**8**	27000	2900	114.2	0.04	25000	2300	90.6	0.04	19000	1800	70.9	0.03	15000	1400	55.1	0.02
		12	24000	2400	94.5	0.03	22000	2000	78.7	0.025	17000	1500	59.1	0.02	14000	1200	47.2	0.015
		16	22000	2200	86.6	0.03	21000	1800	70.9	0.025	16000	1400	55.1	0.02	13000	1100	43.3	0.015
		20	20000	1600	63.0	0.015	18000	1300	51.2	0.01	14000	1000	39.4	0.01	11000	800	31.5	0.007
		25	18000	1400	55.1	0.015	17000	1200	47.2	0.01	13000	900	35.4	0.009	10000	720	28.3	0.006
		30	15000	1100	43.3	0.01	14000	910	35.8	0.009	11000	700	27.6	0.008	8800	560	22.0	0.006
		35	14000	960	37.8	0.008	13000	780	30.7	0.007	10000	600	23.6	0.006	8000	480	18.9	0.004
		40	11000	800	31.5	0.007	11000	650	25.6	0.006	8000	500	19.7	0.005	6400	400	15.7	0.003
		50	8400	610	24.0	0.006	7800	490	19.3	0.005	6000	380	15.0	0.004	4800	300	11.8	0.003
		60	7000	510	20.1	0.004	6500	400	15.7	0.004	5000	320	12.6	0.003	4000	260	10.2	0.002
		70	7000	480	18.9	0.003	6500	390	15.4	0.002	5000	300	11.8	0.002	4000	240	9.4	0.001
	1.5°	**12**	24000	2600	102.4	0.03	22000	2100	82.7	0.025	17000	1600	63.0	0.02	14000	1300	51.2	0.015
		16	22000	2400	94.5	0.03	21000	2000	78.7	0.025	16000	1500	59.1	0.02	13000	1200	47.2	0.015
		20	20000	1800	70.9	0.015	18000	1400	55.1	0.01	14000	1100	43.3	0.01	11000	880	34.6	0.007
		25	18000	1600	63.0	0.015	17000	1300	51.2	0.01	13000	1000	39.4	0.009	11000	800	31.5	0.006
		30	15000	1300	51.2	0.01	14000	1000	39.4	0.01	11000	800	31.5	0.008	8800	640	25.2	0.006
		35	14000	1100	43.3	0.008	13000	910	35.8	0.007	10000	700	27.6	0.006	8000	560	22.0	0.004

Depth of cut

≤0.1RE (RE≤1)
≤0.2RE (RE>1)



RE : Radius

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

VF3XB

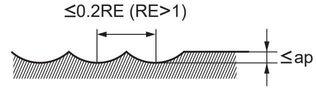
Ball nose, Medium cut length, 3 flute, Taper neck

RECOMMENDED CUTTING CONDITIONS

Workpiece Material			Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.				Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
RE (mm)	BHTA2	LB2 (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
R0.75	0.4°	10	18000	2700	106.3	0.06	17000	2200	86.6	0.05	13000	1700	66.9	0.04	10000	1400	55.1	0.03
		15	17000	2200	86.6	0.04	16000	1800	70.9	0.04	12000	1400	55.1	0.03	9600	1100	43.3	0.02
		20	17000	2100	82.7	0.03	16000	1700	66.9	0.025	12000	1300	51.2	0.02	9600	1000	39.4	0.015
		30	14000	1600	63.0	0.015	13000	1300	51.2	0.01	10000	1000	39.4	0.01	8000	800	31.5	0.007
	0.9°	15	17000	2400	94.5	0.04	16000	2000	78.7	0.04	12000	1500	59.1	0.03	9600	1200	47.2	0.02
		20	17000	2200	86.6	0.03	16000	1800	70.9	0.025	12000	1400	55.1	0.02	9600	1100	43.3	0.015
		30	14000	1800	70.9	0.015	13000	1400	55.1	0.01	10000	1100	43.3	0.01	8000	880	34.6	0.007
		40	13000	1300	51.2	0.01	12000	1000	39.4	0.01	9000	800	31.5	0.008	7200	640	25.2	0.006
	1.5°	15	17000	2600	102.4	0.04	16000	2100	82.7	0.04	12000	1600	63.0	0.03	9600	1300	51.2	0.02
		20	17000	2400	94.5	0.03	16000	2000	78.7	0.025	12000	1500	59.1	0.02	9600	1200	47.2	0.015
		30	14000	2000	78.7	0.015	13000	1600	63.0	0.01	10000	1200	47.2	0.01	8000	960	37.8	0.007
R1	0.4°	16	15000	3200	126.0	0.07	14000	2600	102.4	0.06	11000	2000	78.7	0.05	8800	1600	63.0	0.03
		20	14000	2400	94.5	0.06	13000	2000	78.7	0.05	10000	1500	59.1	0.04	8000	1200	47.2	0.03
		25	14000	2100	82.7	0.04	13000	1700	66.9	0.04	10000	1300	51.2	0.03	8000	1000	39.4	0.02
		30	13000	1800	70.9	0.03	12000	1400	55.1	0.03	9000	1100	43.3	0.025	7200	880	34.6	0.02
		35	13000	1600	63.0	0.03	12000	1300	51.2	0.025	9000	1000	39.4	0.02	7200	800	31.5	0.015
		40	12000	1400	55.1	0.015	11000	1200	47.2	0.01	8500	900	35.4	0.01	6800	720	28.3	0.007
	0.9°	20	14000	2600	102.4	0.06	13000	2100	82.7	0.05	10000	1600	63.0	0.04	8000	1300	51.2	0.03
		25	14000	2200	86.6	0.05	13000	1800	70.9	0.04	10000	1400	55.1	0.03	8000	1100	43.3	0.025
		30	13000	1900	74.8	0.04	12000	1600	63.0	0.04	9000	1200	47.2	0.03	7200	960	37.8	0.02
		35	13000	1800	70.9	0.04	12000	1400	55.1	0.03	9000	1100	43.3	0.025	7200	880	34.6	0.02
		40	12000	1600	63.0	0.03	11000	1300	51.2	0.025	8500	1000	39.4	0.02	6800	800	31.5	0.015
		50	11000	1400	55.1	0.015	10000	1200	47.2	0.01	8000	900	35.4	0.01	6400	720	28.3	0.007
		60	9800	1100	43.3	0.007	9100	910	35.8	0.006	7000	700	27.6	0.005	5600	560	22.0	0.003
		70	8400	960	37.8	0.004	7800	780	30.7	0.004	6000	600	23.6	0.003	4800	480	18.9	0.002
	1.5°	25	14000	2400	94.5	0.05	13000	2000	78.7	0.04	10000	1500	59.1	0.03	8000	1200	47.2	0.025
		30	12600	2100	82.7	0.04	12000	1700	66.9	0.04	9000	1300	51.2	0.03	7200	1000	39.4	0.02
		35	13000	1900	74.8	0.04	12000	1600	63.0	0.03	9000	1200	47.2	0.025	7200	960	37.8	0.02
		40	12000	1800	70.9	0.03	11000	1400	55.1	0.025	8500	1100	43.3	0.02	6800	880	34.6	0.015
R1.25	0.9°	20	13000	2900	114.2	0.06	12000	2300	90.6	0.05	9000	1800	70.9	0.04	7200	1400	55.1	0.03
		30	12000	2600	102.4	0.05	11000	2100	82.7	0.04	8500	1600	63.0	0.03	6800	1300	51.2	0.025
		40	11000	2200	86.6	0.04	9800	1800	70.9	0.04	7500	1400	55.1	0.03	6000	1100	43.3	0.02
	1.5°	20	13000	3000	118.1	0.06	12000	2500	98.4	0.05	9000	1900	74.8	0.04	7200	1500	59.1	0.03
		30	12000	2700	106.3	0.05	11050	2200	86.6	0.04	8500	1700	66.9	0.03	6800	1400	55.1	0.025
		40	11000	2400	94.5	0.04	9800	2000	78.7	0.04	7500	1500	59.1	0.03	6000	1200	47.2	0.02

Depth of cut

≤0.1RE (RE≤1)
≤0.2RE (RE>1)

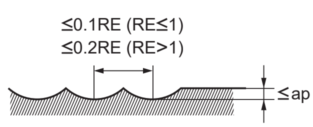


RE : Radius

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

Workpiece Material			Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.				Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.				Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.			
RE (mm)	BHTA2	LB2 (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
R1.5	**0.4°**	**20**	12000	3700	145.7	0.13	11000	3000	118.1	0.1	8500	2300	90.6	0.09	6800	1800	70.9	0.06
		30	11000	2900	114.2	0.07	10000	2300	90.6	0.06	8000	1800	70.9	0.05	6400	1400	55.1	0.03
		40	11000	2400	94.5	0.06	10000	2000	78.7	0.05	8000	1500	59.1	0.04	6400	1200	47.2	0.03
		50	11000	2000	78.7	0.04	9800	1600	63.0	0.04	7500	1200	47.2	0.03	6000	960	37.8	0.02
	0.9°	**20**	12000	3800	149.6	0.13	11000	3100	122.0	0.1	8500	2400	94.5	0.09	6800	1900	74.8	0.06
		30	11000	3000	118.1	0.07	10000	2500	98.4	0.06	8000	1900	74.8	0.05	6400	1500	59.1	0.03
		40	11000	2600	102.4	0.06	10000	2100	82.7	0.05	8000	1600	63.0	0.04	6400	1300	51.2	0.03
		50	11000	2100	82.7	0.04	9800	1700	66.9	0.04	7500	1300	51.2	0.03	6000	1000	39.4	0.02
		60	9800	2000	78.7	0.03	9100	1600	63.0	0.025	7000	1200	47.2	0.02	5600	960	37.8	0.015
		70	9800	1800	70.9	0.015	9100	1400	55.1	0.01	7000	1100	43.3	0.01	5600	880	34.6	0.007
	1.5°	**50**	11000	2200	86.6	0.04	9800	1800	70.9	0.04	7500	1400	55.1	0.03	6000	1100	43.3	0.02
		60	9800	2100	82.7	0.03	9100	1700	66.9	0.025	7000	1300	51.2	0.02	5600	1000	39.4	0.015
		70	9800	2000	78.7	0.015	9100	1600	63.0	0.01	7000	1200	47.2	0.01	5600	960	37.8	0.007
R2	**0.9°**	**30**	10000	3200	126.0	0.3	9400	2600	102.4	0.25	7200	2000	78.7	0.2	5800	1600	63.0	0.15
		40	9500	2400	94.5	0.15	8800	2000	78.7	0.12	6800	1500	59.1	0.1	5400	1200	47.2	0.07
		50	9500	2100	82.7	0.1	8800	1700	66.9	0.1	6800	1300	51.2	0.08	5400	1000	39.4	0.06
		60	9000	1900	74.8	0.07	8300	1600	63.0	0.06	6400	1200	47.2	0.05	5100	960	37.8	0.03
R2.5	**0.9°**	**35**	8000	3500	137.8	0.3	7400	2900	114.2	0.25	5700	2200	86.6	0.2	4600	1800	70.9	0.15
		40	8000	3200	126.0	0.2	7400	2600	102.4	0.18	5700	2000	78.7	0.15	4600	1600	63.0	0.1
		60	7600	2400	94.5	0.15	7000	2000	78.7	0.12	5400	1500	59.1	0.1	4300	1200	47.2	0.07

Depth of cut



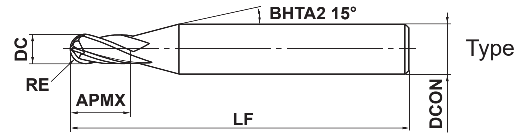
RE : Radius

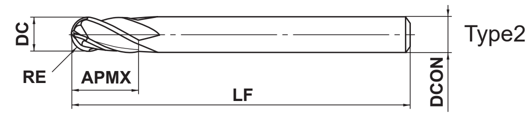
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

VF4MB

Ball nose, Medium cut length, 4 flute

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





0.5≤RE≤6				
±0.01				
DCON=6	8≤DCON≤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

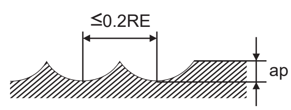
 ● : USA Stock

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened steel (45−55HRC) AISI H13 etc.							Hardened steel (55−62HRC) AISI D2 etc.						
RE (mm)	α≤15°			α>15°			Depth of cut ap (mm)	α≤15°			α>15°			Depth of cut ap (mm)
	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)		Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	
R0.5	40000	8000	315.0	40000	3800	149.6	0.06	40000	5600	220.5	40000	3100	122.0	0.05
R1	40000	9600	378.0	40000	5600	220.5	0.11	40000	8000	315.0	28000	3100	122.0	0.10
R1.5	40000	12000	472.4	32000	5600	220.5	0.13	32000	7700	303.1	19000	2900	114.2	0.12
R2	32000	11000	433.1	24000	4700	185.0	0.15	24000	6200	244.1	14000	2500	98.4	0.13
R2.5	25000	9000	354.3	19000	3800	149.6	0.20	19000	5300	208.7	12000	2200	86.6	0.15
R3	21000	8400	330.7	15000	3400	133.9	0.25	16000	4800	189.0	9600	2000	78.7	0.20
R4	16000	6400	252.0	12000	2600	102.4	0.30	12000	3600	141.7	7200	1600	63.0	0.20
R5	13000	5200	204.7	9600	2200	86.6	0.50	10000	3200	126.0	5800	1300	51.2	0.20
R6	9000	3600	141.7	7200	1700	66.9	0.50	7000	2200	86.6	4300	940	37.0	0.30

Depth of cut



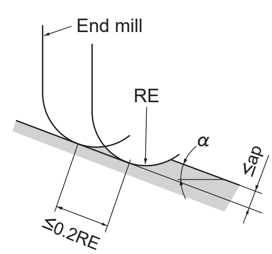
RE : Radius

Workpiece Material	Hardened steel (62−70HRC) AISI W1, AISI M2 etc.						
RE (mm)	α≤15°			α>15°			Depth of cut ap (mm)
	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	
R0.5	40000	4700	185.0	32000	1700	66.9	0.03
R1	24000	5000	196.9	16000	1200	47.2	0.06
R1.5	16000	4200	165.4	11000	1100	43.3	0.07
R2	12000	3100	122.0	8000	1000	39.4	0.08
R2.5	9600	2700	106.3	6000	780	30.7	0.08
R3	8000	2300	90.6	5000	780	30.7	0.09
R4	6000	1900	74.8	4000	620	24.4	0.09
R5	4800	1500	59.1	3000	550	21.7	0.10
R6	3600	1100	43.3	2200	400	15.7	0.10

Depth of cut

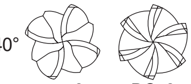
RE : Radius

Note 1) α is the inclination of the machined surface.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

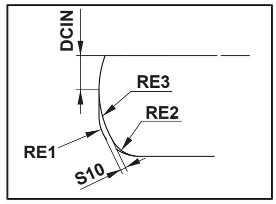


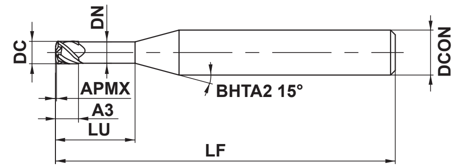
VFFDRB

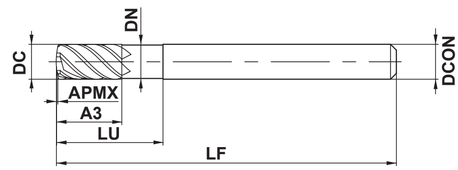
Multi-task corner radius end mill for impact miracle high speed cutting



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	Aluminum Alloy
	○	◎	◎				







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

● Multi-task corner radius type allows more efficient high feed.
● Adoption of multiple cuttings realized high feed cutting.

(mm)

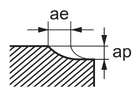
Order Number	DC	RE1 *1	APMX	A3 *3	LU	DN	LF	DCON	No. of Flutes	Multi-task radius part				RMPX *2	Stock	Type
										S10	DCIN	RE2	RE3			
VFFDRBD0300	3	0.64	0.18	3	10	2.8	60	6	4	0.08	0.75	0.5	2	2.1°	●	1
VFFDRBD0400	4	0.71	0.25	4	12	3.8	60	6	4	0.13	1	0.5	3	1.9°	●	1
VFFDRBD0600	6	0.92	0.36	9	18	5.6	80	6	4	0.21	1.5	0.6	5	1.7°	●	2
VFFDRBD0800	8	1.16	0.44	12	24	7.6	90	8	6	0.22	3.2	0.8	4.5	1.7°	●	2
VFFDRBD1000	10	1.47	0.57	15	30	9.4	100	10	6	0.28	4	1	5.5	1.7°	●	2
VFFDRBD1200	12	1.77	0.7	18	36	11.4	110	12	6	0.34	4.8	1.2	6.5	1.8°	●	2

*1 RE1 : Approx. R
*2 RMPX : Max. Ramping Angle
*3 A3 : Cutting Edge Effective Length

RECOMMENDED CUTTING CONDITIONS

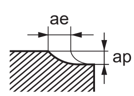
Workpiece Material	Carbon steel, Alloy steel (180—280HB), Alloy tool steel (≤350HB), Mild steel (≤180HB) AISI 1045, AISI 4140, ASTM A36, AISI 1010							Prehardened steel (35—45HRC) AISI P21, AISI P20, AISI 4340						
Dia. **DC** (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min^{-1})	Feed per Tooth (mm/t.)	Table Feed (mm/min)	Table Feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min^{-1})	Feed per Tooth (mm/t.)	Table Feed (mm/min)	Table Feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)
3	80	8500	0.07	2400	95.5	0.12	1.5	100	11000	0.07	3100	122.0	0.12	1.5
4	80	6400	0.1	2600	102.4	0.16	2	100	8000	0.1	3200	126.0	0.16	2
6	80	4200	0.17	2900	114.2	0.24	3	100	5300	0.17	3600	141.7	0.24	3
8	80	3200	0.17	3300	130.0	0.32	4.8	100	4000	0.17	4100	161.4	0.32	4.8
10	80	2500	0.2	3000	118.1	0.4	6	100	3200	0.2	3800	149.6	0.4	6
12	80	2100	0.22	2800	110.2	0.48	7.2	100	2700	0.22	3600	141.7	0.48	7.2

Depth of cut



Workpiece 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^{-1})	Feed per Tooth (mm/t.)	Table Feed (mm/min)	Table Feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)	Cutting Speed (m/min)	Main Spindle Revolution (min^{-1})	Feed per Tooth (mm/t.)	Table Feed (mm/min)	Table Feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)
3	80	8500	0.07	2400	94.5	0.12	1.5	40	4200	0.05	840	33.1	0.12	1.5
4	80	6400	0.1	2600	102.4	0.16	2	40	3200	0.07	960	37.8	0.16	2
6	80	4200	0.17	2900	114.2	0.24	3	40	2100	0.15	1300	51.2	0.24	3
8	80	3200	0.17	3300	129.9	0.32	4.8	40	1600	0.15	1400	55.1	0.32	4.8
10	80	2500	0.2	3000	118.1	0.4	6	40	1300	0.17	1300	51.2	0.4	6
12	80	2100	0.22	2800	110.2	0.48	7.2	40	1100	0.2	1300	51.2	0.48	7.2

Depth of cut



Note 1) When ramping process set the feed rate at 50%. A ramping angle of 1˚ is recommended.
Note 2) Use at a revolution of 70% and feed rate of 50% when the tool overhang exceeds 5D.

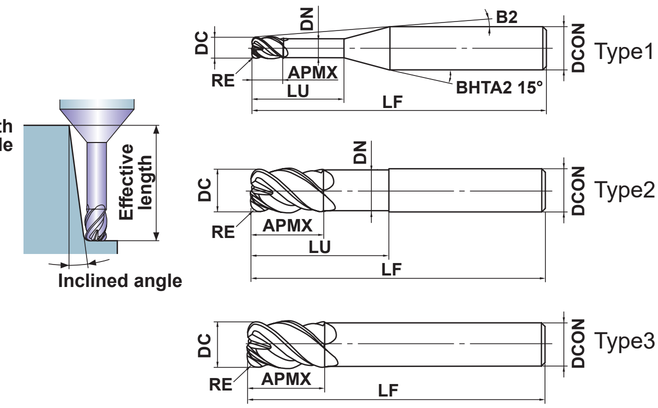
VFHVRB

4 flute, Corner radius, Short cut length, Irregular helix flutes

UWC VF 43° 45°

CARBIDE
SQUARE
BALL
RADIUS
TAPER
BARREL
ROUGHING
CHAMFER
I
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	Aluminum Alloy
◎	◎	◎	○	○	○		



DC≤10	DC>10		
±0.007	±0.01		
DC≤12	DC>12		
0 / - 0.02	0 / - 0.03		
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	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 0.5°	1°	2°	3°
VFHVRBD0100R02N004	1	0.2	1	4	0.94	10.6°	60	6	4	●	1	4.2	4.5	4.7	5.3
VFHVRBD0100R02N006	1	0.2	1	6	0.94	9.2°	60	6	4	●	1	6.4	6.7	7.2	7.7
VFHVRBD0100R02N008	1	0.2	1	8	0.94	8.2°	60	6	4	●	1	8.5	8.8	9.5	10.2
VFHVRBD0100R02N010	1	0.2	1	10	0.94	7.4°	60	6	4	●	1	10.5	11	11.8	12.7
VFHVRBD0100R02N015	1	0.2	1	15	0.94	5.9°	60	6	4	★	1	15.8	16.3	17.5	18.9
VFHVRBD0100R02N020	1	0.2	1	20	0.94	4.9°	80	6	4	★	1	20.9	21.7	23.3	25.1
VFHVRBD0150R03N004	1.5	0.3	1.5	4	1.44	10.3°	60	6	4	●	1	4.2	4.5	4.6	5.2
VFHVRBD0150R03N006	1.5	0.3	1.5	6	1.44	8.9°	60	6	4	●	1	6.3	6.6	7.2	7.7
VFHVRBD0150R03N010	1.5	0.3	1.5	10	1.44	7°	60	6	4	●	1	10.5	10.9	11.8	12.7
VFHVRBD0150R03N015	1.5	0.3	1.5	15	1.44	5.5°	60	6	4	●	1	15.7	16.3	17.5	18.9
VFHVRBD0150R03N020	1.5	0.3	1.5	20	1.44	4.6°	80	6	4	★	1	20.9	21.6	23.3	25.1
VFHVRBD0150R03N025	1.5	0.3	1.5	25	1.44	3.9°	80	6	4	★	1	26.1	27	29	31.3
VFHVRBD0150R03N030	1.5	0.3	1.5	30	1.44	3.4°	80	6	4	★	1	31.3	32.3	34.7	37.5
VFHVRBD0200R05N006	2	0.5	2	6	1.9	8.7°	60	6	4	●	1	6.3	6.5	7	7.5
VFHVRBD0200R05N010	2	0.5	2	10	1.9	6.7°	60	6	4	●	1	10.5	10.8	11.6	12.5
VFHVRBD0200R05N015	2	0.5	2	15	1.9	5.2°	60	6	4	●	1	15.6	16.2	17.4	18.7
VFHVRBD0200R05N020	2	0.5	2	20	1.9	4.3°	80	6	4	●	1	20.8	21.5	23.1	24.9
VFHVRBD0200R05N025	2	0.5	2	25	1.9	3.6°	80	6	4	★	1	26	26.9	28.9	31.2
VFHVRBD0200R05N030	2	0.5	2	30	1.9	3.1°	80	6	4	★	1	31.2	32.2	34.6	37.4
VFHVRBD0200R05N035	2	0.5	2	35	1.9	2.8°	90	6	4	★	1	36.3	37.6	40.4	*
VFHVRBD0200R05N040	2	0.5	2	40	1.9	2.5°	90	6	4	★	1	41.5	42.9	46.1	*
VFHVRBD0300R05N010	3	0.5	3	10	2.9	5.6°	60	6	4	●	1	10.5	10.8	11.6	12.5
VFHVRBD0300R05N015	3	0.5	3	15	2.9	4.3°	60	6	4	●	1	15.6	16.2	17.4	18.7
VFHVRBD0300R05N020	3	0.5	3	20	2.9	3.4°	80	6	4	●	1	20.8	21.5	23.1	24.9
VFHVRBD0300R05N030	3	0.5	3	30	2.9	2.5°	80	6	4	●	1	31.2	32.2	34.6	*
VFHVRBD0300R08N010	3	0.8	3	10	2.9	5.7°	60	6	4	●	1	10.4	10.8	11.6	12.4
VFHVRBD0300R08N015	3	0.8	3	15	2.9	4.3°	60	6	4	●	1	15.6	16.2	17.3	18.7
VFHVRBD0300R08N020	3	0.8	3	20	2.9	3.5°	80	6	4	●	1	20.8	21.5	23.1	24.9
VFHVRBD0300R08N030	3	0.8	3	30	2.9	2.5°	80	6	4	●	1	31.1	32.2	34.6	*
VFHVRBD0300R08N040	3	0.8	3	40	2.9	2°	90	6	4	★	1	41.5	42.9	*	*
VFHVRBD0300R08N050	3	0.8	3	50	2.9	1.6°	90	6	4	★	1	51.8	53.6	*	*
VFHVRBD0400R05N012	4	0.5	4	12	3.9	3.8°	60	6	4	●	1	12.5	13	13.9	15

* No interference

● : USA Stock ★ : Stocked 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°
VFHVRBD0400R05N020	4	0.5	4	20	3.9	2.5°	80	6	4	●	1	20.8	21.5	23.1	*
VFHVRBD0400R05N030	4	0.5	4	30	3.9	1.8°	80	6	4	●	1	31.2	32.2	*	*
VFHVRBD0400R05N048	4	0.5	4	48	3.9	1.2°	90	6	4	★	1	49.8	51.5	*	*
VFHVRBD0400R10N012	4	1	4	12	3.9	3.9°	60	6	4	●	1	12.5	12.9	13.8	14.9
VFHVRBD0400R10N020	4	1	4	20	3.9	2.5°	80	6	4	●	1	20.8	21.5	23	*
VFHVRBD0400R10N030	4	1	4	30	3.9	1.8°	80	6	4	●	1	31.1	32.2	*	*
VFHVRBD0600R05N018	6	0.5	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R05N030	6	0.5	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0600R10N018	6	1	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R10N030	6	1	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0600R10N054	6	1	9	54	5.85	—	90	6	4	★	2	*	*	*	*
VFHVRBD0600R15N018	6	1.5	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R15N030	6	1.5	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0600R15N042	6	1.5	9	42	5.85	—	90	6	4	●	2	*	*	*	*
VFHVRBD0600R15N054	6	1.5	9	54	5.85	—	90	6	4	★	2	*	*	*	*
VFHVRBD0600R20N018	6	2	9	18	5.85	—	60	6	4	●	2	*	*	*	*
VFHVRBD0600R20N030	6	2	9	30	5.85	—	80	6	4	●	2	*	*	*	*
VFHVRBD0700R15	7	1.5	11	—	—	—	80	6	4	★	3	*	*	*	*
VFHVRBD0800R05N024	8	0.5	12	24	7.85	—	60	8	4	★	2	*	*	*	*
VFHVRBD0800R05N040	8	0.5	12	40	7.85	—	100	8	4	★	2	*	*	*	*
VFHVRBD0800R10N024	8	1	12	24	7.85	—	60	8	4	●	2	*	*	*	*
VFHVRBD0800R10N040	8	1	12	40	7.85	—	100	8	4	●	2	*	*	*	*
VFHVRBD0800R20N024	8	2	12	24	7.85	—	60	8	4	●	2	*	*	*	*
VFHVRBD0800R20N040	8	2	12	40	7.85	—	100	8	4	●	2	*	*	*	*
VFHVRBD0800R20N056	8	2	12	56	7.85	—	120	8	4	●	2	*	*	*	*
VFHVRBD0800R20N072	8	2	12	72	7.85	—	120	8	4	●	2	*	*	*	*
VFHVRBD0900R20	9	2	13.5	—	—	—	100	8	4	★	3	*	*	*	*
VFHVRBD1000R05N030	10	0.5	15	30	9.7	—	70	10	4	★	2	*	*	*	*
VFHVRBD1000R05N050	10	0.5	15	50	9.7	—	110	10	4	★	2	*	*	*	*
VFHVRBD1000R10N030	10	1	15	30	9.7	—	70	10	4	●	2	*	*	*	*
VFHVRBD1000R10N050	10	1	15	50	9.7	—	110	10	4	●	2	*	*	*	*
VFHVRBD1000R20N030	10	2	15	30	9.7	—	70	10	4	●	2	*	*	*	*
VFHVRBD1000R20N050	10	2	15	50	9.7	—	110	10	4	●	2	*	*	*	*
VFHVRBD1000R20N070	10	2	15	70	9.7	—	150	10	4	★	2	*	*	*	*
VFHVRBD1000R20N090	10	2	15	90	9.7	—	150	10	4	★	2	*	*	*	*
VFHVRBD1100R20	11	2	16.5	—	—	—	110	10	4	★	3	*	*	*	*
VFHVRBD1200R05N036	12	0.5	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R05N060	12	0.5	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1200R10N036	12	1	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R10N060	12	1	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1200R20N036	12	2	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R20N060	12	2	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1200R20N084	12	2	18	84	11.7	—	160	12	4	★	2	*	*	*	*
VFHVRBD1200R20N108	12	2	18	108	11.7	—	160	12	4	★	2	*	*	*	*
VFHVRBD1200R30N036	12	3	18	36	11.7	—	80	12	4	●	2	*	*	*	*
VFHVRBD1200R30N060	12	3	18	60	11.7	—	120	12	4	●	2	*	*	*	*
VFHVRBD1300R30	13	3	19.5	—	—	—	120	12	4	★	3	*	*	*	*
VFHVRBD1600R05N042	16	0.5	24	42	15.5	—	100	16	4	★	2	*	*	*	*
VFHVRBD1600R20N042	16	2	24	42	15.5	—	100	16	4	★	2	*	*	*	*
VFHVRBD1600R30N042	16	3	24	42	15.5	—	100	16	4	★	2	*	*	*	*
VFHVRBD1600R30N080	16	3	24	80	15.5	—	140	16	4	★	2	*	*	*	*
VFHVRBD1600R30N120	16	3	24	120	15.5	—	175	16	4	★	2	*	*	*	*

* No interference

VFHVRB

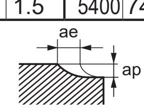
4 flute, Corner radius, Short cut length, Irregular helix flutes

RECOMMENDED CUTTING CONDITIONS

High feed conditions

Workpiece Material			Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.					Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1−10, AISI P21 etc.					Hardened steel (45−55HRC) AISI H13 etc.					Hardened steel (55−62HRC) AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)
1	0.2	4	40000	7200	283.5	0.04	0.45	33000	5100	200.8	0.03	0.45	27000	4100	161.4	0.025	0.45	20000	1800	70.9	0.013	0.45
1	0.2	6	40000	6500	255.9	0.03	0.45	33000	4600	181.1	0.022	0.45	27000	3700	145.7	0.018	0.45	20000	1600	63.0	0.01	0.45
1	0.2	8	32000	4500	177.2	0.022	0.45	27000	3200	126.0	0.018	0.45	21000	2600	102.4	0.012	0.45	16000	1100	43.3	0.008	0.45
1	0.2	10	24000	2700	106.3	0.015	0.45	20000	1900	74.8	0.01	0.45	16000	1500	59.1	0.008	0.45	12000	700	27.6	0.006	0.45
1	0.2	15	16000	1200	47.2	0.008	0.45	14000	700	27.6	0.005	0.45	12000	500	19.7	0.003	0.45	10000	400	15.7	0.003	0.45
1	0.2	20	14000	1000	39.4	0.005	0.45	12000	600	23.6	0.004	0.45	10000	400	15.7	0.002	0.45	9000	300	11.8	0.002	0.45
1.5	0.3	4	32000	10000	393.7	0.1	0.65	27000	7100	279.5	0.08	0.65	21000	5700	224.4	0.06	0.65	16000	2500	98.4	0.03	0.65
1.5	0.3	6	32000	7800	307.1	0.08	0.65	27000	5500	216.5	0.06	0.65	21000	4200	165.4	0.05	0.65	16000	2000	78.7	0.025	0.65
1.5	0.3	10	27000	5700	224.4	0.05	0.65	22000	4000	157.5	0.035	0.65	18000	3000	118.1	0.03	0.65	14000	1400	55.1	0.014	0.65
1.5	0.3	15	22000	3200	126.0	0.03	0.65	18000	2300	90.6	0.025	0.65	15000	1700	66.9	0.018	0.65	11000	1000	39.4	0.009	0.65
1.5	0.3	20	16000	1400	55.1	0.02	0.65	14000	1200	47.2	0.016	0.65	13000	1000	39.4	0.012	0.65	9000	700	27.6	0.007	0.65
1.5	0.3	25	13000	1000	39.4	0.015	0.65	11000	800	31.5	0.012	0.65	10000	700	27.6	0.009	0.65	7500	500	19.7	0.005	0.65
1.5	0.3	30	13000	900	35.4	0.01	0.65	11000	700	27.6	0.008	0.65	10000	600	23.6	0.006	0.65	7500	400	15.7	0.004	0.65
2	0.5	6	24000	10000	393.7	0.1	0.75	20000	7100	279.5	0.08	0.75	16000	5700	224.4	0.06	0.75	12000	2500	98.4	0.03	0.75
2	0.5	10	24000	10000	393.7	0.08	0.75	20000	7100	279.5	0.06	0.75	16000	5700	224.4	0.05	0.75	12000	2500	98.4	0.025	0.75
2	0.5	15	20000	7000	275.6	0.05	0.75	17000	5000	196.9	0.04	0.75	13000	3200	126.0	0.03	0.75	10000	1800	70.9	0.016	0.75
2	0.5	20	20000	3600	141.7	0.04	0.75	17000	2600	102.4	0.03	0.75	13000	1800	70.9	0.025	0.75	10000	900	35.4	0.012	0.75
2	0.5	25	16000	1800	70.9	0.03	0.75	14000	1400	55.1	0.025	0.75	12000	1100	43.3	0.02	0.75	9000	720	28.3	0.01	0.75
2	0.5	30	16000	1400	55.1	0.025	0.75	14000	1200	47.2	0.02	0.75	12000	900	35.4	0.016	0.75	9000	650	25.6	0.008	0.75
2	0.5	35	13000	1100	43.3	0.02	0.75	11000	800	31.5	0.018	0.75	10000	700	27.6	0.014	0.75	7000	500	19.7	0.007	0.75
2	0.5	40	13000	1000	39.4	0.02	0.75	11000	700	27.6	0.015	0.75	10000	600	23.6	0.012	0.75	7000	400	15.7	0.006	0.75
3	0.5	10	16000	11000	433.1	0.12	1.5	13000	7800	307.1	0.09	1.5	11000	6300	248.0	0.07	1.5	8000	2800	110.2	0.04	1.5
3	0.5	15	16000	9000	354.3	0.11	1.5	13000	6400	252.0	0.08	1.5	11000	5100	200.8	0.06	1.5	8000	2300	90.6	0.04	1.5
3	0.5	20	13000	7200	283.5	0.09	1.5	11000	5100	200.8	0.07	1.5	8700	4000	157.5	0.05	1.5	6500	1800	70.9	0.03	1.5
3	0.5	30	13000	5700	224.4	0.06	1.5	11000	4000	157.5	0.05	1.5	8700	3000	118.1	0.04	1.5	6500	1400	55.1	0.02	1.5
3	0.8	10	16000	11000	433.1	0.24	1	13000	7800	307.1	0.19	1	11000	6300	248.0	0.14	1	8000	2800	110.2	0.07	1
3	0.8	15	16000	9000	354.3	0.22	1	13000	6400	252.0	0.17	1	11000	5100	200.8	0.13	1	8000	2300	90.6	0.07	1
3	0.8	20	13000	7200	283.5	0.19	1	11000	5100	200.8	0.15	1	8700	4000	157.5	0.11	1	6500	1800	70.9	0.06	1
3	0.8	30	13000	5700	224.4	0.12	1	11000	4000	157.5	0.09	1	8700	3000	118.1	0.07	1	6500	1400	55.1	0.04	1
3	0.8	40	11000	3600	141.7	0.08	1	9100	2600	102.4	0.06	1	7400	2000	78.7	0.05	1	5500	1000	39.4	0.025	1
3	0.8	50	8000	2600	102.4	0.07	1	6600	1800	70.9	0.05	1	5800	1500	59.1	0.04	1	4600	800	31.5	0.02	1
4	0.5	12	8400	6000	236.2	0.15	2	7000	4300	169.3	0.12	2	5600	3400	133.9	0.09	2	4200	1500	59.1	0.05	2
4	0.5	20	8400	6000	236.2	0.14	2	7000	4300	169.3	0.11	2	5600	3400	133.9	0.08	2	4200	1500	59.1	0.04	2
4	0.5	30	6900	4900	192.9	0.12	2	5700	3500	137.8	0.09	2	4600	2800	110.2	0.07	2	3500	1200	47.2	0.03	2
4	0.5	48	5600	2000	78.7	0.07	2	4600	1400	55.1	0.05	2	3800	1100	43.3	0.04	2	2800	500	19.7	0.02	2
4	1	12	12000	12000	472.4	0.3	1.5	10000	8500	334.6	0.23	1.5	8000	6800	267.7	0.18	1.5	6000	3000	118.1	0.1	1.5
4	1	20	12000	12000	472.4	0.27	1.5	10000	8500	334.6	0.21	1.5	8000	6800	267.7	0.16	1.5	6000	3000	118.1	0.08	1.5
4	1	30	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
6	0.5	18	4000	3900	153.5	0.15	3.5	3300	2800	110.2	0.12	3.5	2700	2200	86.6	0.09	3.5	2000	1000	39.4	0.05	3.5
6	0.5	30	4000	3900	153.5	0.14	3.5	3300	2800	110.2	0.11	3.5	2700	2200	86.6	0.08	3.5	2000	1000	39.4	0.04	3.5
6	1	18	8000	13000	511.8	0.5	3	6600	9200	362.2	0.4	3	5400	7400	291.3	0.3	3	4000	3300	129.9	0.15	3
6	1	30	8000	13000	511.8	0.45	3	6600	9200	362.2	0.35	3	5400	7400	291.3	0.27	3	4000	3300	129.9	0.14	3
6	1	54	6600	11000	433.1	0.25	3	5500	7800	307.1	0.2	3	4400	6300	248.0	0.15	3	3300	2800	110.2	0.08	3
6	1.5	18	8000	13000	511.8	0.5	2	6600	9200	362.2	0.4	2	5400	7400	291.3	0.3	2	4000	3300	129.9	0.15	2
6	1.5	30	8000	13000	511.8	0.45	2	6600	9200	362.2	0.35	2	5400	7400	291.3	0.27	2	4000	3300	129.9	0.14	2
6	1.5	42	6600	11000	433.1	0.4	2	5500	7800	307.1	0.3	2	4400	6300	248.0	0.24	2	3300	2800	110.2	0.12	2
6	1.5	54	6600	11000	433.1	0.25	2	5500	7800	307.1	0.2	2	4400	6300	248.0	0.15	2	3300	2800	110.2	0.08	2
6	2	18	8000	13000	511.8	0.5	1.5	6600	9200	362.2	0.4	1.5	5400	7400	291.3	0.3	1.5	4000	3300	129.9	0.15	1.5
6	2	30	8000	13000	511.8	0.45	1.5	6600	9200	362.2	0.35	1.5	5400	7400	291.3	0.27	1.5	4000	3300	129.9	0.14	1.5

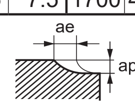
Depth of cut



Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Using air blow or mist is recommended.

Workpiece Material			Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.					Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.					Hardened steel (45—55HRC) AISI H13 etc.					Hardened steel (55—62HRC) AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)
7	**1.5**	—	6800	13000	511.8	0.5	3	5600	9200	362.2	0.4	3	4600	7400	291.3	0.3	3	3400	3300	129.9	0.15	3
8	**0.5**	**24**	3000	3900	153.5	0.18	5	2500	2800	110.2	0.14	5	2000	2200	86.6	0.11	5	1500	1000	39.4	0.05	5
8	**0.5**	**40**	3000	3900	153.5	0.16	5	2500	2800	110.2	0.12	5	2000	2200	86.6	0.1	5	1500	1000	39.4	0.05	5
8	**1**	**24**	4200	6500	255.9	0.3	4.5	3500	4600	181.1	0.23	4.5	2800	3700	145.7	0.18	4.5	2100	1600	63.0	0.09	4.5
8	**1**	**40**	4200	6500	255.9	0.27	4.5	3500	4600	181.1	0.21	4.5	2800	3700	145.7	0.16	4.5	2100	1600	63.0	0.08	4.5
8	**2**	**24**	6000	13000	511.8	0.6	3	5000	9200	362.2	0.46	3	4000	7400	291.3	0.36	3	3000	3300	129.9	0.18	3
8	**2**	**40**	6000	13000	511.8	0.54	3	5000	9200	362.2	0.42	3	4000	7400	291.3	0.32	3	3000	3300	129.9	0.16	3
8	**2**	**56**	5000	11000	433.1	0.48	3	4200	7800	307.1	0.37	3	3400	6300	248.0	0.3	3	2500	2800	110.2	0.14	3
8	**2**	**72**	5000	11000	433.1	0.3	3	4200	7800	307.1	0.23	3	3400	6300	248.0	0.2	3	2500	2800	110.2	0.09	3
9	**2**	—	5300	13000	511.8	0.6	3.5	4400	9200	362.2	0.46	3.5	3600	7400	291.3	0.36	3.5	2700	3300	129.9	0.18	3.5
10	**0.5**	**30**	2400	3900	153.5	0.18	6.5	2000	2800	110.2	0.14	6.5	1600	2200	86.6	0.11	6.5	1200	1000	39.4	0.05	6.5
10	**0.5**	**50**	2400	3900	153.5	0.16	6.5	2000	2800	110.2	0.12	6.5	1600	2200	86.6	0.1	6.5	1200	1000	39.4	0.05	6.5
10	**1**	**30**	3300	6500	255.9	0.3	6	2700	4600	181.1	0.23	6	2200	3700	145.7	0.18	6	1700	1600	63.0	0.09	6
10	**1**	**50**	3300	6500	255.9	0.27	6	2700	4600	181.1	0.21	6	2200	3700	145.7	0.16	6	1700	1600	63.0	0.08	6
10	**2**	**30**	4800	13000	511.8	0.6	4.5	4000	9200	362.2	0.46	4.5	3200	7400	291.3	0.36	4.5	2400	3300	129.9	0.18	4.5
10	**2**	**50**	4800	13000	511.8	0.54	4.5	4000	9200	362.2	0.42	4.5	3200	7400	291.3	0.32	4.5	2400	3300	129.9	0.16	4.5
10	**2**	**70**	4000	11000	433.1	0.48	4.5	3300	7800	307.1	0.37	4.5	2700	6300	248.0	0.3	4.5	2000	2800	110.2	0.14	4.5
10	**2**	**90**	4000	11000	433.1	0.48	4.5	3300	7800	307.1	0.37	4.5	2700	6300	248.0	0.3	4.5	2000	2800	110.2	0.14	4.5
11	**2**	—	4300	12000	472.4	0.6	5	3600	8500	334.6	0.46	5	2900	6800	267.7	0.36	5	2200	3000	118.1	0.18	5
12	**0.5**	**36**	2000	3600	141.7	0.27	8	1700	2600	102.4	0.21	8	1300	2100	82.7	0.14	8	1000	900	35.4	0.07	8
12	**0.5**	**60**	2000	3600	141.7	0.24	8	1700	2600	102.4	0.18	8	1300	2100	82.7	0.12	8	1000	900	35.4	0.06	8
12	**1**	**36**	2400	4800	189.0	0.36	7.5	2000	3400	133.9	0.28	7.5	1600	2700	106.3	0.18	7.5	1200	1200	47.2	0.09	7.5
12	**1**	**60**	2400	4800	189.0	0.32	7.5	2000	3400	133.9	0.25	7.5	1600	2700	106.3	0.16	7.5	1200	1200	47.2	0.08	7.5
12	**2**	**36**	4000	12000	472.4	0.9	6	3300	8500	334.6	0.7	6	2700	6800	267.7	0.45	6	2000	3000	118.1	0.23	6
12	**2**	**60**	4000	12000	472.4	0.8	6	3300	8500	334.6	0.6	6	2700	6800	267.7	0.4	6	2000	3000	118.1	0.2	6
12	**2**	**84**	3300	9900	389.8	0.7	6	2700	7000	275.6	0.55	6	2200	5600	220.5	0.36	6	1700	2500	98.4	0.18	6
12	**2**	**108**	3300	9900	389.8	0.45	6	2700	7000	275.6	0.35	6	2200	5600	220.5	0.23	6	1700	2500	98.4	0.11	6
12	**3**	**36**	4000	12000	472.4	0.9	4.5	3300	8500	334.6	0.7	4.5	2700	6800	267.7	0.45	4.5	2000	3000	118.1	0.23	4.5
12	**3**	**60**	4000	12000	472.4	0.8	4.5	3300	8500	334.6	0.6	4.5	2700	6800	267.7	0.4	4.5	2000	3000	118.1	0.2	4.5
13	**3**	—	3700	12000	472.4	0.9	5	3100	8500	334.6	0.7	5	2500	6800	267.7	0.45	5	1900	3000	118.1	0.23	5
16	**0.5**	**42**	1500	3000	118.1	0.27	11	1200	2100	82.7	0.21	11	1000	1700	66.9	0.12	11	750	750	29.5	0.05	11
16	**2**	**42**	2100	5000	196.9	0.45	9	1700	3600	141.7	0.35	9	1400	2900	114.2	0.2	9	1100	1300	51.2	0.08	9
16	**3**	**42**	3000	10000	393.7	0.9	7.5	2500	7100	279.5	0.7	7.5	2000	5700	224.4	0.4	7.5	1500	2500	98.4	0.15	7.5
16	**3**	**80**	3000	10000	393.7	0.8	7.5	2500	7100	279.5	0.6	7.5	2000	5700	224.4	0.37	7.5	1500	2500	98.4	0.14	7.5
16	**3**	**120**	2500	8300	326.8	0.7	7.5	2100	5900	232.3	0.55	7.5	1700	4700	185.0	0.32	7.5	1300	2100	82.7	0.12	7.5

Depth of cut



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

Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VFHVRB

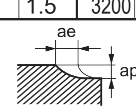
4 flute, Corner radius, Short cut length, Irregular helix flutes

RECOMMENDED CUTTING CONDITIONS

■High depth of cut conditions

Workpiece Material			Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI 35, AISI P20 etc.					Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1−10, AISI P21 etc.					Hardened steel (45−55HRC) AISI H13 etc.					Hardened steel (55−62HRC) AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)
1	0.2	4	24000	2200	86.6	0.08	0.45	20000	1500	59.1	0.07	0.45	16000	1200	47.2	0.05	0.45	12000	550	21.7	0.025	0.45
1	0.2	6	24000	2000	78.7	0.07	0.45	20000	1400	55.1	0.05	0.45	16000	1100	43.3	0.04	0.45	12000	500	19.7	0.02	0.45
1	0.2	8	19000	1400	55.1	0.05	0.45	16000	1000	39.4	0.04	0.45	13000	800	31.5	0.03	0.45	9500	350	13.8	0.016	0.45
1	0.2	10	14000	800	31.5	0.04	0.45	12000	600	23.6	0.03	0.45	9000	400	15.7	0.025	0.45	7000	200	7.9	0.012	0.45
1	0.2	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	0.2	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.3	4	19000	3000	118.1	0.2	0.65	16000	2100	82.7	0.16	0.65	13000	1700	66.9	0.12	0.65	9500	750	29.5	0.06	0.65
1.5	0.3	6	19000	2300	90.6	0.16	0.65	16000	1600	63.0	0.13	0.65	13000	1300	51.2	0.1	0.65	9500	580	22.8	0.05	0.65
1.5	0.3	10	16000	1700	66.9	0.1	0.65	13000	1200	47.2	0.07	0.65	11000	1000	39.4	0.05	0.65	8000	430	16.9	0.03	0.65
1.5	0.3	15	13000	1000	39.4	0.06	0.65	11000	700	27.6	0.05	0.65	9000	600	23.6	0.04	0.65	6500	250	9.8	0.018	0.65
1.5	0.3	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.3	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.5	0.3	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	6	14000	3000	118.1	0.2	0.75	12000	2100	82.7	0.16	0.75	9400	1700	66.9	0.12	0.75	7000	750	29.5	0.06	0.75
2	0.5	10	14000	3000	118.1	0.16	0.75	12000	2100	82.7	0.13	0.75	9400	1700	66.9	0.1	0.75	7000	750	29.5	0.05	0.75
2	0.5	15	12000	2100	82.7	0.1	0.75	10000	1500	59.1	0.08	0.75	8000	1200	47.2	0.06	0.75	6000	530	20.9	0.03	0.75
2	0.5	20	12000	1100	43.3	0.08	0.75	10000	800	31.5	0.06	0.75	8000	600	23.6	0.05	0.75	6000	280	11.0	0.025	0.75
2	0.5	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	0.5	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	0.5	10	9600	3300	129.9	0.24	1.5	8000	2300	90.6	0.2	1.5	6400	1800	70.9	0.14	1.5	4800	830	32.7	0.07	1.5
3	0.5	15	9600	2700	106.3	0.22	1.5	8000	1900	74.8	0.17	1.5	6400	1500	59.1	0.13	1.5	4800	680	26.8	0.06	1.5
3	0.5	20	7800	2200	86.6	0.18	1.5	6500	1500	59.1	0.14	1.5	5200	1200	47.2	0.11	1.5	3900	550	21.7	0.05	1.5
3	0.5	30	7800	1700	66.9	0.12	1.5	6500	1200	47.2	0.1	1.5	5200	1000	39.4	0.07	1.5	3900	430	16.9	0.04	1.5
3	0.8	10	9600	3300	129.9	0.5	1	8000	2300	90.6	0.4	1	6400	1800	70.9	0.3	1	4800	830	32.7	0.14	1
3	0.8	15	9600	2700	106.3	0.5	1	8000	1900	74.8	0.35	1	6400	1500	59.1	0.25	1	4800	680	26.8	0.13	1
3	0.8	20	7800	2200	86.6	0.4	1	6500	1500	59.1	0.3	1	5200	1200	47.2	0.23	1	3900	550	21.7	0.11	1
3	0.8	30	7800	1700	66.9	0.24	1	6500	1200	47.2	0.2	1	5200	1000	39.4	0.14	1	3900	430	16.9	0.05	1
3	0.8	40	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	0.8	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	0.5	12	5000	1800	70.9	0.3	2	4200	1300	51.2	0.24	2	3400	1000	39.4	0.18	2	2500	450	17.7	0.06	2
4	0.5	20	5000	1800	70.9	0.3	2	4200	1300	51.2	0.22	2	3400	1000	39.4	0.17	2	2500	450	17.7	0.06	2
4	0.5	30	4100	1500	59.1	0.24	2	3400	1100	43.3	0.19	2	2700	840	33.1	0.14	2	2100	380	15.0	0.05	2
4	0.5	48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	1	12	7200	3600	141.7	0.6	1.5	6000	2500	98.4	0.5	1.5	4800	2000	78.7	0.36	1.5	3600	900	35.4	0.12	1.5
4	1	20	7200	3600	141.7	0.6	1.5	6000	2500	98.4	0.4	1.5	4800	2000	78.7	0.32	1.5	3600	900	35.4	0.11	1.5
4	1	30	6000	3000	118.1	0.5	1.5	5000	2100	82.7	0.4	1.5	4000	1700	66.9	0.3	1.5	3000	750	29.5	0.1	1.5
6	0.5	18	2400	1200	47.2	0.3	3.5	2000	840	33.1	0.24	3.5	1600	670	26.4	0.18	3.5	1200	300	11.8	0.06	3.5
6	0.5	30	2400	1200	47.2	0.3	3.5	2000	840	33.1	0.22	3.5	1600	670	26.4	0.17	3.5	1200	300	11.8	0.06	3.5
6	1	18	4800	3900	153.5	1	3	4000	2700	106.3	0.8	3	3200	2200	86.6	0.6	3	2400	980	38.6	0.2	3
6	1	30	4800	3900	153.5	0.9	3	4000	2700	106.3	0.7	3	3200	2200	86.6	0.5	3	2400	980	38.6	0.18	3
6	1	54	4000	3300	129.9	0.5	3	3300	2300	90.6	0.4	3	2700	1800	70.9	0.3	3	2000	830	32.7	0.1	3
6	1.5	18	4800	3900	153.5	1	2	4000	2700	106.3	0.8	2	3200	2200	86.6	0.6	2	2400	980	38.6	0.2	2
6	1.5	30	4800	3900	153.5	0.9	2	4000	2700	106.3	0.7	2	3200	2200	86.6	0.5	2	2400	980	38.6	0.18	2
6	1.5	42	4000	3300	129.9	0.8	2	3300	2300	90.6	0.6	2	2700	1800	70.9	0.5	2	2000	830	32.7	0.16	2
6	1.5	54	4000	3300	129.9	0.5	2	3300	2300	90.6	0.4	2	2700	1800	70.9	0.3	2	2000	830	32.7	0.1	2
6	2	18	4800	3900	153.5	1	1.5	4000	2700	106.3	0.8	1.5	3200	2200	86.6	0.6	1.5	2400	980	38.6	0.2	1.5
6	2	30	4800	3900	153.5	0.9	1.5	4000	2700	106.3	0.7	1.5	3200	2200	86.6	0.5	1.5	2400	980	38.6	0.18	1.5

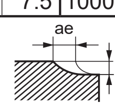
Depth of cut



Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Using air blow or mist is recommended.

Workpiece Material			Carbon steel, Cast iron, Alloy steel (—30HRC) AISI 1050, AISI 35, AISI P20 etc.					Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1—10, AISI P21 etc.					Hardened steel (45—55HRC) AISI H13 etc.					Hardened steel (55—62HRC) AISI D2 etc.				
DC (mm)	RE (mm)	LU (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min⁻¹)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Width of cut ae (mm)
7	**1.5**	—	4100	3900	153.5	1	3	3400	2700	106.3	0.8	3	2700	2200	86.6	0.6	3	2100	980	38.6	0.2	3
8	**0.5**	**24**	1800	1200	47.2	0.35	5	1500	840	33.1	0.3	5	1200	670	26.4	0.2	5	900	300	11.8	0.07	5
8	**0.5**	**40**	1800	1200	47.2	0.3	5	1500	840	33.1	0.25	5	1200	670	26.4	0.2	5	900	300	11.8	0.06	5
8	**1**	**24**	2500	2000	78.7	0.6	4.5	2100	1400	55.1	0.5	4.5	1700	1100	43.3	0.4	4.5	1300	500	19.7	0.12	4.5
8	**1**	**40**	2500	2000	78.7	0.5	4.5	2100	1400	55.1	0.4	4.5	1700	1100	43.3	0.3	4.5	1300	500	19.7	0.11	4.5
8	**2**	**24**	3600	3900	153.5	1.2	3	3000	2700	106.3	1	3	2400	2200	86.6	0.7	3	1800	980	38.6	0.24	3
8	**2**	**40**	3600	3900	153.5	1.1	3	3000	2700	106.3	0.9	3	2400	2200	86.6	0.7	3	1800	980	38.6	0.22	3
8	**2**	**56**	3000	3300	129.9	1	3	2500	2300	90.6	0.8	3	2000	1800	70.9	0.6	3	1500	830	32.7	0.2	3
8	**2**	**72**	3000	3300	129.9	0.6	3	2500	2300	90.6	0.5	3	2000	1800	70.9	0.4	3	1500	830	32.7	0.12	3
9	**2**	—	3200	3900	153.5	1.2	3.5	2700	2700	106.3	1	3.5	2100	2200	86.6	0.7	3.5	1600	980	38.6	0.24	3.5
10	**0.5**	**30**	1400	1200	47.2	0.35	6.5	1200	840	33.1	0.3	6.5	940	670	26.4	0.2	6.5	700	300	11.8	0.07	6.5
10	**0.5**	**50**	1400	1200	47.2	0.3	6.5	1200	840	33.1	0.25	6.5	940	670	26.4	0.2	6.5	700	300	11.8	0.06	6.5
10	**1**	**30**	2000	2000	78.7	0.6	6	1700	1400	55.1	0.5	6	1300	1100	43.3	0.4	6	1000	500	19.7	0.12	6
10	**1**	**50**	2000	2000	78.7	0.5	6	1700	1400	55.1	0.4	6	1300	1100	43.3	0.3	6	1000	500	19.7	0.11	6
10	**2**	**30**	2900	3900	153.5	1.2	4.5	2400	2700	106.3	1	4.5	1900	2200	86.6	0.7	4.5	1500	980	38.6	0.24	4.5
10	**2**	**50**	2900	3900	153.5	1.1	4.5	2400	2700	106.3	0.9	4.5	1900	2200	86.6	0.7	4.5	1500	980	38.6	0.22	4.5
10	**2**	**70**	2400	3300	129.9	1	4.5	2000	2300	90.6	0.8	4.5	1600	1800	70.9	0.6	4.5	1200	830	32.7	0.2	4.5
10	**2**	**90**	2400	3300	129.9	1	4.5	2000	2300	90.6	0.8	4.5	1600	1800	70.9	0.6	4.5	1200	830	32.7	0.2	4.5
11	**2**	—	2600	3600	141.7	1.2	5	2200	2500	98.4	1	5	1700	2000	78.7	0.7	5	1300	900	35.4	0.24	5
12	**0.5**	**36**	1200	1100	43.3	0.5	8	1000	770	30.3	0.4	8	800	620	24.4	0.3	8	600	280	11.0	0.11	8
12	**0.5**	**60**	1200	1100	43.3	0.5	8	1000	770	30.3	0.4	8	800	620	24.4	0.3	8	600	280	11.0	0.1	8
12	**1**	**36**	1400	1400	55.1	0.7	7.5	1200	1000	39.4	0.6	7.5	940	780	30.7	0.4	7.5	700	350	13.8	0.14	7.5
12	**1**	**60**	1400	1400	55.1	0.6	7.5	1200	1000	39.4	0.5	7.5	940	780	30.7	0.4	7.5	700	350	13.8	0.13	7.5
12	**2**	**36**	2400	3600	141.7	1.8	6	2000	2500	98.4	1.4	6	1600	2000	78.7	1.1	6	1200	900	35.4	0.4	6
12	**2**	**60**	2400	3600	141.7	1.6	6	2000	2500	98.4	1.3	6	1600	2000	78.7	1	6	1200	900	35.4	0.3	6
12	**2**	**84**	2000	3000	118.1	1.4	6	1700	2100	82.7	1.1	6	1300	1700	66.9	0.8	6	1000	750	29.5	0.3	6
12	**2**	**108**	2000	3000	118.1	0.9	6	1700	2100	82.7	0.7	6	1300	1700	66.9	0.5	6	1000	750	29.5	0.2	6
12	**3**	**36**	2400	3600	141.7	1.8	4.5	2000	2500	98.4	1.4	4.5	1600	2000	78.7	1.1	4.5	1200	900	35.4	0.4	4.5
12	**3**	**60**	2400	3600	141.7	1.6	4.5	2000	2500	98.4	1.3	4.5	1600	2000	78.7	1	4.5	1200	900	35.4	0.3	4.5
13	**3**	—	2200	3600	141.7	1.8	5	1800	2500	98.4	1.4	5	1500	2000	78.7	1.1	5	1100	900	35.4	0.4	5
16	**0.5**	**42**	900	900	35.4	0.5	11	750	630	24.8	0.4	11	600	500	19.7	0.3	11	450	230	9.1	0.1	11
16	**2**	**42**	1300	1500	59.1	0.9	9	1100	1100	43.3	0.7	9	870	840	33.1	0.5	9	650	380	15.0	0.2	9
16	**3**	**42**	1800	3000	118.1	1.8	7.5	1500	2100	82.7	1.4	7.5	1200	1700	66.9	0.9	7.5	900	750	29.5	0.4	7.5
16	**3**	**80**	1800	3000	118.1	1.6	7.5	1500	2100	82.7	1.3	7.5	1200	1700	66.9	0.8	7.5	900	750	29.5	0.3	7.5
16	**3**	**120**	1500	2500	98.4	1.4	7.5	1200	1800	70.9	1.1	7.5	1000	1400	55.1	0.7	7.5	750	630	24.8	0.3	7.5

Depth of cut



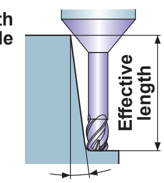
Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the workpiece material and depth of cut.
Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

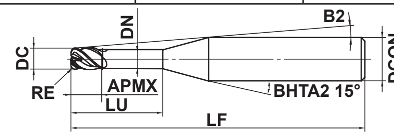
VFHVRB – Inch sizes

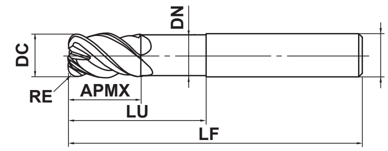
4 flute, Corner radius, Short cut length, Irregular helix flutes

UWC VF 43° 45°

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







DC≤.5000"			
±.0004"			
DC≤.5000"			
0 - .0008"			
.2500"≤DCON≤.3750"	DCON=.5000"		
0 - .00035	0 - .00043		

● Impact Miracle corner radius end mill for high feed and efficient machining.

(inch)

Order Number	DC	RE	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 0.5°	1°	2°	3°
VFHVRBD1/8N3DR0.03	.1250	.030	.125	.375	.1211	6.1°	2.25	.2500	4	●	1	9.9	10.3	11	11.9
VFHVRBD1/8N5DR0.03	.1250	.030	.125	.625	.1211	4.3°	2.25	.2500	4	●	1	16.5	17.1	18.3	19.8
VFHVRBD3/16N3DR0.05	.1875	.050	.188	.563	.1835	2.9°	2.25	.2500	4	●	1	14.9	15.4	16.4	*
VFHVRBD3/16N5DR0.05	.1875	.050	.188	.938	.1835	1.8°	2.25	.2500	4	●	1	24.7	25.6	*	*
VFHVRBD1/4N3DR0.06	.2500	.060	.375	.750	.2441	–	2.25	.2500	4	●	2	*	*	*	*
VFHVRBD1/4N5DR0.06	.2500	.060	.375	1.250	.2441	–	3.00	.2500	4	●	2	*	*	*	*
VFHVRBD5/16N3DR0.08	.3125	.080	.469	.938	.3066	–	3.00	.3125	4	●	2	*	*	*	*
VFHVRBD5/16N5DR0.08	.3125	.080	.469	1.563	.3066	–	4.00	.3125	4	●	2	*	*	*	*
VFHVRBD3/8N3DR0.08	.3750	.080	.563	1.125	.3691	–	3.00	.3750	4	●	2	*	*	*	*
VFHVRBD3/8N5DR0.08	.3750	.080	.563	1.875	.3691	–	4.00	.3750	4	●	2	*	*	*	*
VFHVRBD1/2N3DR0.12	.5000	.120	.750	1.500	.4882	–	4.00	.5000	4	●	2	*	*	*	*
VFHVRBD1/2N5DR0.12	.5000	.120	.750	2.500	.4882	–	5.00	.5000	4	●	2	*	*	*	*

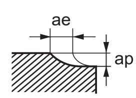
* No interference

RECOMMENDED CUTTING CONDITIONS

■High feed conditions

Workpiece Material			Carbon Steel, Cast Iron, Alloy Steel (—30HRC) AISI 1049, AISI 30, AISI P20					Alloy steel, Tool steel, Pre-haedened steel AIAI H13, AISI W1-10, AISI P21					Hardened Steel (45—55HRC) AISI H13					Hardened Steel (55—62HRC) AISI D2				
DC (inch)	RE (inch)	LU (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
.1250	**.03**	**.375**	16000	11000	433.1	.009	.039	13000	7800	307.1	.007	.039	11000	6300	248	.006	.039	8000	2800	110.2	.003	.039
.1250	**.03**	**.625**	16000	9000	354.3	.009	.039	13000	6400	252	.007	.039	11000	5100	200.8	.006	.039	8000	2300	90.6	.003	.039
.1875	**.05**	**.563**	12000	12000	472.4	.012	.059	10000	8500	334.6	.009	.059	8000	6800	267.7	.007	.059	6000	3000	118.1	.004	.059
.1875	**.05**	**.938**	12000	12000	472.4	.011	.059	10000	8500	334.6	.008	.059	8000	6800	267.7	.006	.059	6000	3000	118.1	.003	.059
.2500	**.06**	**.750**	8000	13000	511.8	.020	.078	6600	9200	362.2	.016	.078	5400	7400	291.3	.012	.078	4000	3300	129.9	.006	.078
.2500	**.06**	**1.250**	8000	13000	511.8	.018	.078	6600	9200	362.2	.014	.078	5400	7400	291.3	.011	.078	4000	3300	129.9	.006	.078
.3125	**.08**	**.938**	6000	13000	511.8	.024	.118	5000	9200	362.2	.018	.118	4000	7400	291.3	.014	.118	3000	3300	129.9	.007	.118
.3125	**.08**	**1.563**	6000	13000	511.8	.021	.118	5000	9200	362.2	.017	.118	4000	7400	291.3	.013	.118	3000	3300	129.9	.006	.118
.3750	**.08**	**1.125**	4800	13000	511.8	.024	.177	4000	9200	362.2	.018	.177	3200	7400	291.3	.014	.177	2400	3300	129.9	.007	.177
.3750	**.08**	**1.875**	4800	13000	511.8	.021	.177	4000	9200	362.2	.017	.177	3200	7400	291.3	.013	.177	2400	3300	129.9	.006	.177
.5000	**.12**	**1.500**	4000	12000	472.4	.035	.177	3300	8500	334.6	.028	.177	2700	6800	267.7	.018	.177	2000	3000	118.1	.009	.177
.5000	**.12**	**2.500**	4000	12000	472.4	.031	.177	3300	8500	334.6	.024	.177	2700	6800	267.7	.016	.177	2000	3000	118.1	.008	.177

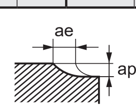
Depth of cut



■High depth of cut conditions

Workpiece Material			Carbon Steel, Cast Iron, Alloy Steel (—30HRC) AISI 1049, AISI 30, AISI P20					Alloy steel, Tool steel, Pre-haedened steel AIAI H13, AISI W1-10, AISI P21					Hardened Steel (45—55HRC) AISI H13					Hardened Steel (55—62HRC) AISI D2				
DC (inch)	RE (inch)	LU (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)	Revolution (min-1)	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (inch)	Width of cut ae (inch)
.1250	**.03**	**.375**	9600	3300	129.9	.020	.039	8000	2300	90.6	.016	.039	6400	1800	70.9	.012	.039	4800	830	32.7	.006	.039
.1250	**.03**	**.625**	9600	2700	106.3	.020	.039	8000	1900	74.8	.014	.039	6400	1500	59.1	.010	.039	4800	680	26.8	.005	.039
.1875	**.05**	**.563**	7200	3600	141.7	.024	.059	6000	2500	98.4	.020	.059	4800	2000	78.7	.014	.059	3600	900	35.4	.005	.059
.1875	**.05**	**.938**	7200	3600	141.7	.024	.059	6000	2500	98.4	.016	.059	4800	2000	78.7	.013	.059	3600	900	35.4	.004	.059
.2500	**.06**	**.750**	4000	3300	129.9	.020	.118	3300	2300	90.6	.016	.118	2700	1800	70.9	.012	.118	2000	830	32.7	.004	.118
.2500	**.06**	**1.250**	4800	3900	153.5	.040	.079	4000	2700	106.3	.031	.079	3200	2200	86.6	.024	.079	2400	980	38.6	.008	.079
.3125	**.08**	**.938**	3600	3900	153.5	.047	.118	3000	2700	106.3	.040	.118	2400	2200	86.6	.028	.118	1800	980	38.6	.009	.118
.3125	**.08**	**1.563**	3600	3900	153.5	.043	.118	3000	2700	106.3	.035	.118	2400	2200	86.6	.028	.118	1800	980	38.6	.009	.118
.3750	**.08**	**1.125**	2900	3900	153.5	.047	.177	2400	2700	106.3	.040	.177	1900	2200	86.6	.028	.177	1500	980	38.6	.009	.177
.3750	**.08**	**1.875**	2900	3900	153.5	.043	.177	2400	2700	106.3	.035	.177	1900	2200	86.6	.028	.177	1500	980	38.6	.009	.177
.5000	**.12**	**1.500**	2400	3600	141.7	.071	.177	2000	2500	98.4	.055	.177	1600	2000	78.7	.043	.177	1200	900	35.4	.016	.177
.5000	**.12**	**2.500**	2400	3600	141.7	.063	.177	2000	2500	98.4	.051	.177	1600	2000	78.7	.040	.177	1200	900	35.4	.012	.177

Depth of cut



Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) Using air blow or mist is recommended.
Note 3) When contour milling, cutting conditions can vary greatly due to the geometry of the workpiece material and depth of cut.
Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

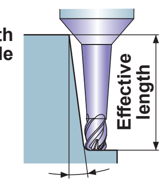
VFHVRB

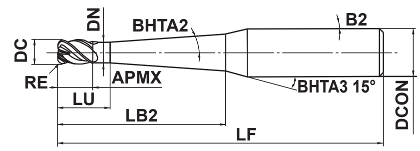
4 flute, Corner radius, Short cut length, Irregular helix flutes

43°
45°

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

Taper neck type





DC≤10	DC>10		
±0.007	±0.01		
DC≤12			
0 - 0.02			
DCON=6	8≤DCON≤10	12≤DCON≤16	
0 - 0.008	0 - 0.009	0 - 0.011	

● Impact Miracle corner radius end mill for high feed and efficient machining.

(mm)

Order Number	DC	RE	BHTA2	APMX	LU	LB2	DN	B2	LF	DCON	No. of Flutes	Stock	Effective length for inclined angle 0.5°	1°	2°	3°
VFHVRBD010R02N006T09	1	0.2	0.9°	1	2.5	6	0.94	9.3°	60	6	4	●	—	6.6	7.1	7.6
VFHVRBD010R02N010T09	1	0.2	0.9°	1	2.5	10	0.94	7.5°	60	6	4	●	—	10.6	11.4	12.3
VFHVRBD010R02N015T09	1	0.2	0.9°	1	2.5	15	0.94	6.1°	60	6	4	●	—	15.6	16.8	18.1
VFHVRBD010R02N020T09	1	0.2	0.9°	1	2.5	20	0.94	5.1°	80	6	4	★	—	20.6	22.1	23.9
VFHVRBD010R02N025T09	1	0.2	0.9°	1	2.5	25	0.94	4.4°	80	6	4	★	—	25.6	27.5	29.7
VFHVRBD010R02N030T09	1	0.2	0.9°	1	2.5	30	0.94	3.8°	80	6	4	★	—	30.6	32.9	35.5
VFHVRBD010R02N035T09	1	0.2	0.9°	1	2.5	35	0.94	3.4°	90	6	4	★	—	35.6	38.3	41.3
VFHVRBD010R02N040T09	1	0.2	0.9°	1	2.5	40	0.94	3.1°	90	6	4	★	—	40.6	43.6	47.2
VFHVRBD010R02N045T09	1	0.2	0.9°	1	2.5	45	0.94	2.8°	90	6	4	★	—	45.6	49	*
VFHVRBD010R02N050T09	1	0.2	0.9°	1	2.5	50	0.94	2.6°	90	6	4	★	—	50.6	54.4	*
VFHVRBD015R03N010T09	1.5	0.3	0.9°	1.5	3	10	1.44	7.1°	60	6	4	●	—	10.6	11.4	12.3
VFHVRBD015R03N015T09	1.5	0.3	0.9°	1.5	3	15	1.44	5.7°	60	6	4	●	—	15.6	16.8	18.1
VFHVRBD015R03N020T09	1.5	0.3	0.9°	1.5	3	20	1.44	4.7°	80	6	4	●	—	20.6	22.2	23.9
VFHVRBD015R03N030T09	1.5	0.3	0.9°	1.5	3	30	1.44	3.5°	80	6	4	★	—	30.6	32.9	35.6
VFHVRBD015R03N040T09	1.5	0.3	0.9°	1.5	3	40	1.44	2.8°	90	6	4	★	—	40.6	43.7	*
VFHVRBD015R03N050T09	1.5	0.3	0.9°	1.5	3	50	1.44	2.4°	90	6	4	★	—	50.6	54.4	*
VFHVRBD020R05N015T04	2	0.5	0.4°	2	4	15	1.9	5.2°	60	6	4	★	15.6	16.2	17.4	18.7
VFHVRBD020R05N020T04	2	0.5	0.4°	2	4	20	1.9	4.3°	80	6	4	★	20.6	21.3	22.9	24.7
VFHVRBD020R05N025T04	2	0.5	0.4°	2	4	25	1.9	3.6°	80	6	4	★	25.6	26.5	28.5	30.8
VFHVRBD020R05N030T04	2	0.5	0.4°	2	4	30	1.9	3.2°	80	6	4	★	30.6	31.7	34	36.8
VFHVRBD020R05N035T04	2	0.5	0.4°	2	4	35	1.9	2.8°	80	6	4	★	35.6	36.9	39.6	*
VFHVRBD020R05N040T04	2	0.5	0.4°	2	4	40	1.9	2.5°	80	6	4	★	40.6	42	45.2	*
VFHVRBD020R05N020T09	2	0.5	0.9°	2	4	20	1.9	4.4°	80	6	4	●	—	20.8	22.3	24.1
VFHVRBD020R05N025T09	2	0.5	0.9°	2	4	25	1.9	3.7°	90	6	4	●	—	25.8	27.7	29.9
VFHVRBD020R05N030T09	2	0.5	0.9°	2	4	30	1.9	3.2°	90	6	4	●	—	30.8	33	35.7
VFHVRBD020R05N035T09	2	0.5	0.9°	2	4	35	1.9	2.9°	90	6	4	●	—	35.8	38.4	*
VFHVRBD020R05N040T09	2	0.5	0.9°	2	4	40	1.9	2.6°	90	6	4	●	—	40.8	43.8	*
VFHVRBD020R05N045T09	2	0.5	0.9°	2	4	45	1.9	2.3°	90	6	4	★	—	45.8	49.2	*
VFHVRBD020R05N050T09	2	0.5	0.9°	2	4	50	1.9	2.2°	100	6	4	★	—	50.8	54.5	*
VFHVRBD020R05N055T09	2	0.5	0.9°	2	4	55	1.9	2°	100	6	4	★	—	55.8	59.9	*
VFHVRBD020R05N060T09	2	0.5	0.9°	2	4	60	1.9	1.8°	100	6	4	★	—	60.8	*	*

* No interference

● : USA Stock ★ : Stocked 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°
VFHVRBD030R08N020T09	3	0.8	0.9°	3	6	20	2.9	3.6°	80	6	4	●	—	20.9	22.4	24.1
VFHVRBD030R08N025T09	3	0.8	0.9°	3	6	25	2.9	3°	80	6	4	●	—	25.9	27.8	30
VFHVRBD030R08N030T09	3	0.8	0.9°	3	6	30	2.9	2.6°	80	6	4	●	—	30.9	33.1	*
VFHVRBD030R08N040T09	3	0.8	0.9°	3	6	40	2.9	2°	90	6	4	●	—	40.9	43.9	*
VFHVRBD030R08N050T09	3	0.8	0.9°	3	6	50	2.9	1.7°	90	6	4	●	—	50.9	*	*
VFHVRBD030R08N060T09	3	0.8	0.9°	3	6	60	2.9	1.4°	100	6	4	●	—	60.9	*	*
VFHVRBD040R10N025T04	4	1	0.4°	4	7	25	3.9	2.1°	80	6	4	★	25.7	26.6	28.5	*
VFHVRBD040R10N030T04	4	1	0.4°	4	7	30	3.9	1.8°	80	6	4	★	30.7	31.8	*	*
VFHVRBD040R10N035T04	4	1	0.4°	4	7	35	3.9	1.6°	80	6	4	★	35.7	36.9	*	*
VFHVRBD040R10N040T04	4	1	0.4°	4	7	40	3.9	1.4°	80	6	4	★	40.7	42.1	*	*
VFHVRBD040R10N045T04	4	1	0.4°	4	7	45	3.9	1.3°	90	6	4	★	45.7	47.3	*	*
VFHVRBD040R10N050T04	4	1	0.4°	4	7	50	3.9	1.2°	90	6	4	★	50.7	52.5	*	*
VFHVRBD040R10N025T09	4	1	0.9°	4	7	25	3.9	2.2°	90	6	4	●	—	25.9	27.8	*
VFHVRBD040R10N030T09	4	1	0.9°	4	7	30	3.9	1.9°	90	6	4	●	—	30.9	*	*
VFHVRBD040R10N040T09	4	1	0.9°	4	7	40	3.9	1.4°	100	6	4	●	—	40.9	*	*
VFHVRBD040R10N050T09	4	1	0.9°	4	7	50	3.9	1.2°	100	6	4	●	—	50.9	*	*
VFHVRBD040R10N060T09	4	1	0.9°	4	7	60	3.9	1°	100	6	4	●	—	60.9	*	*
VFHVRBD060R15N040T09	6	1.5	0.9°	9	12	40	5.85	1.4°	110	8	4	●	—	41.4	*	*
VFHVRBD060R15N050T09	6	1.5	0.9°	9	12	50	5.85	1.2°	110	8	4	●	—	51.4	*	*
VFHVRBD060R15N060T09	6	1.5	0.9°	9	12	60	5.85	1°	110	8	4	●	—	61.4	*	*
VFHVRBD060R15N070T09	6	1.5	0.9°	9	12	70	5.85	0.9°	110	8	4	●	—	*	*	*
VFHVRBD080R20N060T09	8	2	0.9°	12	15	60	7.85	1°	150	10	4	★	—	61.5	*	*
VFHVRBD080R20N080T09	8	2	0.9°	12	15	80	7.85	0.8°	150	10	4	★	—	*	*	*
VFHVRBD100R20N080T09	10	2	0.9°	15	18	80	9.7	2°	130	16	4	★	—	82	88	*
VFHVRBD100R20N120T09	10	2	0.9°	15	18	120	9.7	1.4°	180	16	4	★	—	122	*	*
VFHVRBD120R20N080T09	12	2	0.9°	18	28	80	11.7	1.4°	130	16	4	★	—	82.2	*	*
VFHVRBD120R20N120T09	12	2	0.9°	18	28	120	11.7	1°	180	16	4	★	—	122.2	*	*

* No interference

VFHVRB

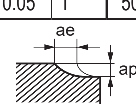
4 flute, Corner radius, Short cut length, Irregular helix flutes

RECOMMENDED CUTTING CONDITIONS

High depth cut conditions

Workpiece 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					Hardened Steel (45−55HRC) AISI H13					Hardened Steel (55−62HRC) AISI D2				
DC (mm)	RE (mm)	BHTA2	LB2 (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)
1	0.2	0.9°	6	40000	6500	255.9	0.03	0.45	33000	4600	181.1	0.022	0.45	27000	3700	145.7	0.018	0.45	20000	1600	63.0	0.01	0.45
1	0.2	0.9°	10	24000	2700	106.3	0.015	0.45	20000	1900	74.8	0.01	0.45	16000	1500	59.1	0.008	0.45	12000	700	27.6	0.006	0.45
1	0.2	0.9°	15	16000	1200	47.2	0.013	0.45	14000	700	27.6	0.008	0.45	12000	500	19.7	0.007	0.45	10000	400	15.7	0.003	0.45
1	0.2	0.9°	20	14000	1000	39.4	0.01	0.45	12000	600	23.6	0.006	0.45	10000	400	15.7	0.005	0.45	9000	300	11.8	0.002	0.45
1	0.2	0.9°	25	9500	610	24.0	0.008	0.45	8000	440	17.3	0.005	0.45	6000	320	12.6	0.004	0.45	4800	160	6.3	0.002	0.45
1	0.2	0.9°	30	4900	320	12.6	0.007	0.45	4100	220	8.7	0.004	0.45	3000	160	6.3	0.003	0.45	2500	80	3.1	0.002	0.45
1	0.2	0.9°	35	4000	260	10.2	0.006	0.45	3400	190	7.5	0.003	0.45	3000	160	6.3	0.003	0.45	2000	70	2.8	0.001	0.45
1	0.2	0.9°	40	3500	180	7.1	0.005	0.45	2900	130	5.1	0.003	0.45	2000	90	3.5	0.003	0.45	1700	50	2.0	0.001	0.45
1	0.2	0.9°	45	2900	150	5.9	0.004	0.45	2400	100	3.9	0.002	0.45	2000	90	3.5	0.002	0.45	1400	40	1.6	0.001	0.45
1	0.2	0.9°	50	2900	110	4.3	0.003	0.45	2400	80	3.1	0.002	0.45	2000	60	2.4	0.002	0.45	1400	30	1.2	0.001	0.45
1.5	0.3	0.9°	10	27000	5700	224.4	0.05	0.65	22000	4000	157.5	0.035	0.65	18000	3000	118.1	0.03	0.65	14000	1400	55.1	0.014	0.65
1.5	0.3	0.9°	15	22000	3200	126.0	0.03	0.65	18000	2300	90.6	0.025	0.65	15000	1700	66.9	0.018	0.65	11000	1000	39.4	0.009	0.65
1.5	0.3	0.9°	20	16000	1400	55.1	0.02	0.65	14000	1200	47.2	0.016	0.65	13000	1000	39.4	0.012	0.65	9000	700	27.6	0.007	0.65
1.5	0.3	0.9°	30	13000	900	35.4	0.01	0.65	11000	700	27.6	0.008	0.65	10000	600	23.6	0.006	0.65	7500	400	15.7	0.004	0.65
1.5	0.3	0.9°	40	4500	230	9.1	0.008	0.65	3700	160	6.3	0.007	0.65	3000	120	4.7	0.005	0.65	2300	70	2.8	0.003	0.65
1.5	0.3	0.9°	50	3700	190	7.5	0.007	0.65	3000	130	5.1	0.006	0.65	3000	120	4.7	0.004	0.65	1900	60	2.4	0.002	0.65
2	0.5	0.4°	15	20000	7000	275.6	0.05	0.75	17000	5000	196.9	0.04	0.75	13000	3200	126.0	0.03	0.75	10000	1800	70.9	0.016	0.75
2	0.5	0.4°	20	20000	3600	141.7	0.04	0.75	17000	2600	102.4	0.03	0.75	13000	1800	70.9	0.025	0.75	10000	900	35.4	0.012	0.75
2	0.5	0.4°	25	16000	1800	70.9	0.03	0.75	14000	1400	55.1	0.025	0.75	12000	1100	43.3	0.02	0.75	9000	720	28.3	0.01	0.75
2	0.5	0.4°	30	16000	1400	55.1	0.025	0.75	14000	1200	47.2	0.02	0.75	12000	900	35.4	0.016	0.75	9000	650	25.6	0.008	0.75
2	0.5	0.4°	35	13000	1100	43.3	0.02	0.75	11000	800	31.5	0.018	0.75	10000	700	27.6	0.014	0.75	7000	500	19.7	0.007	0.75
2	0.5	0.4°	40	13000	1000	39.4	0.02	0.75	11000	700	27.6	0.015	0.75	10000	600	23.6	0.012	0.75	7000	400	15.7	0.006	0.75
2	0.5	0.9°	20	20000	3600	141.7	0.04	0.75	17000	2600	102.4	0.03	0.75	13000	1800	70.9	0.025	0.75	10000	900	35.4	0.012	0.75
2	0.5	0.9°	25	16000	1800	70.9	0.03	0.75	14000	1400	55.1	0.025	0.75	12000	1100	43.3	0.02	0.75	9000	720	28.3	0.01	0.75
2	0.5	0.9°	30	16000	1400	55.1	0.025	0.75	14000	1200	47.2	0.02	0.75	12000	900	35.4	0.016	0.75	9000	650	25.6	0.008	0.75
2	0.5	0.9°	35	13000	1100	43.3	0.02	0.75	11000	800	31.5	0.018	0.75	10000	700	27.6	0.014	0.75	7000	500	19.7	0.007	0.75
2	0.5	0.9°	40	13000	1000	39.4	0.02	0.75	11000	700	27.6	0.015	0.75	10000	600	23.6	0.012	0.75	7000	400	15.7	0.006	0.75
2	0.5	0.9°	45	8000	500	19.7	0.016	0.75	6800	360	14.2	0.012	0.75	5200	250	9.8	0.01	0.75	4000	120	4.7	0.005	0.75
2	0.5	0.9°	50	8000	500	19.7	0.016	0.75	6800	360	14.2	0.012	0.75	5200	250	9.8	0.01	0.75	4000	120	4.7	0.005	0.75
2	0.5	0.9°	55	4100	230	9.1	0.012	0.75	3500	170	6.7	0.009	0.75	2700	120	4.7	0.008	0.75	2000	60	2.4	0.004	0.75
2	0.5	0.9°	60	4100	230	9.1	0.012	0.75	3500	170	6.7	0.009	0.75	2700	120	4.7	0.008	0.75	2000	60	2.4	0.004	0.75
3	0.8	0.9°	20	13000	7200	283.5	0.19	1	11000	5100	200.8	0.15	1	8700	4000	157.5	0.11	1	6500	1800	70.9	0.06	1
3	0.8	0.9°	25	13000	7200	283.5	0.19	1	11000	5100	200.8	0.15	1	8700	4000	157.5	0.11	1	6500	1800	70.9	0.06	1
3	0.8	0.9°	30	13000	5700	224.4	0.12	1	11000	4000	157.5	0.09	1	8700	3000	118.1	0.07	1	6500	1400	55.1	0.04	1
3	0.8	0.9°	40	11000	3600	141.7	0.08	1	9100	2600	102.4	0.06	1	7400	2000	78.7	0.05	1	5500	1000	39.4	0.025	1
3	0.8	0.9°	50	8000	2600	102.4	0.07	1	6600	1800	70.9	0.05	1	5800	1500	59.1	0.04	1	4600	800	31.5	0.02	1
3	0.8	0.9°	60	7800	2480	97.6	0.06	1	6600	1740	68.5	0.05	1	5000	1250	49.2	0.04	1	3900	610	24.0	0.02	1

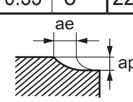
Depth of cut



Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 2) Air blow or oil mist is recommended for good chip evacuation.
Note 3) For profile machining such as molds, machining conditions may differ considerably depending on the workpiece material geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece material.
Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

Workpiece 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					Hardened Steel (45—55HRC) AISI H13					Hardened Steel (55—62HRC) AISI D2				
DC (mm)	RE (mm)	BHTA2	LB2 (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap(mm)	Width of cut ae(mm)
4	**1**	**0.4°**	**25**	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
4	**1**	**0.4°**	**30**	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
4	**1**	**0.4°**	**35**	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	**1**	**0.4°**	**40**	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	**1**	**0.4°**	**45**	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	**1**	**0.4°**	**50**	8100	6300	248.0	0.14	1.5	6700	4420	174.0	0.11	1.5	5400	3500	137.8	0.08	1.5	4000	1600	63.0	0.04	1.5
4	**1**	**0.9°**	**25**	10000	9900	389.8	0.24	1.5	8300	7000	275.6	0.19	1.5	6700	5600	220.5	0.14	1.5	5000	2500	98.4	0.07	1.5
4	**1**	**0.9°**	**30**	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	**1**	**0.9°**	**40**	10000	9900	389.8	0.15	1.5	8300	7000	275.6	0.12	1.5	6700	5600	220.5	0.09	1.5	5000	2500	98.4	0.04	1.5
4	**1**	**0.9°**	**50**	8100	6300	248.0	0.14	1.5	6700	4420	174.0	0.11	1.5	5400	3500	137.8	0.08	1.5	4000	1600	63.0	0.04	1.5
4	**1**	**0.9°**	**60**	8100	6300	248.0	0.11	1.5	6700	4420	174.0	0.08	1.5	5400	3500	137.8	0.06	1.5	4000	1600	63.0	0.03	1.5
6	**1.5**	**0.9°**	**40**	6600	11000	433.1	0.4	2	5500	7600	299.2	0.32	2	4500	6100	240.2	0.24	2	3300	2700	106.3	0.12	2
6	**1.5**	**0.9°**	**50**	6600	11000	433.1	0.4	2	5500	7600	299.2	0.32	2	4500	6100	240.2	0.24	2	3300	2700	106.3	0.12	2
6	**1.5**	**0.9°**	**60**	6600	11000	433.1	0.25	2	5500	7600	299.2	0.2	2	4500	6100	240.2	0.15	2	3300	2700	106.3	0.08	2
6	**1.5**	**0.9°**	**70**	5400	8700	342.5	0.23	2	4400	6200	244.1	0.18	2	3600	5000	196.9	0.14	2	2700	2200	86.6	0.07	2
8	**2**	**0.9°**	**60**	5000	11000	433.1	0.48	3	4200	7600	299.2	0.37	3	3300	6100	240.2	0.29	3	2500	2700	106.3	0.14	3
8	**2**	**0.9°**	**80**	5000	11000	433.1	0.3	3	4200	7600	299.2	0.23	3	3300	6100	240.2	0.18	3	2500	2700	106.3	0.09	3
10	**2**	**0.9°**	**80**	4000	11000	433.1	0.48	4.5	3300	7600	299.2	0.37	4.5	2700	6100	240.2	0.29	4.5	2000	2700	106.3	0.14	4.5
10	**2**	**0.9°**	**120**	3200	8700	342.5	0.27	4.5	2700	6200	244.1	0.21	4.5	2100	5000	196.9	0.16	4.5	1600	2200	86.6	0.08	4.5
12	**2**	**0.9°**	**80**	3300	10000	393.7	0.72	6	2700	7100	279.5	0.56	6	2200	5600	220.5	0.36	6	1700	2500	98.4	0.18	6
12	**2**	**0.9°**	**120**	3300	10000	393.7	0.45	6	2700	7100	279.5	0.35	6	2200	5600	220.5	0.23	6	1700	2500	98.4	0.12	6

Depth of cut

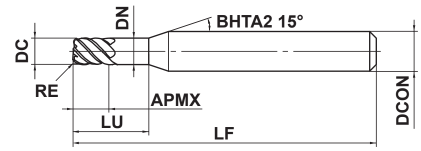


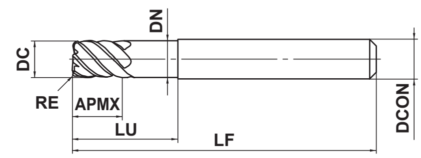
Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 2) Air blow or oil mist is recommended for good chip evacuation.
Note 3) For profile machining such as molds, machining conditions may differ considerably depending on the workpiece material geometry, machining methods and depth of cut. Reduce the feed rate especially when machining the corner sections of a workpiece material.
Note 4) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VFSDRB

Corner radius, Short cut length, 6 flute

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





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

● 6 flute end mill with Impact Miracle coating for high hardened materials.

(mm)

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFSDRBD0300R030	3	0.3	3	9	2.9	45	6	6	★	1
VFSDRBD0400R030	4	0.3	4	12	3.9	45	6	6	★	1
VFSDRBD0500R030	5	0.3	5	15	4.9	50	6	6	★	1
VFSDRBD0600R030	6	0.3	6	18	5.85	50	6	6	★	2
VFSDRBD0600R050	6	0.5	6	18	5.85	50	6	6	★	2
VFSDRBD0600R100	6	1	6	18	5.85	50	6	6	★	2
VFSDRBD0800R030	8	0.3	8	24	7.85	60	8	6	★	2
VFSDRBD0800R050	8	0.5	8	24	7.85	60	8	6	★	2
VFSDRBD0800R100	8	1	8	24	7.85	60	8	6	★	2
VFSDRBD1000R050	10	0.5	10	30	9.7	70	10	6	★	2
VFSDRBD1000R100	10	1	10	30	9.7	70	10	6	★	2
VFSDRBD1200R050	12	0.5	12	36	11.7	75	12	6	★	2
VFSDRBD1200R100	12	1	12	36	11.7	75	12	6	★	2

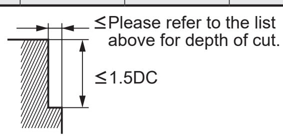
★ : Stocked in Japan

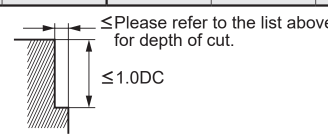
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened steel (45−55HRC) AISI H13 etc.				Hardened steel (55−62HRC) AISI D2 etc.				Hardened steel (62−70HRC) AISI W1, AISI M2 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
3	32000	3800	149.6	0.2	16000	1900	74.8	0.1	11000	1200	47.2	0.05
4	24000	4400	173.2	0.2	12000	2200	86.6	0.1	8000	1300	51.2	0.05
6	16000	5800	228.3	0.3	8000	2900	114.2	0.2	5300	1800	70.9	0.1
8	12000	5800	228.3	0.4	6000	2900	114.2	0.2	4000	1800	70.9	0.1
10	9600	5800	228.3	0.5	4800	2900	114.2	0.3	3200	1800	70.9	0.2
12	8000	4800	189.0	0.6	4000	2400	94.5	0.3	2700	1500	59.1	0.2

Depth of cut





DC : Dia.

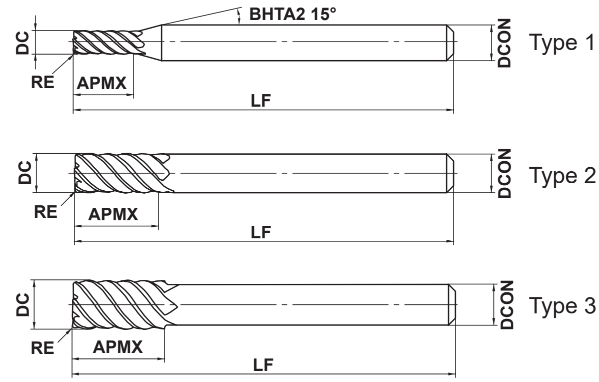
Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

VFMDRB

Corner radius, Medium cut length, 6 flute, For hardened materials

UWC VF 45°

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



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

h6

● 6 flute corner radius end mill with Impact Miracle coating for high hardened materials.

(mm)

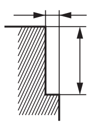
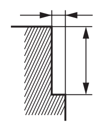
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VFMDRBD0300R030	3	0.3	10	60	6	6	★	1
VFMDRBD0400R030	4	0.3	12	60	6	6	★	1
VFMDRBD0500R030	5	0.3	15	60	6	6	★	1
VFMDRBD0600R030	6	0.3	15	60	6	6	★	2
VFMDRBD0600R050	6	0.5	15	60	6	6	★	2
VFMDRBD0600R100	6	1	15	60	6	6	★	2
VFMDRBD0800R030	8	0.3	20	75	8	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

★ : Stocked in Japan

ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Hardened steel (45—55HRC) AISI H13 etc.				Hardened steel (55—62HRC) AISI D2 etc.				Hardened steel (62—70HRC) AISI W1, AISI M2 etc.			
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut (mm)
3	32000	3800	149.6	0.2	16000	1900	74.8	0.1	11000	1200	47.2	0.05
4	24000	4400	173.2	0.2	12000	2200	86.6	0.1	8000	1300	51.2	0.05
6	16000	5800	228.3	0.3	8000	2900	114.2	0.2	5300	1800	70.9	0.1
8	12000	5800	228.3	0.4	6000	2900	114.2	0.2	4000	1800	70.9	0.1
10	9600	5800	228.3	0.5	4800	2900	114.2	0.3	3200	1800	70.9	0.2
12	8000	4800	189.0	0.6	4000	2400	94.5	0.3	2700	1500	59.1	0.2
16	6000	3600	141.7	0.8	3000	1800	70.9	0.5	2000	1100	43.3	0.3
20	4800	2900	114.2	1.0	2400	1400	55.1	0.5	1600	880	34.6	0.3
Depth of cut	 ≦Please refer to the list above for depth of cut. ≦1.5DC				 ≦Please refer to the list above for depth of cut. ≦1.0DC							

DC : Dia.

Note 1) If the depth of cut is smaller than this table, feed rate can be increased.
Note 2) If the rigidity of the machine or the workpiece material installation is very low, or chattering is generated, please reduce the revolution and the feed rate proportionately.

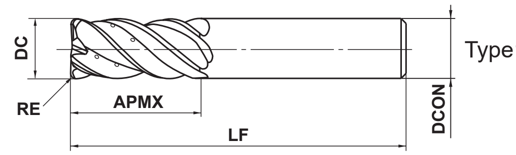
VFMHVRBCH

Corner radius, Medium cut length, 4 flute, Irregular helix flutes, with multiple thru-coolant

UWC VF 42° 45°

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

CoolStar



1≤RE≤3				
±0.015				
16≤DC≤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

★ : Stocked in Japan

ISO13399

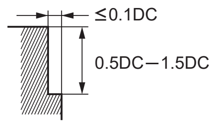
➤ I002

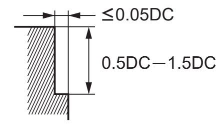
RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel (−45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
DC (mm)	Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	3000	1140	44.9	2000	560	22.0	800	110	4.3
20	2400	860	33.9	1600	510	20.1	600	100	3.9

Depth of cut



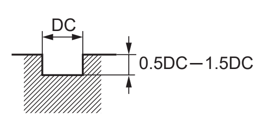


DC:Dia.

Slotting

Workpiece Material	Carbon steel, Cast iron, Alloy steel (−30HRC) AISI 1050, AISI No 35 B, AISI P20			Alloy steel, Tool steel, Pre-hardened steel (−45HRC) AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
16	2400	670	26.4	1400	380	15.0	1400	170	6.7
20	1900	610	24.0	1100	350	13.8	1100	130	5.1

Depth of cut



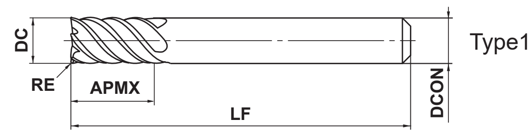
DC:Dia.

Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 2) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abonrmal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VF6MHVRB

Corner radius, Medium cut length, 6 flute, Irregular helix flutes

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



0.5≤RE≤2				
±0.015				
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	

- 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)

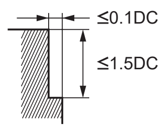
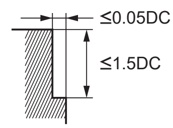
Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VF6MHVRBD0600R050	6	0.5	13	50	6	6	★	1
VF6MHVRBD0600R100	6	1	13	50	6	6	★	1
VF6MHVRBD0800R050	8	0.5	19	60	8	6	★	1
VF6MHVRBD0800R100	8	1	19	60	8	6	★	1
VF6MHVRBD1000R050	10	0.5	22	70	10	6	★	1
VF6MHVRBD1000R100	10	1	22	70	10	6	★	1
VF6MHVRBD1200R050	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

★ : Stocked in Japan

ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

■Side milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21 etc.			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V etc.			Heat resistant alloy Inconel718 etc.		
DC (mm)	Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed		Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)		(mm/min)	(IPM)		(mm/min)	(IPM)
6	10600	2900	114.2	8000	2000	78.7	2100	320	12.6
8	8000	2900	114.2	6000	2000	78.7	1600	300	11.8
10	6400	2700	106.3	4800	2000	78.7	1300	260	10.2
12	5300	2700	106.3	4000	2000	78.7	1100	230	9.1
16	4000	2200	86.6	3000	1600	63.0	800	180	7.1
20	3200	1900	74.8	2400	1400	55.1	640	150	5.9
Depth of cut									

DC : Dia.

Note 1) When cutting austenitic stainless steel, the use of water-soluble cutting fluid is especially effective.
Note 2) If the depth of cut is smaller than this table, feed rate can be increased.
Note 3) The irregular helix flute end mill has a large effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is very low, then vibration can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

IMPACT MIRACLE END MILLS

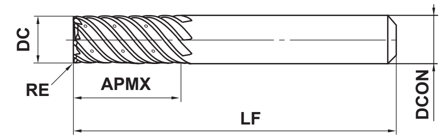
VF8MHVRBCH

Corner radius, Medium cut length, 8 flute, Irregular helix flutes, with multiple thru-coolant

UWC VF 44° 45°

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

CoolStar



Type1

1≤RE≤3				
±0.015				
16≤DC≤20				
0 - 0.03				
DCON=16	DCON=20			
0 - 0.011	0 - 0.013			

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

(mm)

Order Number	DC	RE	APMX	LF	DCON	No. of Flutes	Stock	Type
VF8MHVRBCHD1600R100	16	1	32	90	16	8	★	1
VF8MHVRBCHD1600R300	16	3	32	90	16	8	★	1
VF8MHVRBCHD2000R100	20	1	38	100	20	8	★	1
VF8MHVRBCHD2000R300	20	3	38	100	20	8	★	1

★ : Stocked in Japan

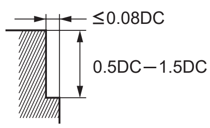
ISO13399 ➤ I002

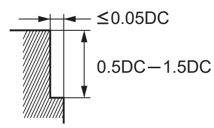
RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V			Heat resistant alloy Inconel718		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
16	4000	2400	94.5	3000	2100	82.7	800	240	9.4
20	3200	1900	74.8	2400	1900	74.8	640	200	7.9

Depth of cut





DC:Dia.

Trochoidal milling

Workpiece Material	Alloy steel, Tool steel, Pre-hardened steel AISI H13, AISI W1-10, AISI P21			Austenitic stainless steel, Titanium alloy AISI 304, AISI 306, Ti-6Al-4V		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
16	4000	1900	74.8	3000	1400	55.1
20	3200	1500	59.1	2400	1200	47.2

Depth of cut

DC:Dia.

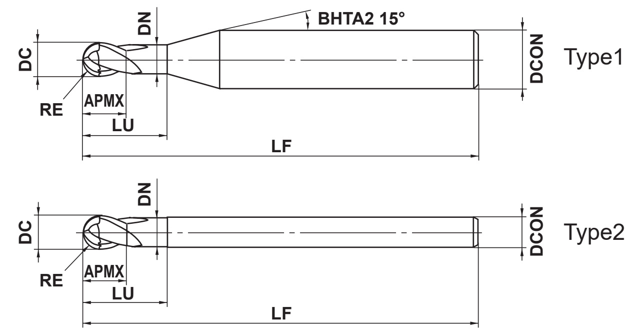
Note 1) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 2) The irregular helix flute end mill has a larger effect on controlling vibration when compared to standard end mills. However, if the rigidity of the machine or the workpiece material installation is poor, vibration or abonrmal sound can occur. In this case, please reduce the revolution and feed rate proportionately, or set a lower depth of cut.

VFR2SSB

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

UWC VFR 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	Aluminum Alloy
	○	◎	◎				



	RE≤6			
	±0.005			
h5	4≤DCON≤6	8≤DCON≤10	DCON=12	
	0 - 0.005	0 - 0.006	0 - 0.008	

● Optimization of the cutting edge curve, helix angle, and rake angle have improved the edge strength at all areas of the ball blades.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFR2SSBR0050S04	0.5	1	1	2	0.94	40	4	2	●	1
VFR2SSBR0050	0.5	1	1	2	0.94	40	6	2	●	1
VFR2SSBR0075S04	0.75	1.5	1.5	3	1.44	40	4	2	●	1
VFR2SSBR0075	0.75	1.5	1.5	3	1.44	40	6	2	●	1
VFR2SSBR0100	1	2	2	4	1.9	45	6	2	●	1
VFR2SSBR0150	1.5	3	3	6	2.9	45	6	2	●	1
VFR2SSBR0200	2	4	4	8	3.9	45	6	2	●	1
VFR2SSBR0250	2.5	5	5	10	4.9	50	6	2	●	1
VFR2SSBR0300	3	6	6	12	5.85	50	6	2	●	2
VFR2SSBR0400	4	8	8	14	7.85	60	8	2	●	2
VFR2SSBR0500	5	10	10	18	9.7	70	10	2	●	2
VFR2SSBR0600	6	12	12	22	11.7	75	12	2	●	2

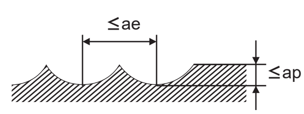
● : USA Stock

ISO13399 ➤ I002

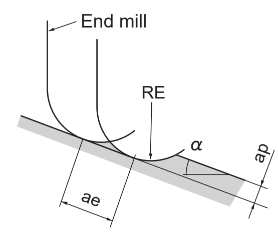
RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Hardened steel (45−55HRC) AISI H13						Hardened steel (55−62HRC) AISI D2						Hardened steel (62−70HRC) AISI W1, AISI M2					
RE		$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut	Depth of cut	$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut	Depth of cut	$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut	Depth of cut
(mm)	(inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	ap (inch)	ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	ap (inch)	ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	ap (inch)	ae (inch)
0.5	**.020**	40000	315.0	40000	126.0	.0024	.0039	40000	220.5	40000	94.5	.0020	.0039	40000	141.7	32000	51.2	.0016	.0039
0.75	**.030**	40000	378.0	40000	157.5	.0035	.0059	40000	283.5	32000	98.4	.0030	.0059	32000	177.2	21000	47.2	.0020	.0059
1	**.039**	40000	378.0	39000	185.0	.0043	.0079	40000	315.0	24000	94.5	.0039	.0079	24000	149.6	16000	39.4	.0028	.0079
1.5	**.059**	40000	472.4	27000	169.3	.0051	.0118	32000	303.1	16000	86.6	.0047	.0118	16000	126.0	11000	34.6	.0035	.0118
2	**.079**	32000	428.3	20000	141.7	.0059	.0157	24000	244.1	12000	74.8	.0051	.0157	12000	94.5	8000	31.5	.0039	.0157
2.5	**.098**	25000	354.3	16000	114.2	.0079	.0197	19000	208.7	9600	66.9	.0059	.0197	9600	82.7	6000	23.6	.0039	.0197
3	**.118**	21000	330.7	13000	102.4	.0098	.0236	16000	189.0	8000	63.0	.0079	.0236	8000	66.9	5000	23.6	.0043	.0236
4	**.157**	16000	252.0	10000	78.7	.0118	.0315	12000	141.7	6000	47.2	.0079	.0315	6000	55.1	4000	18.9	.0043	.0315
5	**.197**	13000	204.7	8000	66.9	.0197	.0394	10000	126.0	4800	37.8	.0079	.0394	4800	43.3	3000	16.5	.0047	.0394
6	**.236**	9000	141.7	6000	51.2	.0197	.0472	7000	86.6	3600	28.3	.0118	.0472	3600	33.9	2200	12.2	.0047	.0472

Depth of cut



Note 1) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Please reduce the feed rate when the surface finish is important.
Note 3) α is the inclination angle of the machined surface.



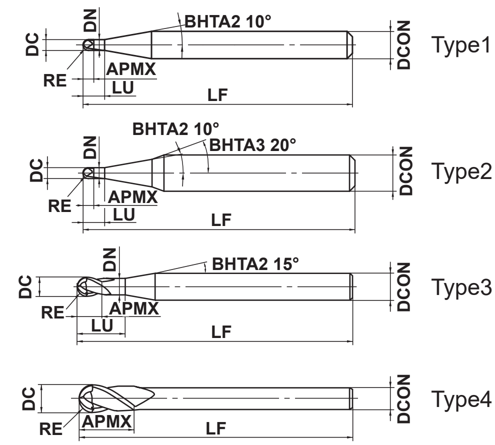
ae:Pick Feed

VFR2SB

Ball nose, Short cut length, 2 flute

UWC VFR 0° RE<0.3 20° RE≥0.3

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	Aluminum Alloy
	○	◎	◎				



RE≤6	RE>6			
±0.005	±0.010			
DCON=3	4≤DCON≤6	8≤DCON≤10	12≤DCON≤16	DCON=20
0 - 0.004	0 - 0.005	0 - 0.006	0 - 0.008	0 - 0.009

● Optimization of the cutting edge curve, helix angle, and rake angle have improved the edge strength at all areas of the ball blades.

(mm)

Order Number	RE	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
VFR2SBR0010	0.1	0.2	0.2	0.4	0.17	45	4	2	●	1
VFR2SBR0010S06	0.1	0.2	0.2	0.4	0.17	50	6	2	●	2
VFR2SBR0015	0.15	0.3	0.3	0.6	0.27	45	4	2	●	1
VFR2SBR0015S06	0.15	0.3	0.3	0.6	0.27	50	6	2	●	2
VFR2SBR0020	0.2	0.4	0.4	0.8	0.36	45	4	2	●	1
VFR2SBR0020S06	0.2	0.4	0.4	0.8	0.36	50	6	2	●	2
VFR2SBR0030	0.3	0.6	0.6	1.2	0.56	45	4	2	●	3
VFR2SBR0030S06	0.3	0.6	0.6	1.2	0.56	50	6	2	●	3
VFR2SBR0040	0.4	0.8	0.8	1.6	0.76	45	4	2	●	3
VFR2SBR0040S06	0.4	0.8	0.8	1.6	0.76	50	6	2	●	3
VFR2SBR0050	0.5	1	1	2	0.94	45	4	2	●	3
VFR2SBR0050S06	0.5	1	1	2	0.94	50	6	2	●	3
VFR2SBR0060	0.6	1.2	1.2	2.4	1.14	45	4	2	●	3
VFR2SBR0060S06	0.6	1.2	1.2	2.4	1.14	50	6	2	●	3
VFR2SBR0070	0.7	1.4	1.4	2.8	1.34	45	4	2	●	3
VFR2SBR0070S06	0.7	1.4	1.4	2.8	1.34	50	6	2	●	3
VFR2SBR0075	0.75	1.5	1.5	3	1.44	45	4	2	●	3
VFR2SBR0075S06	0.75	1.5	1.5	3	1.44	50	6	2	●	3
VFR2SBR0080	0.8	1.6	1.6	3.2	1.54	45	4	2	●	3
VFR2SBR0080S06	0.8	1.6	1.6	3.2	1.54	50	6	2	●	3
VFR2SBR0090	0.9	1.8	1.8	3.6	1.74	45	4	2	●	3
VFR2SBR0090S06	0.9	1.8	1.8	3.6	1.74	50	6	2	●	3
VFR2SBR0100	1	2	2	4	1.9	50	4	2	●	3
VFR2SBR0100S06	1	2	2	4	1.9	60	6	2	●	3
VFR2SBR0125S06	1.25	2.5	2.5	5	2.4	60	6	2	●	3
VFR2SBR0150S03	1.5	3	3	—	—	60	3	2	●	4
VFR2SBR0150	1.5	3	3	6	2.9	70	6	2	●	3
VFR2SBR0200S04	2	4	4	—	—	60	4	2	●	4
VFR2SBR0200	2	4	4	8	3.9	70	6	2	●	3
VFR2SBR0250	2.5	5	5	10	4.9	80	6	2	●	3
VFR2SBR0300	3	6	12	—	—	80	6	2	●	4
VFR2SBR0400	4	8	14	—	—	90	8	2	●	4
VFR2SBR0500	5	10	18	—	—	100	10	2	●	4
VFR2SBR0600	6	12	22	—	—	110	12	2	●	4
VFR2SBR0800	8	16	30	—	—	140	16	2	★	4
VFR2SBR1000	10	20	38	—	—	160	20	2	★	4

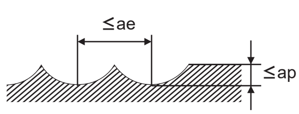
● : USA Stock **★ : Stocked in Japan**

ISO13399 ➤ I002

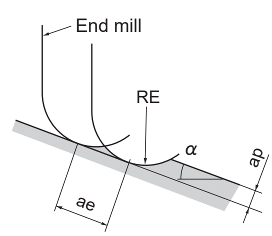
RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Hardened steel (45－55HRC) AISI H13						Hardened steel (55－62HRC) AISI D2						Hardened steel (62－70HRC) AISI W1, AISI M2					
RE		$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut	Depth of cut	$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut	Depth of cut	$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut	Depth of cut
(mm)	(inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	ap (inch)	ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	ap (inch)	ae (inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)	ap (inch)	ae (inch)
0.1	**.004**	40000	12.6	40000	9.4	.0001	.0008	40000	12.6	40000	6.3	.0001	.0008	40000	12.6	40000	6.3	.0001	.0008
0.15	**.006**	40000	25.2	40000	22.0	.0004	.0012	40000	25.2	40000	15.7	.0003	.0012	40000	25.2	40000	15.7	.0002	.0012
0.2	**.008**	40000	63.0	40000	47.2	.0008	.0016	40000	55.1	40000	39.4	.0006	.0016	40000	47.2	40000	39.4	.0004	.0016
0.3	**.012**	40000	126.0	40000	63.0	.0012	.0024	40000	110.2	40000	47.2	.0010	.0024	40000	78.7	40000	47.2	.0008	.0024
0.4	**.016**	40000	252.0	40000	94.5	.0020	.0031	40000	157.5	40000	63.0	.0016	.0031	40000	110.2	40000	63.0	.0012	.0031
0.5	**.020**	40000	315.0	40000	126.0	.0024	.0039	40000	220.5	40000	94.5	.0020	.0039	40000	141.7	32000	51.2	.0016	.0039
0.75	**.030**	40000	378.0	40000	157.5	.0035	.0059	40000	283.5	32000	98.4	.0030	.0059	32000	177.2	21000	47.2	.0020	.0059
1	**.039**	40000	378.0	39000	185.0	.0043	.0079	40000	315.0	24000	94.5	.0039	.0079	24000	149.6	16000	39.4	.0028	.0079
1.25	**.049**	40000	409.4	32000	177.2	.0047	.0098	37000	318.9	19000	90.6	.0043	.0098	19000	133.9	13000	39.4	.0031	.0098
1.5	**.059**	40000	472.4	27000	169.3	.0051	.0118	32000	303.1	16000	86.6	.0047	.0118	16000	126.0	11000	34.6	.0035	.0118
2	**.079**	32000	428.3	20000	141.7	.0059	.0157	24000	244.1	12000	74.8	.0051	.0157	12000	94.5	8000	31.5	.0039	.0157
2.5	**.098**	25000	354.3	16000	114.2	.0079	.0197	19000	208.7	9600	66.9	.0059	.0197	9600	82.7	6000	23.6	.0039	.0197
3	**.118**	21000	330.7	13000	102.4	.0098	.0236	16000	189.0	8000	63.0	.0079	.0236	8000	66.9	5000	23.6	.0043	.0236
4	**.157**	16000	252.0	10000	78.7	.0118	.0315	12000	141.7	6000	47.2	.0079	.0315	6000	55.1	4000	18.9	.0043	.0315
5	**.197**	13000	204.7	8000	66.9	.0197	.0394	10000	126.0	4800	37.8	.0079	.0394	4800	43.3	3000	16.5	.0047	.0394
6	**.236**	9000	141.7	6000	51.2	.0197	.0472	7000	86.6	3600	28.3	.0118	.0472	3600	33.9	2200	12.2	.0047	.0472
8	**.315**	6000	94.5	4000	39.4	.0197	.0630	5000	63.0	2500	19.7	.0118	.0630	2500	25.6	1500	9.4	.0059	.0630
10	**.394**	4500	70.9	3000	30.7	.0197	.0787	4000	51.2	1800	14.2	.0118	.0787	1800	18.5	1000	6.3	.0059	.787

Depth of cut



Note 1) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Please reduce the feed rate when the surface finish is important.
Note 3) α is the inclination angle of the machined surface.

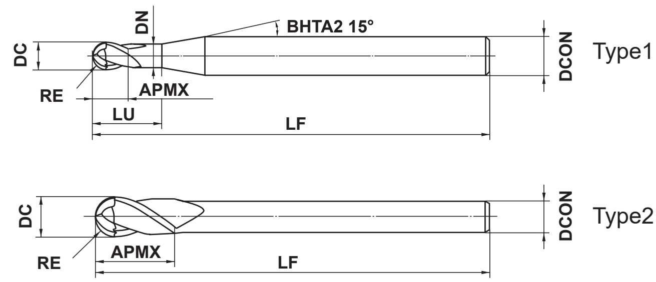


ae:Pick Feed

VFR2SBF

Ball nose, Short cut length, 2 flute, For Mirror finish 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	Aluminum Alloy
	○	◎	◎				



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

●New ball geometry for mirror finish cutting.

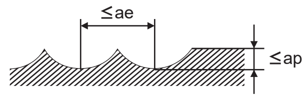
(mm)

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

 ● : USA Stock

ISO13399 ➤ I002

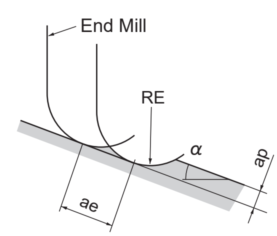
RECOMMENDED CUTTING CONDITIONS

Workpiece Material		Carbon steel, Alloy steel (180−280HB) Alloy tool steel (≦350HB), Pre-hardened steel (35−45HRC) Hardened steel (45−52HRC), Hardened steel (55−62HRC) AISI 1045, AISI 4140, AISI P21, AISI P20, SKD, SKT, AISI H13, AISI L6, AISI D2						Hardened steel (62−70HRC) AISI W1, AISI M2					
RE		$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut ap (inch)	Depth of cut ae (inch)	$\alpha \leq 15°$		$\alpha > 15°$		Depth of cut ap (inch)	Depth of cut ae (inch)
(mm)	(inch)	Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)			Revolution (min^{-1})	Table Feed (IPM)	Revolution (min^{-1})	Table Feed (IPM)		
0.5	**.020**	40000	31.5	40000	31.5	.0003	.0003	40000	22.0	40000	22.0	.0002	.0002
0.75	**.030**	40000	31.5	40000	31.5	.0004	.0004	40000	22.0	40000	22.0	.0003	.0003
1	**.039**	35000	41.3	35000	41.3	.0004	.0004	35000	27.6	35000	27.6	.0004	.0004
1.25	**.049**	35000	41.3	35000	41.3	.0005	.0005	35000	27.6	35000	27.6	.0004	.0004
1.5	**.059**	35000	41.3	35000	41.3	.0006	.0006	35000	27.6	35000	27.6	.0005	.0005
2	**.079**	25000	39.4	25000	39.4	.0007	.0007	25000	29.5	25000	29.5	.0006	.0006
2.5	**.098**	25000	39.4	25000	39.4	.0008	.0008	25000	29.5	25000	29.5	.0006	.0006
3	**.118**	25000	39.4	25000	39.4	.0008	.0008	25000	29.5	25000	29.5	.0006	.0006
Depth of cut													

Note 1) The tools are recommended for use only in finish machining.
Note 2) Air blowing and oil mist are recommended as coolants.
Note 3) Note the following points when using the tools.

- Avoid using equipment abruptly without proper preparation. After sufficiently energizing equipment, ensure that there will be no changes to the depth of cut such as due to elongation of the main axis during machining.
- If the tools are used immediately after rough machining of a surface, large uneven areas (cusp heights) will cause deflection of the tools and waviness of the machined surface. Therefore, it is recommended to add a medium finish machining process which uses the same value of ae as indicated in the table above.

Note 4) α is the inclination angle of the machined surface.



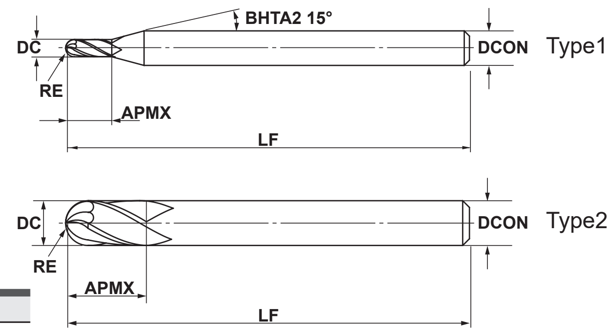
VFR4MB

NEW

Ball nose, Medium cut length, 4 flute

UWC VFR 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	Aluminum Alloy
	○	◎	◎				



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

● The 4 flute geometry with a cutting edge extending to the center achieves a long tool life and enables high efficiency machining.

(mm)

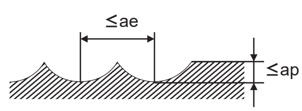
Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
VFR4MBR0050	0.5	1	2.5	50	6	4	●	1
VFR4MBR0100	1	2	6	60	6	4	●	1
VFR4MBR0150	1.5	3	8	70	6	4	●	1
VFR4MBR0200	2	4	8	70	6	4	●	1
VFR4MBR0250	2.5	5	12	80	6	4	●	1
VFR4MBR0300	3	6	12	80	6	4	●	2
VFR4MBR0400	4	8	14	90	8	4	●	2
VFR4MBR0500	5	10	18	100	10	4	●	2
VFR4MBR0600	6	12	22	110	12	4	★	2

● : USA Stock ★ : Stocked in Japan

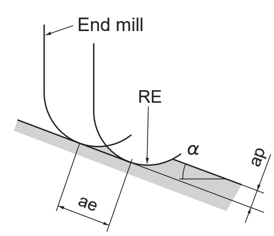
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

(inch)

Workpiece Material		Hardened Steel (45−55HRC)						Hardened Steel (55−65HRC)						Hardened Steel (65−70HRC)					
RE		α≤15°		α>15°		Depth of cut	Depth of cut	α≤15°		α>15°		Depth of cut	Depth of cut	α≤15°		α>15°		Depth of cut	Depth of cut
(mm)	(inch)	Revolution (min^{-1})	Table feed (IPM)	Revolution (min^{-1})	Table feed (IPM)	ap	ae	Revolution (min^{-1})	Table feed (IPM)	Revolution (min^{-1})	Table feed (IPM)	ap	ae	Revolution (min^{-1})	Table feed (IPM)	Revolution (min^{-1})	Table feed (IPM)	ap	ae
0.5	**.020**	40000	315.0	40000	149.6	.0024	.004	40000	220.5	40000	122.0	.0020	.004	40000	185.0	32000	66.9	.0012	.004
1.0	**.039**	40000	378.0	40000	220.5	.0043	.008	40000	315.0	28000	122.0	.0039	.008	24000	196.9	16000	47.2	.0024	.008
1.5	**.059**	40000	472.4	32000	220.5	.0051	.012	32000	303.2	19000	114.2	.0047	.012	16000	165.4	11000	43.3	.0028	.012
2.0	**.079**	32000	433.1	24000	185.0	.0059	.016	24000	244.1	14000	98.4	.0051	.016	12000	122.0	8000	39.4	.0031	.016
2.5	**.098**	25000	354.3	19000	149.6	.0079	.020	19000	208.7	12000	86.6	.0059	.020	9600	106.3	6000	30.7	.0031	.020
3.0	**.118**	21000	330.7	15000	133.9	.0098	.024	16000	189.0	9600	78.7	.0079	.024	8000	90.6	5000	30.7	.0035	.024
4.0	**.157**	16000	252.0	12000	102.4	.0118	.031	12000	141.7	7200	63.0	.0079	.031	6000	74.8	4000	24.4	.0035	.031
5.0	**.197**	13000	204.7	9600	86.6	.0197	.039	10000	126.0	5800	51.2	.0079	.039	4800	59.1	3000	21.7	.0039	.039
6.0	**.236**	9000	141.7	7200	66.9	.0197	.047	7000	86.6	4300	37.0	.0118	.047	3600	43.3	2200	15.7	.0039	.047
Depth of cut																			

Note 1) 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 2) If the rigidity of the machine or the workpiece materials installation is very low, or chattering and noise are generated, please adjust the revolution, feed rate and depth of cut.
Note 3) α is the inclination angle of the machined surface.



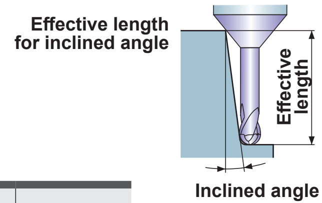
ae:Pick Feed

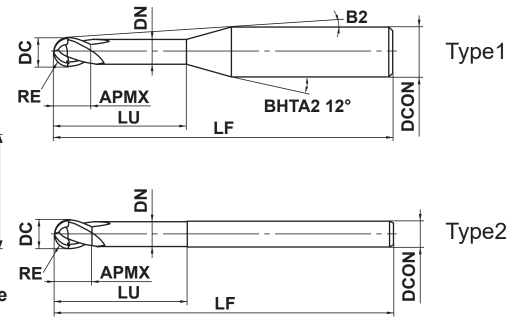
VFR2XLB NEW

Ball nose, 2 Flute, Long neck

CARBIDE

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





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

● Precise machining of vertical walls is possible due to a back taper and a strong, seamless ball nose cutting edge geometry.

(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°
VFR2XLBR0010N005	0.1	0.2	0.15	0.5	0.18	11.5°	50	4	2	★	1	0.5	0.5	0.6	0.7
VFR2XLBR0010N010	0.1	0.2	0.15	1	0.18	10.9°	50	4	2	●	1	1	1.1	1.2	1.3
VFR2XLBR0015N010	0.15	0.3	0.24	1	0.28	10.9°	50	4	2	●	1	1	1.1	1.2	1.3
VFR2XLBR0015N015	0.15	0.3	0.24	1.5	0.28	10.4°	50	4	2	●	1	1.6	1.6	1.8	2
VFR2XLBR0015N020	0.15	0.3	0.24	2	0.28	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
VFR2XLBR0020N010	0.2	0.4	0.3	1	0.37	11°	50	4	2	●	1	1	1.1	1.2	1.3
VFR2XLBR0020N015	0.2	0.4	0.3	1.5	0.37	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
VFR2XLBR0020N020	0.2	0.4	0.3	2	0.37	9.9°	50	4	2	●	1	2.1	2.2	2.3	2.6
VFR2XLBR0020N025	0.2	0.4	0.3	2.5	0.37	9.5°	50	4	2	★	1	2.6	2.7	2.9	3.3
VFR2XLBR0020N030	0.2	0.4	0.3	3	0.37	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
VFR2XLBR0020N040	0.2	0.4	0.3	4	0.37	8.4°	50	4	2	★	1	4.2	4.3	4.7	5.2
VFR2XLBR0025N015	0.25	0.5	0.37	1.5	0.47	10.4°	50	4	2	●	1	1.5	1.6	1.7	1.9
VFR2XLBR0025N020	0.25	0.5	0.37	2	0.47	9.9°	50	4	2	●	1	2.1	2.1	2.3	2.6
VFR2XLBR0025N025	0.25	0.5	0.37	2.5	0.47	9.5°	50	4	2	●	1	2.6	2.7	2.9	3.2
VFR2XLBR0025N030	0.25	0.5	0.37	3	0.47	9.1°	50	4	2	●	1	3.1	3.2	3.5	3.9
VFR2XLBR0025N040	0.25	0.5	0.37	4	0.47	8.3°	50	4	2	●	1	4.1	4.3	4.7	5.2
VFR2XLBR0030N020	0.3	0.6	0.45	2	0.57	9.9°	50	4	2	●	1	2.1	2.2	2.4	2.6
VFR2XLBR0030N020S06	0.3	0.6	0.45	2	0.57	10.6°	50	6	2	●	1	2.1	2.2	2.4	2.6
VFR2XLBR0030N030	0.3	0.6	0.45	3	0.57	9°	50	4	2	●	1	3.1	3.3	3.6	4
VFR2XLBR0030N030S06	0.3	0.6	0.45	3	0.57	9.9°	50	6	2	★	1	3.1	3.3	3.6	4
VFR2XLBR0030N040	0.3	0.6	0.45	4	0.57	8.2°	50	4	2	★	1	4.2	4.4	4.8	5.3
VFR2XLBR0030N050	0.3	0.6	0.45	5	0.57	7.6°	50	4	2	★	1	5.2	5.5	6	6.6
VFR2XLBR0030N060	0.3	0.6	0.45	6	0.57	7.1°	50	4	2	●	1	6.3	6.6	7.2	7.9
VFR2XLBR0040N030	0.4	0.8	0.6	3	0.77	8.9°	50	4	2	●	1	3.1	3.3	3.6	3.9
VFR2XLBR0040N040	0.4	0.8	0.6	4	0.77	8.2°	50	4	2	●	1	4.2	4.4	4.8	5.2
VFR2XLBR0040N060	0.4	0.8	0.6	6	0.77	6.9°	50	4	2	●	1	6.3	6.5	7.2	7.9
VFR2XLBR0040N080	0.4	0.8	0.6	8	0.77	6°	50	4	2	★	1	8.4	8.7	9.5	10.6
VFR2XLBR0050N030	0.5	1	0.75	3	0.96	8.7°	50	4	2	●	1	3.2	3.4	3.7	4.1
VFR2XLBR0050N030S06	0.5	1	0.75	3	0.96	9.8°	50	6	2	●	1	3.2	3.4	3.7	4.1
VFR2XLBR0050N040	0.5	1	0.75	4	0.96	7.9°	50	4	2	●	1	4.3	4.5	4.9	5.4
VFR2XLBR0050N040S06	0.5	1	0.75	4	0.96	9.2°	50	6	2	●	1	4.3	4.5	4.9	5.4
VFR2XLBR0050N060	0.5	1	0.75	6	0.96	6.7°	50	4	2	●	1	6.3	6.5	7.2	7.9

● : USA Stock ★ : Stocked 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°
VFR2XLBR0050N060S06	0.5	1	0.75	6	0.96	8.2°	50	6	2	●	1	6.3	6.5	7.2	7.9
VFR2XLBR0050N080	0.5	1	0.75	8	0.96	5.8°	50	4	2	●	1	8.5	8.9	9.7	10.7
VFR2XLBR0050N100	0.5	1	0.75	10	0.96	5.1°	50	4	2	●	1	10.6	11.1	12.1	13.4
VFR2XLBR0050N120	0.5	1	0.75	12	0.96	4.6°	50	4	2	●	1	12.7	13.2	14.5	16
VFR2XLBR0075N060	0.75	1.5	1.1	6	1.44	6.3°	50	4	2	●	1	6.3	6.6	7.2	7.9
VFR2XLBR0075N060S06	0.75	1.5	1.1	6	1.44	8°	50	6	2	●	1	6.3	6.6	7.2	7.9
VFR2XLBR0075N080	0.75	1.5	1.1	8	1.44	5.4°	50	4	2	●	1	8.4	8.8	9.6	10.6
VFR2XLBR0075N080S06	0.75	1.5	1.1	8	1.44	7.2°	50	6	2	●	1	8.4	8.8	9.6	10.6
VFR2XLBR0075N100	0.75	1.5	1.1	10	1.44	4.7°	50	4	2	★	1	10.5	11	12	13.2
VFR2XLBR0075N120	0.75	1.5	1.1	12	1.44	4.2°	50	4	2	●	1	12.6	13.1	14.4	15.9
VFR2XLBR0075N140	0.75	1.5	1.1	14	1.44	3.8°	50	4	2	★	1	14.7	15.3	16.8	18.5
VFR2XLBR0075N160	0.75	1.5	1.1	16	1.44	3.4°	60	4	2	★	1	16.8	17.5	19.2	21.2
VFR2XLBR0100N060	1	2	1.5	6	1.94	5.8°	50	4	2	●	1	6.3	6.6	7.1	7.8
VFR2XLBR0100N060S06	1	2	1.5	6	1.94	7.8°	50	6	2	●	1	6.3	6.6	7.1	7.8
VFR2XLBR0100N080	1	2	1.5	8	1.94	4.8°	50	4	2	●	1	8.4	8.8	9.5	10.5
VFR2XLBR0100N080S06	1	2	1.5	8	1.94	6.9°	50	6	2	●	1	8.4	8.8	9.5	10.5
VFR2XLBR0100N100	1	2	1.5	10	1.94	4.2°	50	4	2	★	1	10.5	10.9	11.9	13.1
VFR2XLBR0100N100S06	1	2	1.5	10	1.94	6.2°	50	6	2	●	1	10.5	10.9	11.9	13.1
VFR2XLBR0100N120	1	2	1.5	12	1.94	3.6°	50	4	2	●	1	12.6	13.1	14.3	15.8
VFR2XLBR0100N120S06	1	2	1.5	12	1.94	5.6°	50	6	2	●	1	12.6	13.1	14.3	15.8
VFR2XLBR0100N160	1	2	1.5	16	1.94	2.9°	60	4	2	●	1	16.8	17.5	19.1	*
VFR2XLBR0100N160S06	1	2	1.5	16	1.94	4.7°	60	6	2	★	1	16.8	17.5	19.1	21.1
VFR2XLBR0100N200	1	2	1.5	20	1.94	2.4°	60	4	2	●	1	20.9	21.8	23.9	*
VFR2XLBR0100N200S06	1	2	1.5	20	1.94	4°	60	6	2	★	1	20.9	21.8	23.9	26.4
VFR2XLBR0125N100	1.25	2.5	1.9	10	2.4	3.5°	60	4	2	★	1	10.4	10.8	11.8	12.9
VFR2XLBR0125N150	1.25	2.5	1.9	15	2.4	2.5°	60	4	2	★	1	15.6	16.3	17.8	*
VFR2XLBR0150N100	1.5	3	2.3	10	2.9	5.5°	60	6	2	●	1	10.4	10.8	11.7	12.9
VFR2XLBR0150N120	1.5	3	2.3	12	2.9	4.9°	60	6	2	●	1	12.5	13	14.1	15.5
VFR2XLBR0150N160	1.5	3	2.3	16	2.9	4°	70	6	2	●	1	16.7	17.3	18.9	20.8
VFR2XLBR0150N200	1.5	3	2.3	20	2.9	3.4°	70	6	2	●	1	20.8	21.7	23.7	26.1
VFR2XLBR0150N250	1.5	3	2.3	25	2.9	2.8°	70	6	2	●	1	26.1	27.2	29.7	*
VFR2XLBR0150N300	1.5	3	2.3	30	2.9	2.5°	70	6	2	●	1	31.3	32.6	35.7	*
VFR2XLBR0200N100	2	4	3	10	3.9	4.5°	70	6	2	●	1	10.4	10.8	11.6	12.7
VFR2XLBR0200N120	2	4	3	12	3.9	3.9°	70	6	2	●	1	12.5	12.9	14	15.4
VFR2XLBR0200N160	2	4	3	16	3.9	3.1°	70	6	2	●	1	16.6	17.3	18.8	20.7
VFR2XLBR0200N200	2	4	3	20	3.9	2.6°	70	6	2	●	1	20.8	21.7	23.6	*
VFR2XLBR0200N250	2	4	3	25	3.9	2.1°	70	6	2	●	1	26	27.1	29.6	*
VFR2XLBR0200N300	2	4	3	30	3.9	1.8°	70	6	2	★	1	31.2	32.6	*	*
VFR2XLBR0250N200	2.5	5	3.8	20	4.9	1.5°	70	6	2	●	1	20.8	21.6	*	*
VFR2XLBR0250N250	2.5	5	3.8	25	4.9	1.2°	70	6	2	★	1	26	27.1	*	*
VFR2XLBR0300N180	3	6	6	18	5.85	—	80	6	2	★	2	*	*	*	*
VFR2XLBR0300N300	3	6	6	30	5.85	—	80	6	2	●	2	*	*	*	*

* No interference

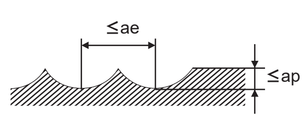
VFR2XLB

Ball nose, 2 Flute, Long neck

RECOMMENDED CUTTING CONDITIONS

Workpiece Material				Hardened Steels (45−55HRC)				Hardened Steels (55−70HRC)			
Corner Radius **RE**		Neck length **LU**		Revolution	Table Feed	Depth of Cut **ap**	Width of Cut **ae**	Revolution	Table Feed	Depth of Cut **ap**	Width of Cut **ae**
(mm)	(inch)	(mm)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)
0.1	**.004**	**0.5**	**.020**	40000	11.8	.00012	.0004	40000	11.8	.00008	.0004
0.1	**.004**	**1**	**.039**	40000	11.8	.00008	.0004	40000	11.8	.00008	.0004
0.15	**.006**	**1**	**.039**	40000	19.7	.00028	.0006	40000	19.7	.00020	.0006
0.15	**.006**	**1.5**	**.059**	40000	19.7	.00020	.0006	40000	19.7	.00012	.0006
0.15	**.006**	**2**	**.079**	40000	19.7	.00012	.0006	40000	19.7	.00008	.0006
0.2	**.008**	**1**	**.039**	40000	55.1	.00059	.0008	40000	55.1	.00039	.0008
0.2	**.008**	**1.5**	**.059**	40000	39.4	.00039	.0008	40000	39.4	.00024	.0008
0.2	**.008**	**2**	**.079**	40000	39.4	.00039	.0008	40000	39.4	.00024	.0008
0.2	**.008**	**2.5**	**.098**	40000	27.6	.00020	.0008	40000	27.6	.00012	.0008
0.2	**.008**	**3**	**.118**	40000	27.6	.00020	.0008	40000	27.6	.00012	.0008
0.2	**.008**	**4**	**.157**	40000	23.6	.00016	.0008	40000	19.7	.00012	.0008
0.25	**.010**	**1.5**	**.059**	40000	78.7	.00079	.0010	40000	78.7	.00059	.0010
0.25	**.010**	**2**	**.079**	40000	78.7	.00079	.0010	40000	78.7	.00059	.0010
0.25	**.010**	**2.5**	**.098**	40000	59.1	.00059	.0010	40000	59.1	.00039	.0010
0.25	**.010**	**3**	**.118**	40000	47.2	.00059	.0010	40000	47.2	.00039	.0010
0.25	**.010**	**4**	**.157**	36000	35.4	.00394	.0010	36000	35.4	.00028	.0010
0.3	**.012**	**2**	**.079**	40000	110.2	.0012	.0012	40000	110.2	.0008	.0012
0.3	**.012**	**3**	**.118**	40000	110.2	.0012	.0012	40000	110.2	.0008	.0012
0.3	**.012**	**4**	**.157**	35000	78.7	.0008	.0012	35000	78.7	.0006	.0012
0.3	**.012**	**5**	**.197**	30000	39.4	.0004	.0012	30000	39.4	.0003	.0012
0.3	**.012**	**6**	**.236**	30000	31.5	.0003	.0012	30000	31.5	.0002	.0012
0.4	**.016**	**3**	**.118**	40000	118.1	.0016	.0016	40000	118.1	.0012	.0016
0.4	**.016**	**4**	**.157**	40000	118.1	.0008	.0016	40000	118.1	.0006	.0016
0.4	**.016**	**6**	**.236**	30000	63.0	.0008	.0016	30000	63.0	.0004	.0016
0.4	**.016**	**8**	**.315**	25000	39.4	.0004	.0016	25000	39.4	.0003	.0016
0.5	**.020**	**3**	**.118**	40000	157.5	.0020	.0020	40000	157.5	.0016	.0020
0.5	**.020**	**4**	**.157**	40000	157.5	.0020	.0020	40000	157.5	.0016	.0020
0.5	**.020**	**6**	**.236**	35000	78.7	.0012	.0020	35000	78.7	.0008	.0020
0.5	**.020**	**8**	**.315**	30000	63.0	.0008	.0020	30000	63.0	.0004	.0020
0.5	**.020**	**10**	**.394**	20000	39.4	.0004	.0020	20000	39.4	.0004	.0020
0.5	**.020**	**12**	**.472**	20000	39.4	.0004	.0020	20000	31.5	.0003	.0020
0.75	**.030**	**6**	**.236**	40000	196.9	.0028	.0030	40000	157.5	.0024	.0030
0.75	**.030**	**8**	**.315**	40000	196.9	.0028	.0030	40000	137.8	.0024	.0030
0.75	**.030**	**10**	**.394**	40000	177.2	.0024	.0030	40000	94.5	.0024	.0030
0.75	**.030**	**12**	**.472**	32000	133.9	.0016	.0030	32000	78.7	.0016	.0030
0.75	**.030**	**14**	**.551**	16000	59.1	.0016	.0030	16000	47.2	.0012	.0030
0.75	**.030**	**16**	**.630**	13000	47.2	.0012	.0030	13000	47.2	.0008	.0030
1	**.039**	**6**	**.236**	40000	236.2	.0039	.0039	40000	133.9	.0039	.0039
1	**.039**	**8**	**.315**	40000	196.9	.0039	.0039	40000	118.1	.0039	.0039
1	**.039**	**10**	**.394**	40000	196.9	.0031	.0039	40000	118.1	.0028	.0039
1	**.039**	**12**	**.472**	40000	196.9	.0031	.0039	40000	102.4	.0020	.0039
1	**.039**	**16**	**.630**	32000	137.8	.0020	.0039	32000	66.9	.0012	.0039
1	**.039**	**20**	**.787**	10000	39.4	.0016	.0039	10000	39.4	.0012	.0039
1.25	**.049**	**10**	**.394**	36000	196.9	.0047	.0098	36000	102.4	.0043	.0098
1.25	**.049**	**15**	**.591**	36000	181.1	.0031	.0098	36000	78.7	.0030	.0098

Depth of Cut

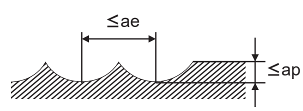


Note 1) When the inclination angle of machined surface is large, or machining with large cutting load such as corner area, reduce the revolution and feed rate.
Note 2) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) Cutting conditions may differ considerably due to the tool overhang, depth of cut and machine tool condition. Please use the table above as a reference starting point.

RECOMMENDED CUTTING CONDITIONS

Workpiece Material				Hardened Steels (45−55HRC)				Hardened Steels (55−70HRC)			
Corner Radius **RE**		Neck length **LU**		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)	Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut **ap** (inch)	Width of Cut **ae** (inch)
(mm)	(inch)	(mm)	(inch)								
1.5	**.059**	**10**	**.394**	32000	200.8	.0059	.0118	32000	86.6	.0059	.0118
1.5	**.059**	**12**	**.472**	32000	200.8	.0051	.0118	32000	86.6	.0051	.0118
1.5	**.059**	**16**	**.630**	32000	177.2	.0039	.0118	32000	70.9	.0039	.0118
1.5	**.059**	**20**	**.787**	27000	149.6	.0039	.0118	27000	63.0	.0024	.0118
1.5	**.059**	**25**	**.984**	21000	106.3	.0031	.0118	21000	47.2	.0024	.0118
1.5	**.059**	**30**	**1.181**	9000	39.4	.0031	.0118	9000	27.6	.0020	.0118
2	**.079**	**10**	**.394**	24000	189.0	.0079	.0157	24000	86.6	.0079	.0157
2	**.079**	**12**	**.472**	24000	189.0	.0079	.0157	24000	86.6	.0079	.0157
2	**.079**	**16**	**.630**	24000	149.6	.0059	.0157	24000	59.1	.0059	.0157
2	**.079**	**20**	**.787**	24000	149.6	.0059	.0157	24000	59.1	.0059	.0157
2	**.079**	**25**	**.984**	24000	149.6	.0059	.0157	24000	43.3	.0039	.0157
2	**.079**	**30**	**1.181**	24000	118.1	.0039	.0157	24000	43.3	.0031	.0157
2.5	**.098**	**20**	**.787**	19000	133.9	.0079	.0197	19000	55.1	.0079	.0197
2.5	**.098**	**25**	**.984**	19000	133.9	.0079	.0197	19000	55.1	.0079	.0197
3	**.118**	**18**	**.709**	16000	137.8	.0098	.0236	16000	39.4	.0079	.0236
3	**.118**	**30**	**1.181**	16000	137.8	.0079	.0236	16000	39.4	.0079	.0236

Depth of Cut



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) If the depth of cut is shallow, the revolution and feed rate can be increased.
Note 3) Cutting conditions may differ considerably due to the tool overhang, depth of cut and machine tool condition. Please use the table above as a reference starting point.

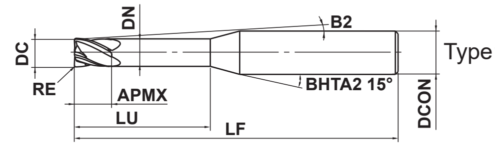
VFRPSRB NEW

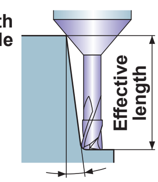
Corner radius, Short cut length, 4 Flute

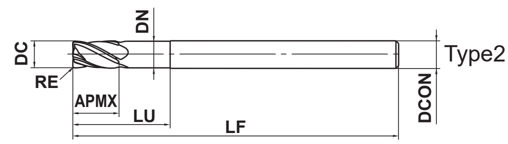
30° DC≤1.0 DC≥1.5

CARBIDE

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







0.5≤DC≤6	6<DC≤12	
±0.005	±0.007	
0.5≤DC≤6	6<DC≤12	
0 - 0.01	0 - 0.015	
DCON=6	8≤DCON≤10	DCON=12
h5 0 - 0.005	0 - 0.006	0 - 0.008

- Completely seamless curved R edge. DC≥1.5
- The wiper edge and strong back taper achieve high-precision machining. 1.5≤DC≤5

(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°
VFRPSRBD0050R005N020	0.5	0.05	0.5	2	0.47	12.6	50	6	4	★	1	2.1	2.2	2.3	2.5
VFRPSRBD0050R010N020	0.5	0.1	0.5	2	0.47	12.7	50	6	4	★	1	2.1	2.2	2.3	2.5
VFRPSRBD0060R005N020	0.6	0.05	0.6	2	0.57	12.5	50	6	4	●	1	2.1	2.2	2.4	2.6
VFRPSRBD0060R010N020	0.6	0.1	0.6	2	0.57	12.5	50	6	4	★	1	2.1	2.2	2.3	2.6
VFRPSRBD0060R010N040	0.6	0.1	0.6	4	0.57	10.8	50	6	4	★	1	4.2	4.4	4.7	5.1
VFRPSRBD0060R020N020	0.6	0.2	0.6	2	0.57	12.6	50	6	4	●	1	2.1	2.2	2.2	2.6
VFRPSRBD0080R005N040	0.8	0.05	0.8	4	0.77	10.7	50	6	4	★	1	4.2	4.4	4.7	5.1
VFRPSRBD0080R010N040	0.8	0.1	0.8	4	0.77	10.7	50	6	4	●	1	4.2	4.4	4.7	5.1
VFRPSRBD0080R020N040	0.8	0.2	0.8	4	0.77	10.8	50	6	4	●	1	4.2	4.4	4.7	5.1
VFRPSRBD0080R030N040	0.8	0.3	0.8	4	0.77	10.8	50	6	4	●	1	4.2	4.4	4.7	5
VFRPSRBD0100R005N040	1	0.05	1	4	0.96	10.4	50	6	4	★	1	4.3	4.5	4.9	5.4
VFRPSRBD0100R010N040	1	0.1	1	4	0.96	10.4	50	6	4	●	1	4.3	4.5	4.9	5.4
VFRPSRBD0100R010N060	1	0.1	1	6	0.96	9.1	50	6	4	●	1	6.4	6.7	7.3	7.9
VFRPSRBD0100R020N040	1	0.2	1	4	0.96	10.5	50	6	4	●	1	4.3	4.5	4.7	5.3
VFRPSRBD0100R020N060	1	0.2	1	6	0.96	9.2	50	6	4	★	1	6.4	6.7	7.3	7.8
VFRPSRBD0100R030N040	1	0.3	1	4	0.96	10.5	50	6	4	★	1	4.3	4.5	4.6	5.3
VFRPSRBD0100R040N040	1	0.4	1	4	0.96	10.6	50	6	4	★	1	4.3	4.5	4.5	5.3
VFRPSRBD0150R010N040	1.5	0.1	1.5	4	1.42	10.2	50	6	4	●	1	4.2	4.4	4.8	5.2
VFRPSRBD0150R010N060	1.5	0.1	1.5	6	1.42	8.8	50	6	4	●	1	6.3	6.6	7.1	7.7
VFRPSRBD0150R010N100	1.5	0.1	1.5	10	1.42	6.9	50	6	4	★	1	10.5	10.9	11.7	12.7
VFRPSRBD0150R020N040	1.5	0.2	1.5	4	1.42	10.2	50	6	4	●	1	4.2	4.4	4.6	5.2
VFRPSRBD0150R020N060	1.5	0.2	1.5	6	1.42	8.8	50	6	4	●	1	6.3	6.6	7.1	7.7
VFRPSRBD0150R020N100	1.5	0.2	1.5	10	1.42	7	50	6	4	●	1	10.5	10.9	11.7	12.6
VFRPSRBD0150R030N040	1.5	0.3	1.5	4	1.42	10.3	50	6	4	★	1	4.2	4.4	4.5	5.2
VFRPSRBD0150R030N060	1.5	0.3	1.5	6	1.42	8.9	50	6	4	●	1	6.3	6.6	7.1	7.6
VFRPSRBD0150R030N100	1.5	0.3	1.5	10	1.42	7	50	6	4	●	1	10.5	10.9	11.7	12.6
VFRPSRBD0150R050N040	1.5	0.5	1.5	4	1.42	10.5	50	6	4	●	1	4.2	4.4	4.3	5.1
VFRPSRBD0150R050N060	1.5	0.5	1.5	6	1.42	9	50	6	4	●	1	6.3	6.6	7.1	7.6

● : USA Stock ★ : Stocked 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°
VFRPSRBD0150R050N100	1.5	0.5	1.5	10	1.42	7.1	50	6	4	●	1	10.5	10.9	11.7	12.6
VFRPSRBD0200R010N060	2	0.1	2	6	1.9	8.4	50	6	4	●	1	6.3	6.6	7.1	7.6
VFRPSRBD0200R010N100	2	0.1	2	10	1.9	6.5	50	6	4	●	1	10.5	10.9	11.7	12.6
VFRPSRBD0200R010N150	2	0.1	2	15	1.9	5.1	50	6	4	★	1	15.7	16.2	17.4	18.8
VFRPSRBD0200R020N060	2	0.2	2	6	1.9	8.4	50	6	4	●	1	6.3	6.6	7.1	7.6
VFRPSRBD0200R020N100	2	0.2	2	10	1.9	6.5	50	6	4	●	1	10.5	10.9	11.7	12.6
VFRPSRBD0200R020N150	2	0.2	2	15	1.9	5.1	50	6	4	●	1	15.7	16.2	17.4	18.8
VFRPSRBD0200R030N060	2	0.3	2	6	1.9	8.5	50	6	4	★	1	6.3	6.6	7	7.6
VFRPSRBD0200R030N100	2	0.3	2	10	1.9	6.6	50	6	4	●	1	10.5	10.8	11.6	12.6
VFRPSRBD0200R030N150	2	0.3	2	15	1.9	5.1	50	6	4	★	1	15.7	16.2	17.4	18.8
VFRPSRBD0200R030N200	2	0.3	2	20	1.9	4.2	60	6	4	★	1	20.8	21.5	23.1	25
VFRPSRBD0200R050N060	2	0.5	2	6	1.9	8.6	50	6	4	●	1	6.3	6.5	7	7.5
VFRPSRBD0200R050N100	2	0.5	2	10	1.9	6.6	50	6	4	●	1	10.5	10.8	11.6	12.5
VFRPSRBD0200R050N150	2	0.5	2	15	1.9	5.2	50	6	4	●	1	15.6	16.2	17.4	18.7
VFRPSRBD0200R050N200	2	0.5	2	20	1.9	4.2	60	6	4	●	1	20.8	21.5	23.1	24.9
VFRPSRBD0250R030N080	2.5	0.3	2.5	8	2.35	6.9	50	6	4	●	1	8.3	8.6	9.2	10
VFRPSRBD0250R030N150	2.5	0.3	2.5	15	2.35	4.7	50	6	4	●	1	15.6	16.1	17.3	18.7
VFRPSRBD0250R050N080	2.5	0.5	2.5	8	2.35	7	50	6	4	●	1	8.3	8.6	9.2	9.9
VFRPSRBD0250R050N150	2.5	0.5	2.5	15	2.35	4.7	50	6	4	★	1	15.6	16.1	17.3	18.6
VFRPSRBD0250R100N080	2.5	1	2.5	8	2.35	7.3	50	6	4	●	1	8.3	8.6	9.1	9.8
VFRPSRBD0300R010N100	3	0.1	3	10	2.85	5.5	60	6	4	●	1	10.4	10.8	11.6	12.5
VFRPSRBD0300R010N150	3	0.1	3	15	2.85	4.2	60	6	4	★	1	15.6	16.1	17.3	18.7
VFRPSRBD0300R020N100	3	0.2	3	10	2.85	5.5	60	6	4	●	1	10.4	10.8	11.6	12.5
VFRPSRBD0300R020N150	3	0.2	3	15	2.85	4.2	60	6	4	●	1	15.6	16.1	17.3	18.7
VFRPSRBD0300R020N200	3	0.2	3	20	2.85	3.4	60	6	4	●	1	20.7	21.5	23.1	24.9
VFRPSRBD0300R030N100	3	0.3	3	10	2.85	5.6	60	6	4	●	1	10.4	10.8	11.5	12.5
VFRPSRBD0300R030N150	3	0.3	3	15	2.85	4.2	60	6	4	●	1	15.6	16.1	17.3	18.7
VFRPSRBD0300R030N200	3	0.3	3	20	2.85	3.4	60	6	4	●	1	20.7	21.5	23	24.9
VFRPSRBD0300R050N100	3	0.5	3	10	2.85	5.6	60	6	4	●	1	10.4	10.7	11.5	12.4
VFRPSRBD0300R050N150	3	0.5	3	15	2.85	4.2	60	6	4	●	1	15.6	16.1	17.3	18.6
VFRPSRBD0300R050N200	3	0.5	3	20	2.85	3.4	60	6	4	●	1	20.7	21.4	23	24.8
VFRPSRBD0300R100N100	3	1	3	10	2.85	5.8	60	6	4	★	1	10.4	10.7	11.4	12.3
VFRPSRBD0300R100N150	3	1	3	15	2.85	4.3	60	6	4	●	1	15.5	16.1	17.2	18.5
VFRPSRBD0300R100N200	3	1	3	20	2.85	3.5	60	6	4	●	1	20.7	21.4	22.9	24.7
VFRPSRBD0400R010N120	4	0.1	4	12	3.85	3.6	60	6	4	●	1	12.5	12.9	13.9	15
VFRPSRBD0400R010N200	4	0.1	4	20	3.85	2.4	60	6	4	●	1	20.7	21.5	23.1	*
VFRPSRBD0400R020N120	4	0.2	4	12	3.85	3.7	60	6	4	★	1	12.5	12.9	13.9	15
VFRPSRBD0400R020N200	4	0.2	4	20	3.85	2.4	60	6	4	●	1	20.7	21.5	23.1	*
VFRPSRBD0400R030N120	4	0.3	4	12	3.85	3.7	60	6	4	●	1	12.5	12.9	13.8	15
VFRPSRBD0400R030N200	4	0.3	4	20	3.85	2.4	60	6	4	●	1	20.7	21.5	23	*
VFRPSRBD0400R030N300	4	0.3	4	30	3.85	1.7	70	6	4	★	1	31.1	32.2	*	*
VFRPSRBD0400R050N120	4	0.5	4	12	3.85	3.7	60	6	4	●	1	12.5	12.9	13.8	14.9
VFRPSRBD0400R050N200	4	0.5	4	20	3.85	2.5	60	6	4	●	1	20.7	21.4	23	*
VFRPSRBD0400R050N300	4	0.5	4	30	3.85	1.7	70	6	4	●	1	31.1	32.1	*	*
VFRPSRBD0400R100N120	4	1	4	12	3.85	3.8	60	6	4	●	1	12.4	12.8	13.7	14.8
VFRPSRBD0400R100N200	4	1	4	20	3.85	2.5	60	6	4	●	1	20.7	21.4	22.9	*

* No interference

VFRPSRB

Corner radius, Short cut length, 4 Flute

(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°
VFRPSRBD0400R100N300	4	1	4	30	3.85	1.7	70	6	4	●	1	31.1	32.1	*	*
VFRPSRBD0500R050N150	5	0.5	5	15	4.85	1.7	60	6	4	★	1	15.6	16.1	*	*
VFRPSRBD0500R100N150	5	1	5	15	4.85	1.8	60	6	4	●	1	15.5	16.1	*	*
VFRPSRBD0600R010N180	6	0.1	9	18	5.85	—	70	6	4	●	2	*	*	*	*
VFRPSRBD0600R020N180	6	0.2	9	18	5.85	—	70	6	4	●	2	*	*	*	*
VFRPSRBD0600R030N180	6	0.3	9	18	5.85	—	70	6	4	●	2	*	*	*	*
VFRPSRBD0600R050N180	6	0.5	9	18	5.85	—	70	6	4	●	2	*	*	*	*
VFRPSRBD0600R100N180	6	1	9	18	5.85	—	70	6	4	●	2	*	*	*	*
VFRPSRBD0600R200N180	6	2	9	18	5.85	—	70	6	4	●	2	*	*	*	*
VFRPSRBD0800R020N240	8	0.2	12	24	7.85	—	90	8	4	●	2	*	*	*	*
VFRPSRBD0800R030N240	8	0.3	12	24	7.85	—	90	8	4	●	2	*	*	*	*
VFRPSRBD0800R050N240	8	0.5	12	24	7.85	—	90	8	4	●	2	*	*	*	*
VFRPSRBD0800R100N240	8	1	12	24	7.85	—	90	8	4	●	2	*	*	*	*
VFRPSRBD0800R200N240	8	2	12	24	7.85	—	90	8	4	★	2	*	*	*	*
VFRPSRBD1000R030N300	10	0.3	15	30	9.7	—	100	10	4	●	2	*	*	*	*
VFRPSRBD1000R050N300	10	0.5	15	30	9.7	—	100	10	4	●	2	*	*	*	*
VFRPSRBD1000R100N300	10	1	15	30	9.7	—	100	10	4	●	2	*	*	*	*
VFRPSRBD1000R200N300	10	2	15	30	9.7	—	100	10	4	●	2	*	*	*	*
VFRPSRBD1000R300N300	10	3	15	30	9.7	—	100	10	4	●	2	*	*	*	*
VFRPSRBD1200R050N360	12	0.5	18	36	11.7	—	110	12	4	★	2	*	*	*	*
VFRPSRBD1200R100N360	12	1	18	36	11.7	—	110	12	4	●	2	*	*	*	*
VFRPSRBD1200R200N360	12	2	18	36	11.7	—	110	12	4	★	2	*	*	*	*
VFRPSRBD1200R300N360	12	3	18	36	11.7	—	110	12	4	●	2	*	*	*	*

* No interference

● : USA Stock ★ : Stocked in Japan

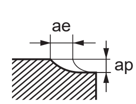
ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material						Hardened Steels (45−55HRC)				Hardened Steels (55−65HRC)				Hardened Steels (65−70HRC)			
Dia. **DC**		Corner Radius **RE**		Usable Length **LU**		Revolution	Table Feed	Depth of Cut **ap**	Width of Cut **ae**	Revolution	Feed Rate	Depth of Cut	Width of Cut	Revolution	Table Feed	Depth of Cut **ap**	Width of Cut **ae**
(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)	(min^{-1})	(IPM)	**ap**	**ae**	(min^{-1})	(IPM)	(inch)	(inch)
0.5	**.020**	**0.05**	**.002**	**2**	**.079**	25000	39.4	.0002	.004	19000	29.9	.0002	.003	13000	20.1	.0001	.003
0.5	**.020**	**0.1**	**.004**	**2**	**.079**	25000	39.4	.0003	.004	19000	29.9	.0002	.003	13000	20.1	.0002	.003
0.6	**.024**	**0.05**	**.002**	**2**	**.079**	21000	39.4	.0002	.004	16000	29.9	.0002	.003	11000	20.1	.0001	.003
0.6	**.024**	**0.1**	**.004**	**2**	**.079**	21000	39.4	.0003	.004	16000	29.9	.0002	.003	11000	20.1	.0002	.003
0.6	**.024**	**0.1**	**.004**	**4**	**.157**	18000	35.0	.0002	.004	16000	29.9	.0002	.003	11000	20.1	.0002	.003
0.6	**.024**	**0.2**	**.008**	**2**	**.079**	24000	43.3	.0004	.004	19000	35.0	.0003	.003	16000	29.9	.0002	.003
0.8	**.031**	**0.05**	**.002**	**4**	**.157**	16000	29.9	.0006	.005	12000	22.4	.0004	.004	7900	15.0	.0004	.004
0.8	**.031**	**0.1**	**.004**	**4**	**.157**	16000	29.9	.0008	.005	12000	22.4	.0006	.004	7900	15.0	.0004	.004
0.8	**.031**	**0.2**	**.008**	**4**	**.157**	20000	37.4	.0012	.005	16000	29.9	.0010	.004	12000	22.4	.0008	.004
0.8	**.031**	**0.3**	**.012**	**4**	**.157**	20000	37.4	.0012	.005	16000	29.9	.0010	.004	12000	22.4	.0008	.004
1	**.039**	**0.05**	**.002**	**4**	**.157**	13000	39.4	.0006	.006	9500	29.9	.0004	.005	6400	20.1	.0004	.005
1	**.039**	**0.1**	**.004**	**4**	**.157**	13000	39.4	.0008	.006	9500	29.9	.0006	.005	6400	20.1	.0006	.005
1	**.039**	**0.1**	**.004**	**6**	**.236**	11000	35.0	.0006	.005	6400	20.1	.0004	.004	6400	20.1	.0004	.004
1	**.039**	**0.2**	**.008**	**4**	**.157**	16000	51.2	.0012	.006	9500	29.9	.0010	.005	6400	20.1	.0008	.005
1	**.039**	**0.2**	**.008**	**6**	**.236**	13000	39.4	.0008	.005	6400	20.1	.0008	.004	6400	20.1	.0006	.004
1	**.039**	**0.3**	**.012**	**4**	**.157**	16000	51.2	.0012	.006	9500	29.9	.0010	.005	6400	20.1	.0008	.005
1	**.039**	**0.4**	**.016**	**4**	**.157**	16000	51.2	.0016	.006	9500	29.9	.0012	.005	6400	20.1	.0010	.005
1.5	**.059**	**0.1**	**.004**	**4**	**.157**	14000	66.9	.0010	.009	11000	36.2	.0006	.008	7200	22.4	.0004	.008
1.5	**.059**	**0.1**	**.004**	**6**	**.236**	11000	55.1	.0010	.007	9200	28.7	.0006	.006	5700	18.1	.0004	.006
1.5	**.059**	**0.1**	**.004**	**10**	**.394**	11000	55.1	.0010	.007	9200	28.7	.0006	.006	5700	18.1	.0004	.006
1.5	**.059**	**0.2**	**.008**	**4**	**.157**	14000	66.9	.0020	.009	11000	36.2	.0014	.008	7200	22.4	.0010	.008
1.5	**.059**	**0.2**	**.008**	**6**	**.236**	11000	55.1	.0020	.007	9200	28.7	.0014	.006	5700	18.1	.0010	.006
1.5	**.059**	**0.2**	**.008**	**10**	**.394**	11000	55.1	.0020	.007	9200	28.7	.0014	.006	5700	18.1	.0010	.006
1.5	**.059**	**0.3**	**.012**	**4**	**.157**	16000	74.8	.0030	.009	13000	39.4	.0020	.008	8000	25.2	.0014	.008
1.5	**.059**	**0.3**	**.012**	**6**	**.236**	13000	59.1	.0030	.007	10000	31.9	.0020	.006	6400	20.1	.0014	.006
1.5	**.059**	**0.3**	**.012**	**10**	**.394**	13000	59.1	.0030	.007	10000	31.9	.0020	.006	6400	20.1	.0014	.006
1.5	**.059**	**0.5**	**.020**	**4**	**.157**	16000	74.8	.0031	.009	13000	39.4	.0022	.008	8000	25.2	.0016	.008
1.5	**.059**	**0.5**	**.020**	**6**	**.236**	13000	59.1	.0031	.007	10000	31.9	.0022	.006	6400	20.1	.0016	.006
1.5	**.059**	**0.5**	**.020**	**10**	**.394**	13000	59.1	.0031	.007	10000	31.9	.0022	.006	6400	20.1	.0016	.006
2	**.079**	**0.1**	**.004**	**6**	**.236**	11000	66.9	.0010	.012	8600	39.4	.0008	.011	5400	25.2	.0006	.011
2	**.079**	**0.1**	**.004**	**10**	**.394**	8600	55.1	.0010	.009	6900	32.7	.0008	.009	4300	20.5	.0006	.009
2	**.079**	**0.1**	**.004**	**15**	**.591**	6400	39.4	.0008	.007	5200	24.4	.0006	.007	3200	15.4	.0004	.007
2	**.079**	**0.2**	**.008**	**6**	**.236**	11000	66.9	.0022	.012	8600	39.4	.0014	.011	5400	25.2	.0010	.011
2	**.079**	**0.2**	**.008**	**10**	**.394**	8600	55.1	.0022	.009	6900	32.7	.0014	.009	4300	20.5	.0010	.009
2	**.079**	**0.2**	**.008**	**15**	**.591**	6400	39.4	.0016	.007	5200	24.4	.0010	.007	3200	15.4	.0008	.006
2	**.079**	**0.3**	**.012**	**6**	**.236**	12000	74.8	.0031	.012	6900	43.3	.0022	.011	6000	16.5	.0016	.011
2	**.079**	**0.3**	**.012**	**10**	**.394**	9500	59.1	.0031	.009	7600	36.2	.0022	.009	4800	22.4	.0016	.009
2	**.079**	**0.3**	**.012**	**15**	**.591**	7200	43.3	.0026	.007	5700	27.2	.0018	.007	3600	16.9	.0012	.006
2	**.079**	**0.3**	**.012**	**20**	**.787**	7200	43.3	.0026	.007	5700	27.2	.0018	.007	3600	16.9	.0012	.006
2	**.079**	**0.5**	**.020**	**6**	**.236**	12000	74.8	.0033	.012	9500	43.3	.0024	.011	6000	28.3	.0016	.011
2	**.079**	**0.5**	**.020**	**10**	**.394**	9500	59.1	.0033	.009	7600	36.2	.0024	.009	4800	22.4	.0016	.009
2	**.079**	**0.5**	**.020**	**15**	**.591**	7200	43.3	.0028	.007	5700	27.2	.0018	.007	3600	16.9	.0014	.006
2	**.079**	**0.5**	**.020**	**20**	**.787**	7200	43.3	.0028	.007	5700	27.2	.0018	.007	3600	16.9	.0014	.006
2.5	**.098**	**0.3**	**.012**	**8**	**.315**	9500	74.8	.0031	.015	7600	55.1	.0022	.014	4800	33.9	.0016	.013
2.5	**.098**	**0.3**	**.012**	**15**	**.591**	7600	59.1	.0031	.012	6100	43.3	.0022	.011	3800	27.2	.0016	.011
2.5	**.098**	**0.5**	**.020**	**8**	**.315**	9500	74.8	.0035	.015	7600	55.1	.0024	.014	4800	33.9	.0016	.013
2.5	**.098**	**0.5**	**.020**	**15**	**.591**	7600	59.1	.0035	.012	6100	43.3	.0024	.011	3800	27.2	.0016	.011
2.5	**.098**	**1**	**.039**	**8**	**.315**	9500	74.8	.0059	.013	7600	55.1	.0035	.012	4800	33.9	.0026	.012

Depth of Cut



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 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 workpiece.
Note 4) If the rigidity of the machine or the workpiece installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately.

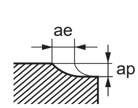
VFRPSRB

Corner radius, Short cut length, 4 Flute

RECOMMENDED CUTTING CONDITIONS

Workpiece Material						Hardened Steels (45−55HRC)				Hardened Steels (55−65HRC)				Hardened Steels (65−70HRC)			
Dia. DC		Corner Radius RE		Usable Length LU		Revolution	Table Feed	Depth of Cut ap	Width of Cut ae	Revolution	Table Feed	Depth of Cut ap	Width of Cut ae	Revolution	Table Feed	Depth of Cut ap	Width of Cut ae
(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)	(min^{-1})	(IPM)	(inch)	(inch)
3	.118	0.1	.004	10	.394	8100	74.8	.0010	.024	6500	47.2	.0008	.022	4100	28.7	.0006	.022
3	.118	0.1	.004	15	.591	6500	63.0	.0010	.019	5200	37.0	.0008	.017	3200	22.8	.0006	.017
3	.118	0.2	.008	10	.394	8100	74.8	.0022	.024	6500	47.2	.0016	.022	4100	28.7	.0010	.022
3	.118	0.2	.008	15	.591	6500	63.0	.0022	.019	5200	37.0	.0016	.017	3200	22.8	.0010	.017
3	.118	0.2	.008	20	.787	6500	63.0	.0022	.019	5200	37.0	.0016	.017	3200	22.8	.0010	.017
3	.118	0.3	.012	10	.394	9000	86.6	.0033	.024	7200	51.2	.0022	.022	4500	31.9	.0016	.022
3	.118	0.3	.012	15	.591	7200	66.9	.0033	.019	5800	39.4	.0022	.017	3600	25.6	.0016	.017
3	.118	0.3	.012	20	.787	7200	66.9	.0033	.019	5800	39.4	.0022	.017	3600	25.6	.0016	.017
3	.118	0.5	.020	10	.394	9000	86.6	.0035	.024	7200	51.2	.0024	.022	4500	31.9	.0018	.022
3	.118	0.5	.020	15	.591	7200	66.9	.0035	.019	5800	39.4	.0024	.017	3600	25.6	.0018	.017
3	.118	0.5	.020	20	.787	7200	66.9	.0035	.019	5800	39.4	.0024	.017	3600	25.6	.0018	.017
3	.118	1	.039	10	.394	9000	86.6	.0059	.021	7200	51.2	.0039	.020	4500	31.9	.0028	.020
3	.118	1	.039	15	.591	7200	66.9	.0059	.017	5800	39.4	.0039	.016	3600	25.6	.0028	.016
3	.118	1	.039	20	.787	7200	78.7	.0059	.017	5800	39.4	.0039	.016	3600	25.6	.0028	.016
4	.157	0.1	.004	12	.472	6100	66.9	.0098	.031	4900	38.2	.0008	.029	3000	24.0	.0006	.029
4	.157	0.1	.004	20	.787	4900	55.1	.0098	.024	3900	30.7	.0008	.024	2400	19.3	.0006	.023
4	.157	0.2	.008	12	.472	6100	66.9	.0022	.031	4900	38.2	.0016	.029	3000	24.0	.0010	.029
4	.157	0.2	.008	20	.787	4900	55.1	.0022	.024	3900	30.7	.0016	.024	2400	19.3	.0010	.023
4	.157	0.3	.012	12	.472	6800	74.8	.0033	.031	5400	43.3	.0022	.030	3400	26.8	.0016	.029
4	.157	0.3	.012	20	.787	5400	59.1	.0033	.024	4300	34.3	.0022	.024	2700	21.3	.0016	.023
4	.157	0.3	.012	30	1.181	4100	43.3	.0026	.020	3200	25.6	.0018	.018	2000	16.1	.0014	.017
4	.157	0.5	.020	12	.472	6800	74.8	.0035	.031	5400	43.3	.0024	.030	3400	26.8	.0018	.029
4	.157	0.5	.020	20	.787	5400	59.1	.0035	.026	4300	34.3	.0024	.024	2700	21.3	.0018	.023
4	.157	0.5	.020	30	1.181	4100	43.3	.0030	.020	4300	25.6	.0020	.018	2000	16.1	.0014	.017
4	.157	1	.039	12	.472	6800	74.8	.0059	.028	5400	43.3	.0039	.026	3400	26.8	.0028	.026
4	.157	1	.039	20	.787	5400	59.1	.0059	.022	4300	34.3	.0039	.021	2700	21.3	.0028	.021
4	.157	1	.039	30	1.181	4100	43.3	.0039	.016	3200	25.6	.0030	.016	2000	16.1	.0022	.016
5	.197	0.5	.020	15	.591	6400	70.9	.0039	.051	5100	39.4	.0026	.047	3200	25.2	.0018	.043
5	.197	1	.039	15	.591	6400	70.9	.0059	.043	5100	39.4	.0039	.039	3200	25.2	.0030	.039
6	.236	0.1	.004	18	.709	4800	59.1	.0012	.059	3800	36.2	.0008	.055	2400	22.4	.0006	.051
6	.236	0.2	.008	18	.709	4800	59.1	.0024	.059	3800	36.2	.0016	.055	2400	22.4	.0012	.051
6	.236	0.3	.012	18	.709	5300	66.9	.0035	.059	4200	39.4	.0024	.055	2700	25.2	.0018	.051
6	.236	0.5	.020	18	.709	5300	66.9	.0039	.059	4200	39.4	.0026	.055	2700	25.2	.0018	.051
6	.236	1	.039	18	.709	5300	66.9	.0059	.055	4200	39.4	.0039	.047	2700	25.2	.0030	.047
6	.236	2	.079	18	.709	5300	66.9	.0118	.051	4200	39.4	.0079	.043	2700	25.2	.0059	.043
8	.315	0.2	.008	24	.945	3600	43.3	.0024	.079	2900	27.2	.0016	.071	1800	16.9	.0012	.071
8	.315	0.3	.012	24	.945	4000	51.2	.0035	.079	3200	29.9	.0024	.071	2000	18.9	.0018	.071
8	.315	0.5	.020	24	.945	4000	51.2	.0037	.079	3200	29.9	.0026	.071	2000	18.9	.0018	.071
8	.315	1	.039	24	.945	4000	51.2	.0059	.071	3200	29.9	.0039	.067	2000	18.9	.0030	.063
8	.315	2	.079	24	.945	4000	51.2	.0118	.067	3200	29.9	.0079	.063	2000	18.9	.0059	.059
10	.394	0.3	.012	30	1.181	3200	39.4	.0035	.098	2500	24.0	.0024	.091	1600	15.0	.0018	.091
10	.394	0.5	.020	30	1.181	3200	39.4	.0037	.098	2500	24.0	.0026	.091	1600	15.0	.0018	.091
10	.394	1	.039	30	1.181	3200	39.4	.0059	.091	2500	24.0	.0039	.083	1600	15.0	.0030	.079
10	.394	2	.079	30	1.181	3200	39.4	.0118	.083	2500	24.0	.0079	.079	1600	15.0	.0059	.075
10	.394	3	.118	30	1.181	3200	39.4	.0177	.075	2500	24.0	.0118	.067	1600	15.0	.0079	.067
12	.472	0.5	.020	36	1.417	2700	37.4	.0039	.118	2100	20.1	.0026	.110	1300	12.6	.0020	.106
12	.472	1	.039	36	1.417	2700	37.4	.0059	.106	2100	20.1	.0039	.098	1300	12.6	.0030	.094
12	.472	2	.079	36	1.417	2700	37.4	.0118	.102	2100	20.1	.0079	.094	1300	12.6	.0059	.091
12	.472	3	.118	36	1.417	2700	37.4	.0177	.091	2100	20.1	.0118	.083	1300	12.6	.0079	.079

Depth of Cut

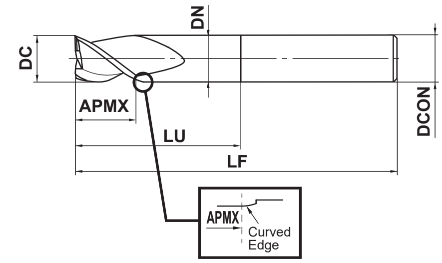


A3SA NEW

End mill, Short cut length, 3 flute, with multiple internal thru-coolant holes

UWC 37.5°

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



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

h6

- Stability and reliability even when slotting, ramping and plunging.
- The cross sectional geometry of the flutes is perfect for efficient chip discharge.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock
A3SA120N36C	12	18	36	11.4	80	12	3	●
A3SA160N48C	16	24	48	15.4	90	16	3	●
A3SA200N55C	20	30	55	18	100	20	3	●
A3SA250N55C	25	37.5	55	23	100	25	3	●

● : USA Stock

ISO13399 ➤ I002

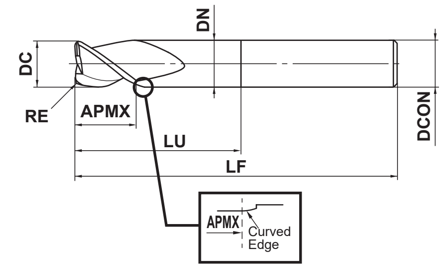
A3SARB NEW

Corner radius end mill, Short cut length, 3 flute, with multiple internal thru-coolant holes

UWC 37.5°

CARBIDE

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



	DC=12	DC>12			
	0 - 0.020	0 - 0.030			
h6	12≤DCON≤16	20≤DCON≤25			
	0 - 0.011	0 - 0.013			

- Stability and reliability even when slotting, ramping and plunging.
- The cross sectional geometry of the flutes is perfect for efficient chip discharge.

(mm)

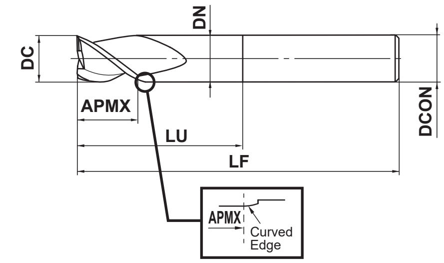
Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock
A3SARB120R100N36C	12	1	18	36	11.4	80	12	3	●
A3SARB120R200N36C	12	2	18	36	11.4	80	12	3	●
A3SARB120R300N36C	12	3	18	36	11.4	80	12	3	●
A3SARB160R200N48C	16	2	24	48	15.4	90	16	3	●
A3SARB160R300N48C	16	3	24	48	15.4	90	16	3	●
A3SARB160R400N48C	16	4	24	48	15.4	90	16	3	●
A3SARB200R200N55C	20	2	30	55	18	100	20	3	●
A3SARB200R300N55C	20	3	30	55	18	100	20	3	●
A3SARB200R400N55C	20	4	30	55	18	100	20	3	●
A3SARB250R200N55C	25	2	37.5	55	23	100	25	3	●
A3SARB250R300N55C	25	3	37.5	55	23	100	25	3	●
A3SARB250R400N55C	25	4	37.5	55	23	100	25	3	●
A3SARB250R500N55C	25	5	37.5	55	23	100	25	3	●

● : USA Stock

DLC3SA NEW

End mill, Short cut length, 3 flute, with multiple internal thru-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	Aluminum Alloy
							◎



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

h6

- Stability and reliability even when slotting, ramping and plunging.
- DLC coating aids in providing excellent chip evacuation.

(mm)

Order Number	DC	APMX	LU	DN	LF	DCON	No. of Flutes	Stock
DLC3SA120N36C	12	18	36	11.4	80	12	3	●
DLC3SA160N48C	16	24	48	15.4	90	16	3	●
DLC3SA200N55C	20	30	55	18	100	20	3	●
DLC3SA250N55C	25	37.5	55	23	100	25	3	●

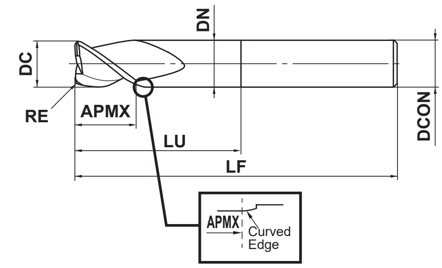
ISO13399 ➤I002

DLC3SARB NEW

Corner radius end mill, Short cut length, 3 flute, with multiple internal thru-coolant holes

UWC DLC 37.5°

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



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

h6

- Stability and reliability even when slotting, ramping and plunging.
- DLC coating aids in providing excellent chip evacuation.

(mm)

Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock
DLC3SARB120R100N36C	12	1	18	36	11.4	80	12	3	●
DLC3SARB120R200N36C	12	2	18	36	11.4	80	12	3	●
DLC3SARB120R300N36C	12	3	18	36	11.4	80	12	3	●
DLC3SARB160R200N48C	16	2	24	48	15.4	90	16	3	●
DLC3SARB160R300N48C	16	3	24	48	15.4	90	16	3	●
DLC3SARB160R400N48C	16	4	24	48	15.4	90	16	3	●
DLC3SARB200R200N55C	20	2	30	55	18	100	20	3	●
DLC3SARB200R300N55C	20	3	30	55	18	100	20	3	●
DLC3SARB200R400N55C	20	4	30	55	18	100	20	3	●
DLC3SARB250R200N55C	25	2	37.5	55	23	100	25	3	●
DLC3SARB250R300N55C	25	3	37.5	55	23	100	25	3	●
DLC3SARB250R400N55C	25	4	37.5	55	23	100	25	3	●
DLC3SARB250R500N55C	25	5	37.5	55	23	100	25	3	●

ISO13399 ➤ I002

A3SA/A3SARB, DLC3SA/DLC3SARB

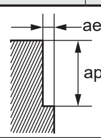
Square/Corner radius end mill, Short cut length, 3 flute, with multiple internal thru-coolant holes

RECOMMENDED CUTTING CONDITIONS

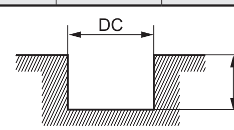
Use high efficiency cutting conditions when the machine and workpiece rigidity, and chip evacuation properties are sufficient. Use lower, general-purpose cutting conditions when the mechanical or workpiece rigidity or chip evacuation porperties are insufficient.

High Efficiency Conditions

■Side Milling

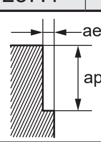
Workpiece Material		Aluminum Alloys				
Dia.**DC**		Cutting Speed	Revolution	Table Feed	Depth of Cut ae	Depth of Cut ap
(mm)	(inch)	(SFM)	(min^{-1})	(IPM)	(inch)	(inch)
12	**.472**	4070	33000	590.6	.236	.472
16	**.630**	5445	33000	787.4	.315	.630
20	**.787**	6790	33000	1023.6	.394	.787
25	**.984**	8495	33000	1259.8	.492	.984
Depth of Cut						

■Slot Milling

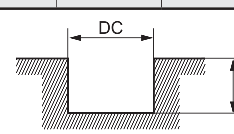
Workpiece Material		Aluminum Alloys			
Dia.**DC**		Cutting Speed	Revolution	Table Feed	Depth of Cut ae
(mm)	(inch)	(SFM)	(min^{-1})	(IPM)	(inch)
12	**.472**	4070	33000	590.6	.236
16	**.630**	5445	33000	787.4	.315
20	**.787**	6790	33000	1023.6	.394
25	**.984**	8495	33000	1259.8	.492
Depth of Cut		 DC:Cutting Dia.			

General-purpose Conditions

■Side Milling

Workpiece Material		Aluminum Alloys				
Dia.**DC**		Cutting Speed	Revolution	Table Feed	Depth of Cut ae	Depth of Cut ap
(mm)	(inch)	(SFM)	(min^{-1})	(IPM)	(inch)	(inch)
12	**.472**	1970	16000	283.5	.236	.472
16	**.630**	1970	12000	283.5	.315	.630
20	**.787**	1970	9500	291.3	.394	.787
25	**.984**	1970	7600	287.4	.492	.984
Depth of Cut						

■Slot Milling

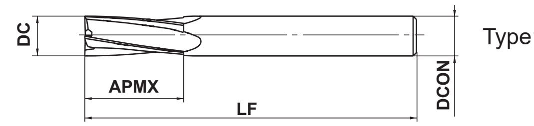
Workpiece Material		Aluminum Alloys			
Dia.**DC**		Cutting Speed	Revolution	Table Feed	Depth of Cut ae
(mm)	(inch)	(SFM)	(min^{-1})	(IPM)	(inch)
12	**.472**	1970	16000	283.5	.236
16	**.630**	1970	12000	283.5	.315
20	**.787**	1970	9500	291.3	.394
25	**.984**	1970	7600	287.4	.492
Depth of Cut		 DC:Cutting Dia.			

Note 1) It is recommended to use a water-soluble coolant. It is also possible to use air blow (external/internal) for DLC coated types.
Note 2) Climb milling is recommended for side cutting.
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) When ramping, consider the chip discharge and use a feed rate 50% lower than the slotting conditions above and also use a ramping angle of 5º or less.
Note 5) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately within the range described in the above table, or reduce the depth and width of cut.

DFC4JC

End mill, 4 flute, For CFRP

CFRP
◎



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

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

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DFC4JCD0600	6	20	70	6	4	●	1
DFC4JCD0800	8	30	80	8	4	●	1
DFC4JCD1000	10	30	90	10	4	●	1
DFC4JCD1200	12	30	100	12	4	●	1

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

RECOMMENDED CUTTING CONDITIONS

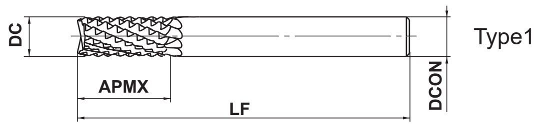
Workpiece Material	CFRP		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
6	11000	950	37.4
8	8000	780	30.7
10	6400	700	27.6
12	5300	650	25.6

Note 1) Cutting conditions may differ considerably due to the kind of CFRP, the rigidity of the machine, or the clamping and geometry of the workpiece material. Please use the above table as a guideline.
Note 2) When high machining accuracy is needed or if large burrs or delamination occur, we recommend reducing the feed rate.
Note 3) When the depth of cut is greater than 0.8DC, we recommend reducing the feed rate.
Note 4) Please take precautions against dust.

DFCJRT

End mill with cross-nick, For CFRP

CFRP
◎



h6	DCON=6	8≦DCON≦10	DCON=12		
	0 - 0.008	0 - 0.009	0 - 0.011		

● Cross-nick type end mill with original CVD diamond coating for CFRP machining.

(mm)

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

Workpiece Material	CFRP		
DC (mm)	Revolution (min^{-1})	Table feed	
		(mm/min)	(IPM)
6	11000	1200	47.2
8	8000	1000	39.4
10	6400	900	35.4
12	5300	850	33.4

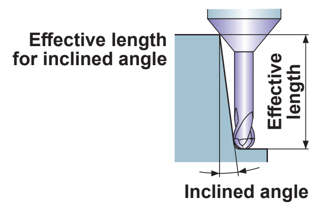
Note 1) Cutting conditions may differ considerably due to the kind of CFRP, the rigidity of the machine, or the clamping and geometry of the workpiece material. Please use the above table as a guideline.
Note 2) When high machining accuracy is needed or if large burrs or delamination occur, we recommend reducing the feed rate.
Note 3) When the depth of cut is greater than 0.8DC, we recommend reducing the feed rate.
Note 4) Please take precautions against dust.

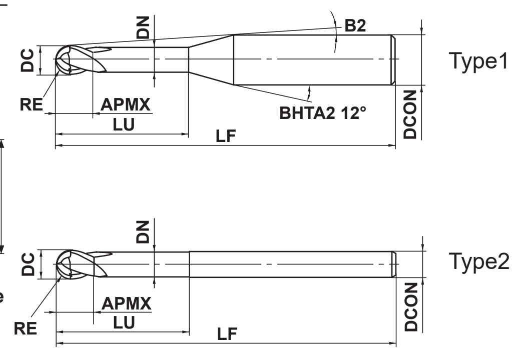
DF2XLB

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

UWC DF 30°

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





0.2≤RE≤2					
±0.01					
DCON=4					
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°
DF2XLBR0015N020	0.15	0.3	0.3	2	0.27	9.9°	50	4	2	★	1	2.1	2.2	2.4	2.6
DF2XLBR0020N040	0.2	0.4	0.6	4	0.36	8.4°	60	4	2	★	1	4.1	4.3	4.7	5.2
DF2XLBR0020N080	0.2	0.4	0.6	8	0.36	6.4°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0025N040	0.25	0.5	0.6	4	0.46	8.3°	60	4	2	★	1	4.1	4.3	4.7	5.2
DF2XLBR0025N080	0.25	0.5	0.6	8	0.46	6.3°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0030N060	0.3	0.6	0.9	6	0.56	7.1°	60	4	2	★	1	6.3	6.5	7.1	7.9
DF2XLBR0030N100	0.3	0.6	0.9	10	0.56	5.5°	60	4	2	★	1	10.4	10.9	11.9	13.2
DF2XLBR0040N080	0.4	0.8	1.2	8	0.76	6.1°	60	4	2	★	1	8.3	8.7	9.5	10.5
DF2XLBR0050N040	0.5	1	1.5	4	0.94	8.0°	60	4	2	★	1	4.2	4.4	4.8	5.3
DF2XLBR0050N100	0.5	1	1.5	10	0.94	5.2°	60	4	2	★	1	10.5	11.0	12.0	13.3
DF2XLBR0050N120	0.5	1	1.5	12	0.94	4.6°	60	4	2	★	1	12.6	13.2	14.4	15.9
DF2XLBR0050N160	0.5	1	1.5	16	0.94	3.8°	80	4	2	★	1	16.8	17.5	19.2	21.3
DF2XLBR0050N200	0.5	1	1.5	20	0.94	3.3°	80	4	2	★	1	21.0	21.9	24.0	26.6
DF2XLBR0050N300	0.5	1	1.5	30	0.94	2.4°	80	4	2	★	1	31.4	32.8	36.0	*
DF2XLBR0075N160	0.75	1.5	2.3	16	1.44	3.4°	80	4	2	★	1	16.8	17.5	19.2	21.2
DF2XLBR0100N160	1	2	3	16	1.9	2.9°	80	4	2	★	1	16.7	17.4	19.0	*
DF2XLBR0100N200	1	2	3	20	1.9	2.5°	80	4	2	★	1	20.9	21.8	23.8	*
DF2XLBR0100N250	1	2	3	25	1.9	2.0°	80	4	2	★	1	26.1	27.2	*	*
DF2XLBR0100N400	1	2	3	40	1.9	1.4°	100	4	2	★	1	41.7	43.5	*	*
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	*	*
DF2XLBR0200N300	2	4	6	30	3.9	—	80	4	2	★	2	*	*	*	*
DF2XLBR0200N600	2	4	6	60	3.9	—	100	4	2	★	2	*	*	*	*

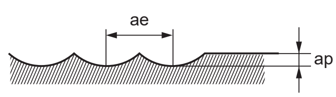
* No interference

 ★ : Stocked in Japan

ISO13399 ➤ I002

Workpiece Material		Graphite					Copper, Copper alloy				
RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)	Revolution (min^{-1})	Table feed		Depth of cut ap (mm)	Width of cut ae (mm)
			(mm/min)	(IPM)				(mm/min)	(IPM)		
R0.15	**2**	40000	1200	47.2	0.03	0.08	40000	800	31.5	0.003	0.03
R0.2	**4**	40000	1300	51.2	0.04	0.1	32000	600	23.6	0.004	0.04
	8	30000	800	31.5	0.03	0.1	—	—	—	—	—
R0.25	**4**	40000	1500	59.1	0.05	0.15	40000	800	31.5	0.01	0.05
	8	30000	1000	39.4	0.04	0.12	28000	500	19.7	0.002	0.05
R0.3	**6**	40000	1500	59.1	0.06	0.15	40000	1000	39.4	0.008	0.06
	10	35000	1000	39.4	0.05	0.15	—	—	—	—	—
R0.4	**8**	40000	1700	66.9	0.08	0.15	30000	1200	47.2	0.008	0.08
R0.5	**4**	40000	2500	98.4	0.12	0.3	40000	2000	78.7	0.05	0.1
	10	40000	2000	78.7	0.1	0.2	33000	1400	55.1	0.01	0.1
	12	40000	2000	78.7	0.1	0.2	30000	1000	39.4	0.007	0.1
	20	30000	1100	43.3	0.08	0.2	—	—	—	—	—
	30	20000	600	23.6	0.06	0.15	—	—	—	—	—
R0.75	**16**	35000	2000	78.7	0.15	0.3	20000	900	35.4	0.03	0.15
R1	**16**	30000	2000	78.7	0.2	0.5	30000	1800	70.9	0.05	0.2
	20	30000	2000	78.7	0.2	0.5	20000	1200	47.2	0.04	0.2
	25	25000	1500	59.1	0.18	0.45	20000	1000	39.4	0.03	0.2
	40	20000	1000	39.4	0.15	0.4	—	—	—	—	—
R1.5	**16**	28000	3000	118.1	0.3	0.9	28000	3000	118.1	0.3	0.3
	25	20000	2000	78.7	0.25	0.75	20000	2000	78.7	0.25	0.3
R2	**30**	15000	2000	78.7	0.4	1.2	15000	2000	78.7	0.3	0.4
	60	12000	1400	55.1	0.3	0.9	12000	1400	55.1	0.2	0.4

Depth of cut



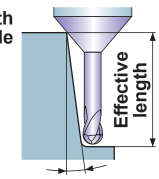
Note 1) When high machining accuracy is needed, or workpiece material becomes chipped, we recommend lowering feed rate.
Note 2) Use a milling machine dedicated for graphite.
Note 3) If rigidity of machine or workpiece material installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

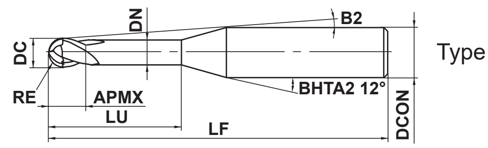
DF2XLBF (For Finishing)

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

UWC DF 30°

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





0.3≤RE≤1	1.5≤RE			
±0.005	±0.01			
DCON=4				
h5: 0 / - 0.008				

● Diamond coated long neck ball end mills are ideal for finished surfaces of non-ferrous metals.

(mm)

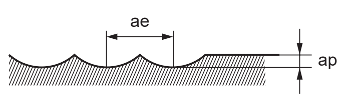
Order Number	RE	DC	APMX	LU	DN	B2	LF	DCON	No. of Flutes	Stock	Type	Effective length for inclined angle 0.5°	1°	2°	3°
DF2XLBFR0030N100	0.3	0.6	0.45	10	0.57	5.5°	50	4	2	●	1	10.4	10.9	11.9	13.2
DF2XLBFR0050N120	0.5	1	1.5	12	0.86	4.6°	50	4	2	●	1	12.6	13.2	14.4	15.9
DF2XLBFR0050N160	0.5	1	1.5	16	0.86	3.8°	50	4	2	●	1	16.8	17.5	19.2	21.3
DF2XLBFR0050N200	0.5	1	1.5	20	0.86	3.2°	50	4	2	●	1	21	21.9	24	26.6
DF2XLBFR0100N160	1	2	3	16	1.86	2.9°	50	4	2	●	1	16.7	17.4	19	*
DF2XLBFR0100N200	1	2	3	20	1.86	2.4°	50	4	2	●	1	20.9	21.8	23.9	*
DF2XLBFR0150N160	1.5	3	4.5	16	2.86	1.7°	50	4	2	●	1	16.7	17.3	18.9	20.8
DF2XLBFR0150N200	1.5	3	4.5	20	2.86	1.4°	50	4	2	●	1	20.8	21.7	23.7	26.1

* No interference

RECOMMENDED CUTTING CONDITIONS

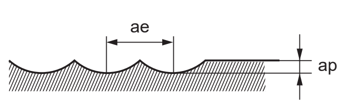
Workpiece Material			Graphite					Zirconia (Before Sintering)				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPR)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPR)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.6	**R0.3**	**10**	35000	1000	39.4	0.05	0.015	26000	600	23.6	0.06	0.03
1	**R0.5**	**12**	40000	2000	78.7	0.10	0.200	26000	600	23.6	0.10	0.05
		16	35000	1500	59.1	0.09	0.200	26000	600	23.6	0.08	0.04
		20	30000	1100	43.3	0.08	0.200	26000	600	23.6	0.08	0.04
2	**R1**	**16**	30000	2000	78.7	0.20	0.500	18000	1400	55.1	0.06	0.80
		20	30000	2000	78.7	0.20	0.500	18000	1200	47.2	0.50	0.60
3	**R1.5**	**16**	28000	3000	118.1	0.30	0.900	15000	1600	63.0	0.90	0.90
		20	25000	2500	98.4	0.20	0.900	15000	1400	55.1	0.60	0.80

Depth of cut



Workpiece Material			Copper, Copper alloy					Rigid Composite Resin (Composite Resin)				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPR)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPR)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.6	**R0.3**	**10**	30000	600	23.6	0.005	0.040	28000	450	17.7	0.050	0.050
1	**R0.5**	**12**	33000	1400	55.1	0.010	0.100	25000	900	35.4	0.100	0.100
		16	25000	800	31.5	0.007	0.080	25000	700	27.6	0.080	0.080
		20	20000	500	19.7	0.005	0.050	25000	600	23.6	0.080	0.080
2	**R1**	**16**	30000	1800	70.9	0.050	0.200	25000	2100	82.7	0.800	0.800
		20	20000	1200	47.2	0.040	0.200	25000	1800	70.9	0.500	0.500
3	**R1.5**	**16**	28000	3000	118.1	0.300	0.300	25000	2400	94.5	1.000	1.000
		20	25000	2500	98.4	0.200	0.300	25000	2100	82.7	0.800	0.800

Depth of cut



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

Note 2) If the rigidity of the machine or the workpiece material 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).

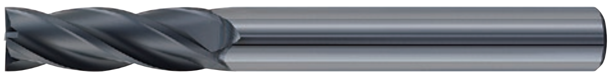
Note 4) Use a milling machine dedicated for graphite.

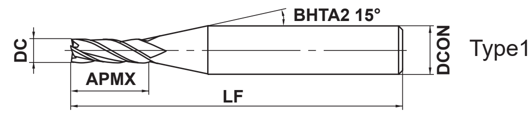
DF4JC

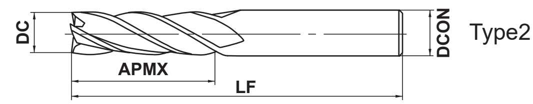
End mill, Semi long cut length, 4 flute, For graphite

30°

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







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

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

(mm)

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

★ : Stocked in Japan

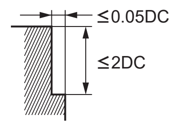
ISO13399

➤ I002

RECOMMENDED CUTTING CONDITIONS

Workpiece Material	Graphite					Copper, Copper alloy				
DC (mm)	Revolution (min^{-1})	Table feed		Depth of cut	Width of cut	Revolution (min^{-1})	Table feed		Depth of cut	Width of cut
		(mm/min)	(IPM)	(mm)	(mm)		(mm/min)	(IPM)	(mm)	(mm)
3	22000	2500	98.4	6	0.15	10600	280	11.0	6	0.15
4	18000	2900	114.2	8	0.2	8000	330	13.0	8	0.2
6	14000	3200	126.0	12	0.3	6400	380	15.0	12	0.3
8	10500	2900	114.2	16	0.4	4000	420	16.5	16	0.4
10	8700	2600	102.4	20	0.5	3200	460	18.1	20	0.5
12	7200	2200	86.6	24	0.6	2700	460	18.1	24	0.6

Depth of cut



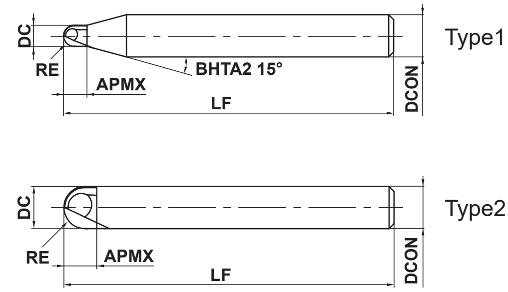
DC : Dia.

Note 1) When high machining accuracy is needed, or workpiece material becomes chipped, we recommend lowering feed rate.
Note 2) Use a milling machine dedicated for graphite.
Note 3) If rigidity of machine or workpiece material installation is very low, or chattering and noise are generated, reduce revolution and feed rate proportionately.

DC2SB

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

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



0.1≤RE≤3				
±0.01				
4≤DCON≤6				
0 - 0.008				

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

(mm)

Order Number	RE	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
DC2SBR0010	0.1	0.2	0.12	50	4	2	★	1
DC2SBR0020	0.2	0.4	0.24	50	4	2	★	1
DC2SBR0030	0.3	0.6	0.42	50	4	2	★	1
DC2SBR0040	0.4	0.8	0.56	50	4	2	★	1
DC2SBR0050	0.5	1	0.7	50	4	2	★	1
DC2SBR0075	0.75	1.5	1	50	4	2	★	1
DC2SBR0100	1	2	1.4	50	4	2	★	1
DC2SBR0150	1.5	3	2.1	60	6	2	★	1
DC2SBR0200	2	4	2.8	60	6	2	★	1
DC2SBR0250	2.5	5	3.5	60	6	2	★	1
DC2SBR0300	3	6	4.2	60	6	2	★	2

★ : Stocked in Japan

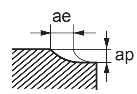
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

(mm)

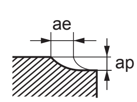
Workpiece Material		Cemented carbide					Alumina Zirconia				
DC (mm)	RE (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	**0.1**	30000	100	3.9	0.01	0.01	30000	100	3.9	0.01	0.01
0.4	**0.2**	30000	150	5.9	0.02	0.08	30000	150	5.9	0.02	0.08
0.6	**0.3**	30000	200	7.9	0.03	0.14	30000	200	7.9	0.03	0.14
0.8	**0.4**	30000	250	9.8	0.04	0.19	30000	250	9.8	0.04	0.19
1	**0.5**	30000	300	11.8	0.05	0.25	30000	300	11.8	0.05	0.25
1.5	**0.75**	30000	300	11.8	0.075	0.275	30000	300	11.8	0.075	0.275
2	**1**	30000	300	11.8	0.1	0.3	30000	300	11.8	0.1	0.3
3	**1.5**	27500	275	10.8	0.125	0.33	27500	275	10.8	0.125	0.33
4	**2**	24000	240	9.4	0.15	0.35	24000	240	9.4	0.15	0.35
5	**2.5**	22000	220	8.7	0.175	0.37	22000	220	8.7	0.175	0.37
6	**3**	20000	200	7.9	0.2	0.4	20000	200	7.9	0.2	0.4

Depth of cut



Workpiece Material		Silicon carbide Silicon nitride					Quartz glass				
DC (mm)	RE (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	**0.1**	30000	50	2.0	0.005	0.005	30000	150	5.9	0.015	0.015
0.4	**0.2**	30000	75	3.0	0.01	0.04	30000	225	8.9	0.03	0.12
0.6	**0.3**	30000	100	3.9	0.015	0.07	30000	300	11.8	0.045	0.21
0.8	**0.4**	30000	125	4.9	0.02	0.095	30000	375	14.8	0.06	0.285
1	**0.5**	30000	150	5.9	0.025	0.125	30000	450	17.7	0.075	0.375
1.5	**0.75**	30000	150	5.9	0.038	0.138	30000	450	17.7	0.113	0.413
2	**1**	30000	150	5.9	0.05	0.15	30000	450	17.7	0.15	0.45
3	**1.5**	27500	138	5.4	0.063	0.165	27500	413	16.3	0.188	0.495
4	**2**	24000	120	4.7	0.075	0.175	24000	360	14.2	0.225	0.525
5	**2.5**	22000	110	4.3	0.088	0.185	22000	330	13.0	0.263	0.555
6	**3**	20000	100	3.9	0.1	0.2	20000	300	11.8	0.3	0.6

Depth of cut

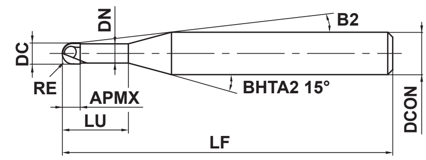


Note 1) The cemented carbide in the above mentioned cutting conditions table is based on CIS standard VM-40(90HRA).
Note 2) Air blow or dry processing is recommended with cemented carbide processing.
*Note: Using coolants or oil mists may decrease tool longevity.
Note 3) The use of a water soluble cutting oil is recommended with the processing of hard brittle materials other than the cemented carbide mentioned in the above table. Be sure to refuel the oil and eliminate any chip discharge that adheres to the tool.
Note 4) Cutting conditions may need adjustments depending on the type of workpiece material.
Note 5) Reduce the rotation speed and feed rate shown in the above table at a similar ratio when no rigidity in the machinery or work mounting and occurrence of chatter or abnormal sound.
Note 6) Implementation of special countermeasures is recommended since fine chip discharge may enter gaps in the processing machinery.

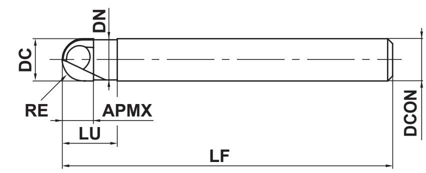
DC2XLB

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

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



Type1



Type2

0.1≤RE≤3				
±0.01				
4≤DCON≤6				
0 - 0.008				

● 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

★ : Stocked in Japan

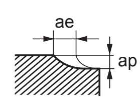
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

(mm)

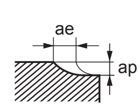
Workpiece Material			Cemented carbide					Alumina Zirconia				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	**0.1**	**0.5**	30000	30	1.2	0.005	0.01	30000	30	1.2	0.005	0.01
0.4	**0.2**	**1**	30000	100	3.9	0.015	0.08	30000	100	3.9	0.015	0.08
0.6	**0.3**	**1.5**	30000	200	7.9	0.03	0.14	30000	200	7.9	0.03	0.14
0.8	**0.4**	**2**	30000	250	9.8	0.04	0.19	30000	250	9.8	0.04	0.19
1	**0.5**	**2.5**	30000	300	11.8	0.05	0.25	30000	300	11.8	0.05	0.25
1	**0.5**	**5**	30000	300	11.8	0.05	0.25	30000	300	11.8	0.05	0.25
1.5	**0.75**	**3.8**	30000	300	11.8	0.075	0.275	30000	300	11.8	0.075	0.275
2	**1**	**6**	30000	300	11.8	0.1	0.3	30000	300	11.8	0.1	0.3
2	**1**	**10**	30000	300	11.8	0.1	0.3	30000	300	11.8	0.1	0.3
3	**1.5**	**8**	27500	275	10.8	0.125	0.33	27500	275	10.8	0.125	0.33
4	**2**	**10**	24000	240	9.4	0.15	0.35	24000	240	9.4	0.15	0.35
5	**2.5**	**10**	22000	220	8.7	0.175	0.37	22000	220	8.7	0.175	0.37
6	**3**	**10**	20000	200	7.9	0.2	0.4	20000	200	7.9	0.2	0.4

Depth of cut



Workpiece Material			Silicon carbide Silicon nitride					Quartz glass				
DC (mm)	RE (mm)	LU (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)	Depth of cut ap (mm)	Depth of cut ae (mm)
0.2	**0.1**	**0.5**	30000	15	.6	0.003	0.005	30000	45	1.8	0.008	0.015
0.4	**0.2**	**1**	30000	50	2.0	0.008	0.04	30000	150	5.9	0.023	0.12
0.6	**0.3**	**1.5**	30000	100	3.9	0.015	0.07	30000	300	11.8	0.045	0.21
0.8	**0.4**	**2**	30000	125	4.9	0.02	0.095	30000	375	14.8	0.06	0.285
1	**0.5**	**2.5**	30000	150	5.9	0.025	0.125	30000	450	17.7	0.075	0.375
1	**0.5**	**5**	30000	150	5.9	0.025	0.125	30000	450	17.7	0.075	0.375
1.5	**0.75**	**3.8**	30000	150	5.9	0.038	0.138	30000	450	17.7	0.113	0.413
2	**1**	**6**	30000	150	5.9	0.05	0.15	30000	450	17.7	0.15	0.45
2	**1**	**10**	30000	150	5.9	0.05	0.15	30000	450	17.7	0.15	0.45
3	**1.5**	**8**	27500	138	5.4	0.063	0.165	27500	413	16.3	0.188	0.495
4	**2**	**10**	24000	120	4.7	0.075	0.175	24000	360	14.2	0.225	0.525
5	**2.5**	**10**	22000	110	4.3	0.088	0.185	22000	330	13.0	0.263	0.555
6	**3**	**10**	20000	100	3.9	0.1	0.2	20000	300	11.8	0.3	0.6

Depth of cut



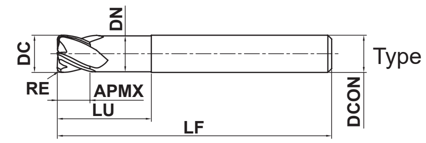
Note 1) The cemented carbide in the above mentioned cutting conditions table is based on CIS standard VM-40(90HRA).
Note 2) Air blow or dry processing is recommended with cemented carbide processing.
*Note: Using coolants or oil mists may decrease tool longevity.
Note 3) The use of a water soluble cutting oil is recommended with the processing of hard brittle materials other than the cemented carbide mentioned in the above table. Be sure to refuel the oil and eliminate any chip discharge that adheres to the tool.
Note 4) Cutting conditions may need adjustments depending on the type of workpiece material.
Note 5) Reduce the rotation speed and feed rate shown in the above table at a similar ratio when no rigidity in the machinery or work mounting and occurrence of chatter or abnormal sound.
Note 6) Implementation of special countermeasures is recommended since fine chip discharge may enter gaps in the processing machinery.

CE4SRB

Corner radius, short cut length, 4 flute

CERAMIC 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	Aluminum Alloy
					◎		



DC≤12				
0.02 - 0.02				
DC=6	DC=8,10	DC=12		
- 0.008 - 0.028	- 0.009 - 0.029	- 0.011 - 0.031		
DCON=6	DCON=8,10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

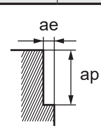
- Ceramic corner radius end mill with high heat resistance.
- Capable of softening Ni based alloys by generating heat during machining

(mm)

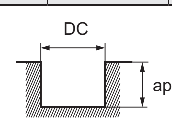
Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CE4SRBD0600R050	6	0.5	4.5	12	5.85	50	6	4	●	1
CE4SRBD0800R100	8	1.0	6.0	16	7.85	60	8	4	●	1
CE4SRBD1000R100	10	1.0	7.5	20	9.70	65	10	4	●	1
CE4SRBD1200R150	12	1.5	9.0	24	11.70	70	12	4	●	1

RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Heat resistant alloy Inconel			
DC (mm)	Vc=1970SFM (1150-3300)	fz=.0016IPT	Depth of cut ap (inch)	Depth of cut ae (inch)
	RPM	IPM		
6	32000	151.2	.177	.047
8	24000	113.4	.236	.063
10	19000	89.8	.295	.079
12	16000	75.6	.354	.094
Cutting Condition				

Slotting

Workpiece Material	Heat resistant alloy Inconel		
DC (mm)	Vc=1970SFM (1150-3300)	fz=.0008IPT	Depth of cut ap (inch)
	RPM	IPM	
6	32000	100.8	.059
8	24000	75.6	.098
10	19000	59.8	.118
12	16000	50.4	.157
Cutting Condition			

*Leave .012" of material on bottom and side

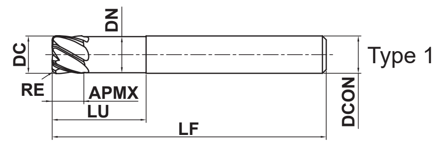
* Note 1) The outermost layer of the material may be affected by heat. Ensure a minimum of 0.012" final machining allowance remains.
Note 2) The recommended ramping angle is 1.5 degree. When conducting ramping it is recommended to reduce the feed rate by 50% from the cutting conditions shown.
Note 3) Gradually increase the width of cut starting from 0.05 x DC (cutter diameter) to maximum width of cut, this will help maintain tool life.

CE6SRB

Corner radius, short cut length, 6 flute

CERAMIC 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	Aluminum Alloy
					◎		



DC≤12				
0.02 - 0.02				
DC=6	DC=8,10	DC=12		
- 0.008 - 0.028	- 0.009 - 0.029	- 0.011 - 0.031		
DCON=6	DCON=8,10	DCON=12		
0 - 0.008	0 - 0.009	0 - 0.011		

- Ceramic corner radius end mill with high heat resistance.
- Capable of softening Ni based alloys by generating heat during machining

(mm)

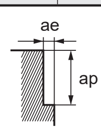
Order Number	DC	RE	APMX	LU	DN	LF	DCON	No. of Flutes	Stock	Type
CE6SRBD0600R050	6	0.5	4.5	12	5.85	50	6	6	●	1
CE6SRBD0800R100	8	1.0	6.0	16	7.85	60	8	6	●	1
CE6SRBD1000R100	10	1.0	7.5	20	9.70	65	10	6	●	1
CE6SRBD1200R150	12	1.5	9.0	24	11.70	70	12	6	●	1

RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Heat resistant alloy Inconel			
DC (mm)	Vc=1970SFM (1150-3300) RPM	fz=.0016IPT IPM	Depth of cut ap (inch)	Depth of cut ae (inch)
6	32000	226.8	.177	.047
8	24000	170.1	.236	.063
10	19000	134.6	.295	.079
12	16000	113.4	.354	.094

Cutting Condition

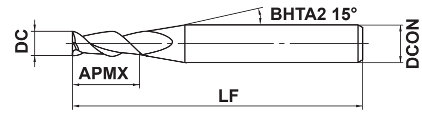


Note 1) The outermost layer of the material may be affected by heat.
Ensure a minimum of 0.012” final machining allowance remains.
Note 2) The recommended ramping angle is 1.5 degree. When conducting ramping it is recommended to reduce the feed rate by 50% from the cutting conditions shown.
Note 3) Gradually increase the width of cut starting from 0.05 x DC (cutter diameter) to maximum width of cut, this will help maintain tool life.

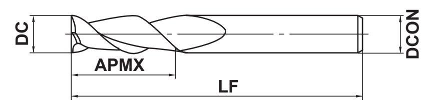
C2MHA

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

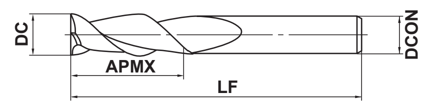
Carbon Steel, Alloy Steel, Cast Iron (<30HRC)	Tool Steel, Pre-Hardened Steel, Hardened Steel (≤45HRC)	Hardened Steel (≤55HRC)	Hardened Steel (>55HRC)	Austenitic Stainless Steel	Titanium Alloy, Heat Resistant Alloy	Copper Alloy	Aluminum Alloy
							◎



Type 1



Type 2



Type 3

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

● High efficiency machining for aluminum alloys.

(mm)

Order Number	DC	APMX	LF	DCON	No. of Flutes	Stock	Type
C2MHAD0300	3	9	60	6	2	★	1
C2MHAD0400	4	12	60	6	2	★	1
C2MHAD0500	5	15	60	6	2	★	1
C2MHAD0600	6	18	60	6	2	★	2
C2MHAD0800	8	20	75	8	2	★	2
C2MHAD1000	10	25	75	10	2	★	2
C2MHAD1200	12	25	75	12	2	★	2
C2MHAD1400	14	32	75	12	2	★	3
C2MHAD1600	16	32	100	16	2	★	2
C2MHAD2000	20	38	125	20	2	★	2
C2MHAD2500	25	38	125	25	2	★	2

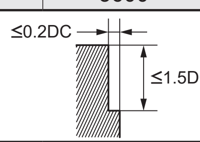
★ : Stocked in Japan

RECOMMENDED CUTTING CONDITIONS

Side milling

Workpiece Material	Aluminum alloy		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
3	40000	2400	94.5
4	36000	2600	102.4
5	30000	4000	157.5
6	27000	4000	157.5
8	20000	4000	157.5
10	16000	4500	177.2
12	13000	4500	177.2
16	10000	4500	177.2
20	8000	4300	169.3
25	6000	3600	141.7

Depth of cut

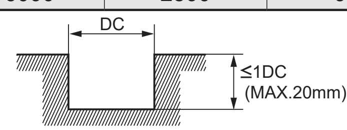


DC:Dia.

Slotting

Work Material	Aluminum alloy		
DC (mm)	Revolution (min^{-1})	Table feed (mm/min)	Table feed (IPM)
3	40000	1500	59.1
4	36000	1800	70.9
5	30000	2800	110.2
6	27000	2800	110.2
8	20000	2800	110.2
10	16000	3200	126.0
12	13000	3200	126.0
16	10000	3200	126.0
20	8000	3000	118.1
25	6000	2500	98.4

Depth of cut



DC:Dia.

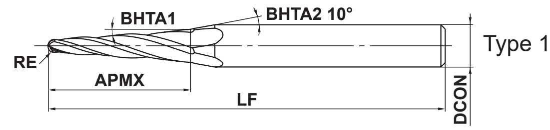
Note 1) Water-soluble cutting fluid is recommended.
Note 2) Down cutting is recommended for side milling.
Note 3) If the tooling clamping is insufficient, the tool can be pulled out of the holder therefore ensure that it is securely located.
Note 4) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.

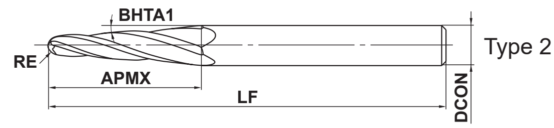
C4LATB

Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers

UWC 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	Aluminum Alloy
							◎





RE≤2				
± 0.010				
±5'				
DCON=6	DCON=8			
0 - 0.008	0 - 0.009			

- The high-rigidity design with improved breakage resistance achieves high-efficiency machining of aluminum alloy impellers.
- First recommended for machining aluminum alloy impellers.

(mm)

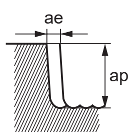
Order Number	RE	BHTA1	APMX	LF	DCON	No. of Flutes	Stock	Type
C4LATBR050T040AP20	0.5	4°	20	70	6	4	●	1
C4LATBR100T040AP20	1	4°	20	70	6	4	●	1
C4LATBR150T040AP20	1.5	4°	20	75	8	4	●	1
C4LATBR200T040AP30	2	4°	30	75	8	4	●	2

Note 1) A wide range of non-standard shapes are available. Please inquire for more information.
(Ex. Different coatings or RE sizes, of a minimum R0.3 and taper half angles.)

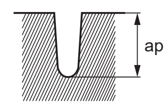
ISO13399 ➤ I002

RECOMMENDED CUTTING CONDITIONS

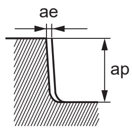
■Side Milling

Workpiece Material		Aluminum alloys			
RE		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut ap (inch)	Depth of Cut ae (inch)
(mm)	(inch)				
0.5	**.020**	20000	78.7	.591	.030
1.0	**.039**	20000	157.5	.591	.059
1.5	**.059**	20000	204.7	.591	.089
2.0	**.079**	20000	204.7	.906	.118
Depth of Cut					

■Slotting

Workpiece Material		Aluminum alloys		
RE		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut ap (inch)
(mm)	(inch)			
0.5	**.020**	20000	23.6	.394
1.0	**.039**	20000	110.2	.394
1.5	**.059**	20000	157.5	.394
2.0	**.079**	20000	157.5	.591
Depth of Cut				

■Side Milling (For Finishing)

Workpiece Material		Aluminum alloys			
RE		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut ap (inch)	Depth of Cut ae (inch)
(mm)	(inch)				
0.5	**.020**	20000	31.5	.709	.004
1.0	**.039**	20000	78.7	.709	.008
1.5	**.059**	20000	94.5	.709	.012
2.0	**.079**	20000	94.5	1.063	.012
Depth of Cut					

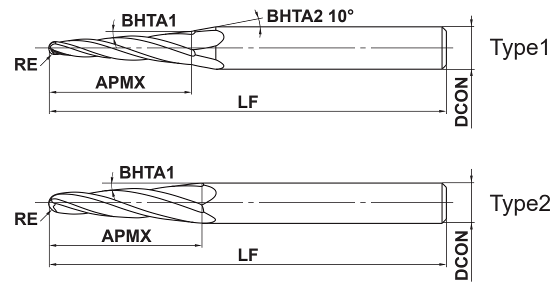
Note 1) Water-soluble cutting fluid is recommended.
Note 2) Down cutting is recommended for side milling.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately, or set the depth of cut smaller.

DLC4LATB NEW

Ball nose taper end mill, Long cut length, 4 flute, For aluminum impellers

UWC DLC 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	Aluminum Alloy
							◎



RE≤2				
± 0.010				
±5'				
DCON=6	DCON=8			
0 - 0.008	0 - 0.009			

- The high-rigidity design with improved breakage resistance achieves high-efficiency machining of aluminum alloy impellers.
- High resistance to welding when there is an insufficient coolant supply or during high-speed cutting.

(mm)

Order Number	RE	BHTA1	APMX	LF	DCON	No. of Flutes	Stock	Type
DLC4LATBR050T040AP20	0.5	4°	20	70	6	4	●	1
DLC4LATBR100T040AP20	1	4°	20	70	6	4	●	1
DLC4LATBR150T040AP20	1.5	4°	20	75	8	4	●	1
DLC4LATBR200T040AP30	2	4°	30	75	8	4	●	2

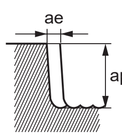
Note 1) A wide range of non-standard shapes are available. Please inquire for more information.
(ex.: RE sizes starting from a minimum of R0.3, half included taper angles) or coatings.

RECOMMENDED CUTTING CONDITIONS

■Side Milling

Workpiece Material		Aluminum alloys			
RE		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut ap (inch)	Depth of Cut ae (inch)
(mm)	(inch)				
0.5	**.020**	20000	78.7	.591	.030
1.0	**.039**	20000	157.5	.591	.059
1.5	**.059**	20000	204.7	.591	.089
2.0	**.079**	20000	204.7	.906	.118

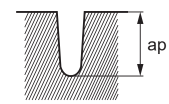
Depth of Cut



■Slotting

Workpiece Material		Aluminum alloys		
RE		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut ap (inch)
(mm)	(inch)			
0.5	**.020**	20000	23.6	.394
1.0	**.039**	20000	110.2	.394
1.5	**.059**	20000	157.5	.394
2.0	**.079**	20000	157.5	.591

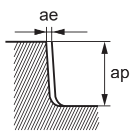
Depth of Cut



■Side Milling (For Finishing)

Workpiece Material		Aluminum alloys			
RE		Revolution (min^{-1})	Table Feed (IPM)	Depth of Cut ap (inch)	Depth of Cut ae (inch)
(mm)	(inch)				
0.5	**.020**	20000	31.5	.709	.004
1.0	**.039**	20000	78.7	.709	.008
1.5	**.059**	20000	94.5	.709	.012
2.0	**.079**	20000	94.5	1.063	.012

Depth of Cut



Note 1) Water-soluble cutting fluid is recommended.
Note 2) Down cutting is recommended for side milling.
Note 3) If the rigidity of the machine or the workpiece material installation is very low, or chattering and noise are generated, reduce the revolution and feed rate proportionately, or set the depth of cut smaller.