

THE NEW VALUE FRONTIER



CARBIDE ENDMILL

Solid Carbide Endmill with MEGACOAT

General Purpose

Hardened Material

Difficult-to-Cut Material

Aluminum & Non Ferrous Material

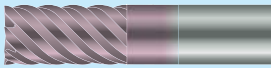


Solid End Mill Series

- Kyocera's solid end mill series has a wide product lineup from roughing to finishing as well as items for difficult-to-cut materials and hardened materials.

■ New PVD technology, MEGACOAT

MEGACOAT - for hardened materials.

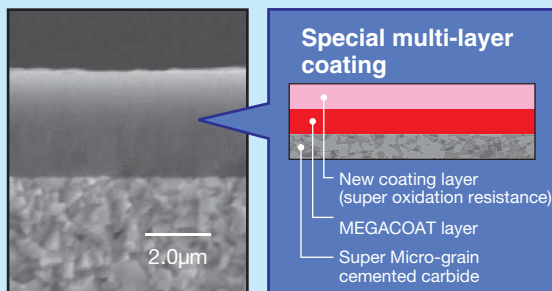


Achieves longer tool life and stable machining of hardened materials with a special multi-layer coating.

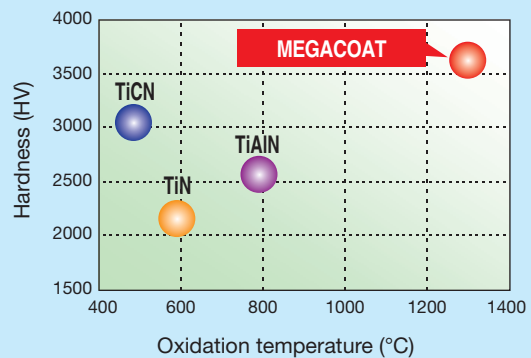
Hseries
P25-P26

■ Excellent wear resistance and heat resistance

● MEGACOAT hard structure

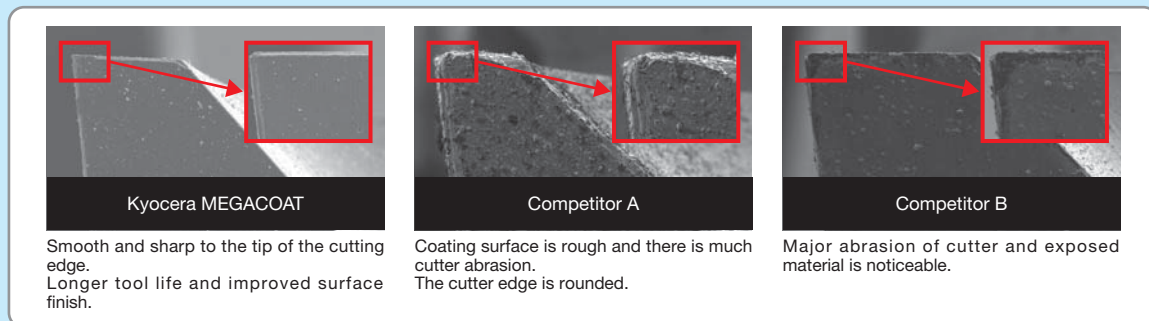


Achieves super hardness to control abrasion of the edge coating



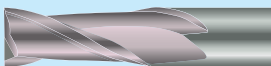
■ Smooth cutting edge quality with a unique coating technology

● Smooth surface quality



● Smooth endmill surface reduces welding and allows stable machining.

MEGACOAT - for high precision finishing.



MEGACOAT achieves high precision finishing and a sharp cutting edge.

Fseries
P10-P19

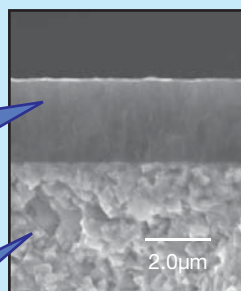
● Wear resistant and high heat resistant

MEGACOAT

Nitride solid solution of high melting point metal
High hardness and oxidation resistant
Smooth surface

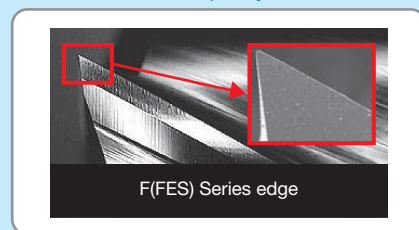
● Fracture resistant and stable machining

Super Micro-grain cemented carbide



■ High-quality, sharp edge

● Smooth surface quality

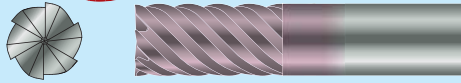


New product introduction

HFS type

End mill for finishing of hardened materials.

NEW



(4,5,6,7HFSS) (4,5,6,7HFSM)

MEGACOAT is applied



with Corner land



HFS cross section



FES cross section

For finishing of hardened materials

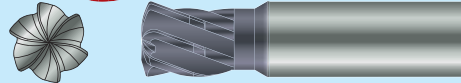
- End mill for hardened materials that achieves longer tool life and stable machining.
- Applicable for hardened materials up to 67HRC.
- Achieves high feed rate machining for cutting of hardened materials.
- Compared to the FES type, the core diameter was increased by 30%, for higher rigidity. Negative rake angle and stronger cutting edge design with corner land.

P25, P26

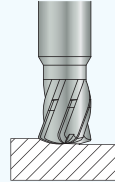
PDR type

High efficiency radius end mill for hardened materials.

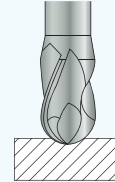
NEW



(6PDRS)



PDR type



General Purpose Ball-Nosed End Mill

For high efficiency machining of hardened materials

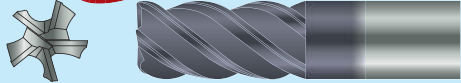
- Improved productivity with 6 edge design and high feed rate.
- Achieves large machining allowance and high efficiency machining with special corner-R shape, due to the large contact area on the bottom surface.
- Applicable for hardened materials up to 67HRC.

P32

DEK type DER type

End mill for high feed rate machining of difficult-to-cut material.

NEW



(5DEKM, 5DERM)

For high efficiency machining of difficult-to-cut materials

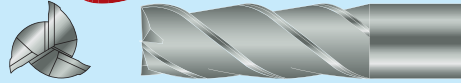
- Achieves high feed rate machining with 5 edge design.
- Achieves high efficiency machining for difficult-to-cut materials, such as stainless steel and heat-resistant alloys.
- Applicable for slotting with a cutting depth up to 0.8Dc.
- Unequally partitioned flute design prevents vibration and reduces cutting force.
- Able to accommodate work from roughing to finishing with a single tool.

P37

NES type

End mill for finishing of aluminum & non-ferrous materials.

NEW



with wiper edge

(3NESM)

For finishing of aluminum

- A wiper is attached at the lower edge for improving bottom surface finish.
- Chattering is controlled with cutting edge slots at varied intervals, and finishing of lateral surfaces is improved.
- A special core shape facilitates improved chip evacuation, while assuring rigidity.
- Able to accommodate work from roughing to finishing with a single tool.

P39

General Purpose End Mill

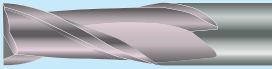
End mill for difficult-to-cut materials, cast iron, and steel machining.

P10-P24

Finishing

F Series

MEGACOAT is applied



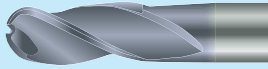
(FES)

For finishing. Beautiful surface finish is achieved by high quality cutting edges and MEGACOAT that has excellent wear resistance and heat resistance.

P10-P19

Semi Finishing

U Series



(3UEBS)

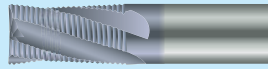
For semi-finishing. High efficiency machining products such as the 3-edge square type and ball-nose end mill have been added to the lineup.



P20-P22

Roughing

R Series



(RDS)

End mill for stainless steel and cast iron centered on steel machining. The sine curve shaped cutting edge reduces cutting resistance and controls chatter.



P23-P24

End mill applicable for hardened materials

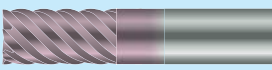
End mill developed primarily for machining hardened materials. Also suitable for steel.

P25-P34

Finishing

H Series

MEGACOAT is applied



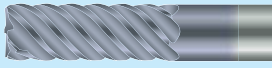
(HFS)

Applicable for finishing of hardened materials. MEGACOAT Hard is applied. Achieves stable machining of hardened materials.

P25-P26

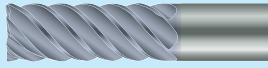
Semi Finishing

P,U Series



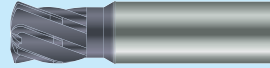
(UGS)

For stable and high efficiency machining of hardened materials.



(PGS)

Good chip evacuation and high rigidity. Short, medium and long types available.



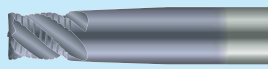
(6PDRS)

High efficiency radius. Achieves large machining allowance and high efficiency machining with special corner radius shape.

P27-P32

Roughing

R Series



(3/4RFRS)

For rough copying/profiling. Strong cutting edge suitable for machining of hardened materials and titanium alloys.

P33-P34

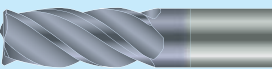
End mill for difficult-to-cut materials

End mill designed for difficult-to-cut materials, such as stainless steel, inconel and titanium.

P35-P38

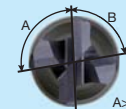
Semi Finishing

Y Series



(4YECM, 4YERM, 4YEKM)

Reduced vibration (chattering) and high efficiency machining with the cutting edge slots (flutes) at varying intervals. Various types of cutting edges are available, such as sharp edge, chamfered, land, radius and ball-nose.

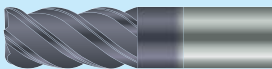


4YECM varied interval flute

P35-P36
P38

High feed

D Series



(5DEKM, 5DERM)

5 edge design. Achieves machining of difficult-to-cut materials, such as stainless steel and high temperature alloys at high feed rates.

P37

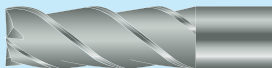
End mill for aluminum & non-ferrous materials

End mills available for finishing, semi finishing and roughing of aluminum & non-ferrous materials.

P39-P43

Finishing

N Series



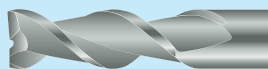
(3NESM)

A wiper is attached at the lower edge for improving the bottom surface finish. Chattering is controlled with cutting edge slots at varied intervals, and finishing of lateral surfaces is improved.

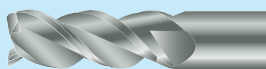
P39

Semi Finishing

N Series



(2NFMS)



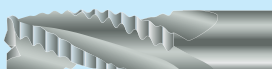
(3NFMS)

Achieves good chip evacuation with special rake face shape and 45° helix angle.

P40-P41

Roughing

A Series


























(3AESM)

For roughing of aluminum & non-ferrous materials. Achieves high efficiency machining with a large chip evacuation space.

P42-P43




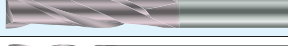





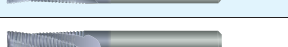

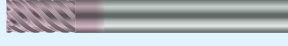

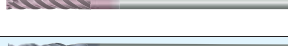

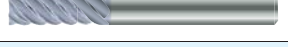




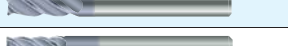







Guide for tool selection

Application and selection

Material	Process	Application	Recommendation	Shape	Ref. Page	
General purpose (carbon steel/ alloy steel)	Finishing	Surface roughness-oriented	Sharp cutting oriented	2FESS 2FESM 2FESL	 P.12	
			Tough corner edge	2FEKS 2FEKM 4FEKM	 P.13~14	
		Automatic lathe	Productivity-oriented	4FESM	 P.15	
				2/3/4FESW	 P.17	
		Semi Finishing	Copying	Deep milling	2UEBS	 P.18
				Productivity-oriented	3UEBS	 P.19
	Roughing			3/4/5RDSM 3/4/5RDSL	 P.16	
				2/3/4FESW	 P.10~11	
	Hardened Material	Finishing			4/5/6/7HFSS 4/5/6/7HFMS	 P.20
					4/5/6/7HFMS	 P.21
		Semi Finishing	High Rigidity	Deep milling	4PGRM	 P.22
				High feed	6PDRS	 P.27
Roughing		Deep milling		4/5/6PGSS 4/5/6PGSM 4/5/6PGSL	 P.31	
				4/6RFSM	 P.32	
Difficult-to-Cut Material		Semi Finishing	Productivity-oriented		4YECM 4YEKM 4YERM 4/6YFSM	 P.23
				High feed	5DEKM 5DERM	 P.28
			Copying	4YEBM	 P.29	
		Finishing	Surface roughness-oriented		3NESM	 P.33
					2NFMS	 P.34
					3NFMS 3NFSL	 P.35
Aluminum & Non Ferrous Material	Semi Finishing	Productivity-oriented		3AESE 3AESL	 P.36	
				3AESM 3AESL	 P.37	
	Roughing			3AESM 3AESL	 P.42	

Guide for tool selection

Application and selection of type distinctions









Type	Flutes	Application	Shape	Description	Outside Dia. ϕ Dc (mm)	Page
Square	2/3/4	For automatic lathe, for general use, for finishing		2FESW 3FESW 4FESW	$\phi 3 \sim \phi 12$	P.10~11
	2	Finishing		2FESS	$\phi 1 \sim \phi 16$	P.12
	2	Finishing		2FESM	$\phi 0.2 \sim \phi 16$	P.13~14
	2	Finishing		2FESL	$\phi 1 \sim \phi 16$	P.15
	4	Finishing		4FESM	$\phi 1 \sim \phi 16$	P.16
	2	Finishing, Tough corner edge		2FEKS	$\phi 3 \sim \phi 16$	P.17
	2	Finishing, Tough corner edge		2FEKM	$\phi 3 \sim \phi 16$	P.18
	4	Finishing, Tough corner edge		4FEKM	$\phi 3 \sim \phi 16$	P.19
	3	Semi-Finishing		3UFSM	$\phi 1 \sim \phi 20$	P.20
	3/4/5	Roughing		3RDSM 4RDSM 5RDSM	$\phi 4 \sim \phi 25$	P.23
	3/4/5	Roughing		3RDSL 4RDSL 5RDSL	$\phi 6 \sim \phi 25$	P.24
	4/5/6/7	Finishing of Hardened Material		4HFSS 5HFSS 6HFSS 7HFSS	$\phi 1 \sim \phi 12$	P.25
	4/5/6/7	Finishing of Hardened Material		4HFMS 5HFMS 6HFMS 7HFMS	$\phi 1 \sim \phi 16$	P.26
	4/5	Deep Slotting and Semi-Finishing of Hardened Material		4PGSS 5PGSS	$\phi 3 \sim \phi 25$	P.28
	4/5/6	Semi-Finishing of Hardened Material		4PGSM 5PGSM 6PGSM	$\phi 6 \sim \phi 25$	P.29
	4/5/6	Semi-Finishing of Hardened Material		4PGSL 5PGSL 6PGSL	$\phi 6 \sim \phi 25$	P.30
	4/6	Semi-Finishing and high efficiency machining of Hardened Material		4UGSM 6UGSM	$\phi 3 \sim \phi 16$	P.31
	4/6	Roughing of Hardened Material		4RFMS 6RFMS	$\phi 6 \sim \phi 25$	P.33
	4	Semi-Finishing of Difficult-to-Cut Material		4YECM	$\phi 4 \sim \phi 25$	P.35
	4	Semi-Finishing of Difficult-to-Cut Material		4YEKM	$\phi 4 \sim \phi 25$	P.35
	4/6	Semi-Finishing of Difficult-to-Cut Material		4YFSM 6YFSM	$\phi 4 \sim \phi 20$	P.36
	5	Semi-Finishing of Difficult-to-Cut Material		5DEKM	$\phi 4 \sim \phi 25$	P.37
	3	Finishing of Aluminum		3NESM	$\phi 3 \sim \phi 20$	P.39
	2/3	Semi-Finishing of Aluminum	 	2NFMS 3NFMS	$\phi 1 \sim \phi 20$ $\phi 3 \sim \phi 20$	P.40
	3	Semi-Finishing of Aluminum		3NFSL	$\phi 3 \sim \phi 20$	P.41
3	Roughing of Aluminum		3AEMS	$\phi 6 \sim \phi 25$	P.42	
3	Roughing of Aluminum		3AESL	$\phi 6 \sim \phi 25$	P.43	

Workpiece material										Page
Steel for general structures Carbon steel	Steel		Hardened Steel		Stainless steel	Titanium Alloy	Heat-resistant Alloy	Cast Iron	Aluminum & Non Ferrous Material	
 ~750N/mm ²	 ~30HRC	 30~40HRC	 ~55HRC	 ~68HRC	 Stainless steel	 Titanium Alloy	 Heat-resistant Alloy	 Cast Iron	 Aluminum & Non Ferrous Material	
○	○	○	○		○			○	○	P.10~11
○	○	○	○		○			○	○	P.12
○	○	○	○		○			○	○	P.13~14
○	○	○	○		○			○	○	P.15
○	○	○	○		○			○	○	P.16
○	○	○	○		○			○	○	P.17
○	○	○	○		○			○	○	P.18
○	○	○	○		○			○	○	P.19
	○	○	○		○	○		○	○	P.20
○	○	○			○			○		P.23
○	○	○			○			○		P.24
○	○	○	○	○						P.25
○	○	○	○	○						P.26
		○	○	○				○		P.28
		○	○	○				○		P.29
		○	○	○				○		P.30
			○	○						P.31
		○	○	○	○	○	○	○		P.33
	○	○			○	○	○	○		P.35
	○	○			○	○	○	○		P.35
○	○	○			○	○	○	○		P.36
○	○	○			○	○	○	○		P.37
									○	P.39
									○	P.40
									○	P.41
									○	P.42
									○	P.43

○ : 1st Recommendation ○ : 2nd Recommendation

Guide for tool selection

Application and Tool Selection














Type	Flutes	Application	Shape	Description	Outside Dia. ϕ Dc (mm)	Page
Radius	4	Deep Slotting and Finishing for Hardened Material		4PGRM	$\phi 3 \sim \phi 20$	P.27
	6	Semi Finishing for Hardened Material		6PDRS	$\phi 6 \sim \phi 12$	P.32
	3/4	Rough Copying for Hardened Material		3RFRS 4RFRS	$\phi 4 \sim \phi 12$	P.34
	4	Semi Finishing for Difficult-to-Cut Material		4YERM	$\phi 4 \sim \phi 25$	P.35
	5	Semi Finishing and high feed machining for Difficult-to-Cut Material		5DERM	$\phi 4 \sim \phi 25$	P.37
Ball nose	2	Copying		2UEBS	$\phi 1 \sim \phi 20$	P.21
	3	Copying		3UEBS	$\phi 3 \sim \phi 12$	P.22
	4	Semi Finishing for Difficult-to-Cut Material		4YEBM	$\phi 5 \sim \phi 20$	P.38

Solid End Mill Series

Solid End Mill Identification System

2 F E S M 020 - 060 - 04 XXXXXXXX								
①	②	③	④	⑤	⑥	⑦	⑧	⑨
① Flutes	② Series	③ Helix Angle	④ Application	⑤ Length of cut	⑥ Outside Dia.	⑦ Length of cut	⑧ Shank Dia.	⑨ Others
2 3 4 5 6 7	F : Finishing U : Semi Finishing Y : Difficult-to-Cut Material D : Difficult-to-Cut Material H : Hardened Material, Finishing P : Hardened Material R : Roughing A : Roughing for Aluminum N : Aluminum	D : 20-29° E : 30-39° F : 40-49° G : 50-59°	S : Square B : Ball Nose R : Radius K : Tough corner edge (Corner land) C : with Corner Chamfering	S : Short M : Medium L : Long W : For automatic lathe	020 ↓ 2.0mm	060 ↓ 6.0mm	04 ↓ 4.0mm	Corner Radius C width etc...

How to read icon

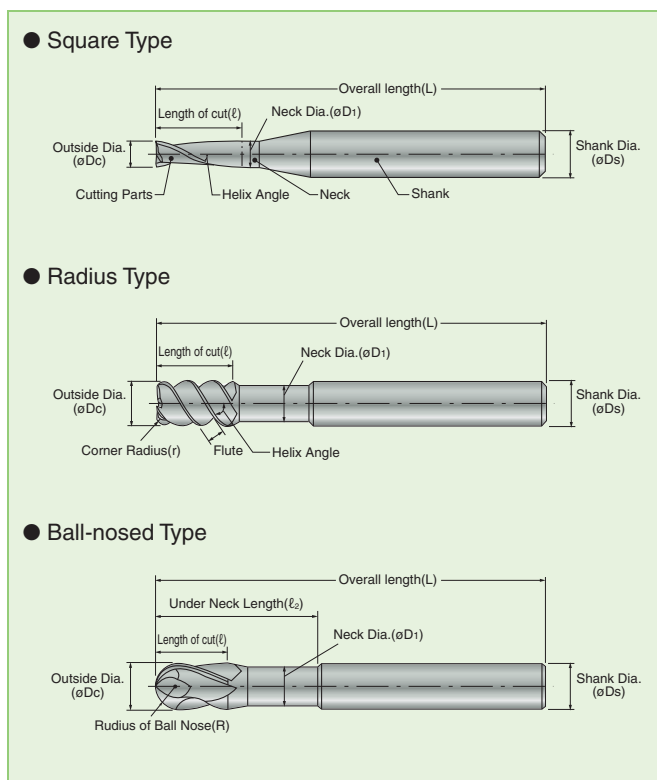
Coating  MEGACOAT Hard  MEGACOAT  TiAlN Coating  A2TiN Coating  Uncoated Non-coating	Shank Diameter Tolerance  h5 Shank Dia. Tolerance is h5.	Corner Radius Tolerance  R Corner Radius Tolerance is 0/-0.02mm.
Corner Form  Radius  Sharp Corner sharp edge  Land with Corner land  C with Corner Chamfering	Ball-nose Radius Tolerance  R The R tolerance of ball end mill is 0/-0.02mm.	Helix Angle  30° Helix Angle 30°

Workpiece material										Page
Steel for general structures Carbon steel	Steel		Hardened Steel		Stainless steel	Titanium Alloy	Heat-resistant Alloy	Cast Iron	Aluminum & Non Ferrous Material	
P ~750N/mm ²	UP to 30HRC P ~30HRC	UP to 40HRC P 30~40HRC	UP to 55HRC H ~55HRC	UP to 68HRC H ~68HRC	M Stainless steel	S Titanium Alloy	S Heat-resistant Alloy	K Cast Iron	N Aluminum & Non Ferrous Material	
		○	◎	◎				○		P.27
◎	◎	◎	◎	◎						P.32
		○	◎	◎	○	◎		○		P.34
	◎	◎			◎	○	○	◎		P.35
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◎	◎	○						◎		P.21
◎	◎				○				○	P.22
	◎	○			◎	◎	○	○		P.38

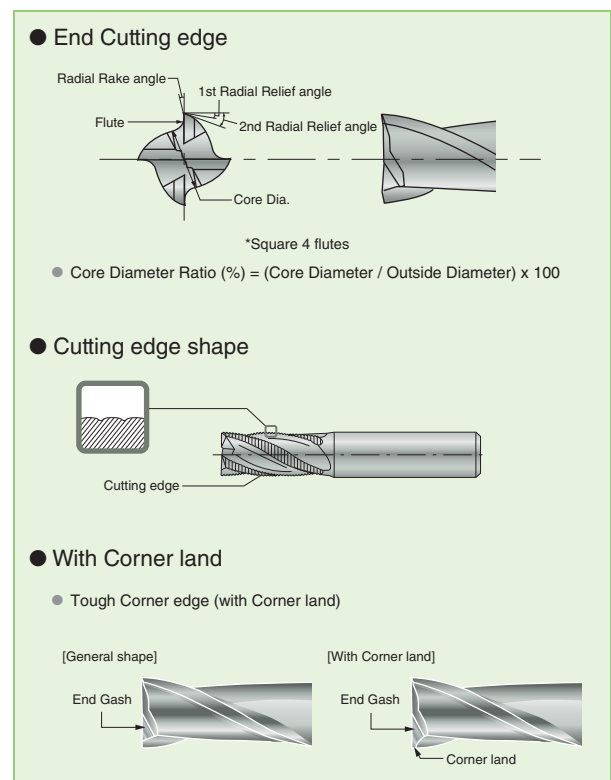
◎ : 1st Recommendation ○ : 2nd Recommendation

Name of Solid End Mill Parts and Shapes

Name of parts



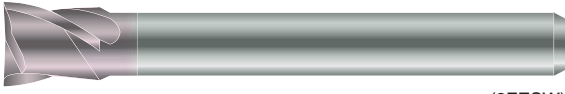
Cutting parts shape



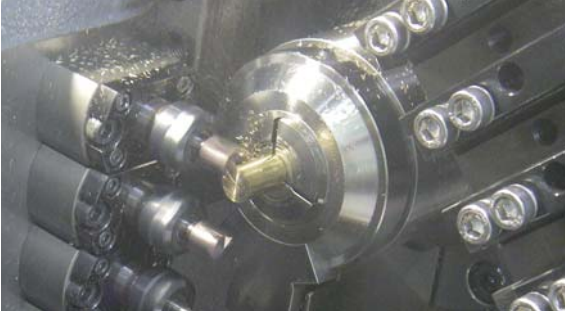
2FESW, 3FESW, 4FESW

Flutes : **2,3,4**

For General Use and Finishing using an Automatic Lathe

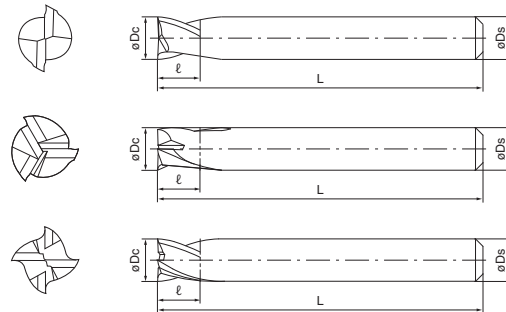


(2FESW)



Recommended Material

★ 1st Recommendation



MEGACOAT is applied

Super micro grain carbide

General Purpose

Sharp Cutting Edge Reduced Burrs

- Applicable to the Swiss-type automatic lathe.
- Achieves high precision machining by reducing burr formation with new PVD coating "MEGACOAT" and sharp edge.

Workpiece Material: Kovar		
2FES (ø3 • 2 flutes)		Facing of machine component
○ Smooth surface of shoulder wall Competitor Coating C (ø3 • 2 flutes) ✗ Large burrs		• Vc=20m/min (n=2150min ⁻¹) • fz=0.023mm/t (Vf=100mm/min)

Comparison with competitor's endmill after 600 passes

Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc	tolerance	ℓ	øDs	L	Z
2FESW030-030-04	●	3	0 -0.020	3	4	45	2
2FESW035-035-04	●	3.5	0 -0.020	3.5	4	45	2
2FESW040-040-04	●	4	0 -0.020	4	4	45	2
2FESW050-050-06	●	5	0 -0.020	5	6	45	2
2FESW060-060-06	●	6	0 -0.020	6	6	45	2
2FESW070-070-07	●	7	0 -0.025	7	7	45	2
2FESW080-080-07	●	8	0 -0.025	8	7	45	2
2FESW080-080-08	●	8	0 -0.025	8	8	45	2
2FESW100-080-07	●	10	0 -0.025	8	7	45	2
2FESW100-080-10	●	10	0 -0.025	8	10	45	2
2FESW120-080-10	●	12	0 -0.025	8	10	45	2

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc	tolerance	ℓ	øDs	L	Z
3FESW030-030-04	●	3	0 -0.020	3	4	45	3
3FESW035-035-04	●	3.5	0 -0.020	3.5	4	45	3
3FESW040-040-04	●	4	0 -0.020	4	4	45	3
3FESW050-050-06	●	5	0 -0.020	5	6	45	3
3FESW060-060-06	●	6	0 -0.020	6	6	45	3
3FESW070-070-07	●	7	0 -0.025	7	7	45	3
3FESW080-080-07	●	8	0 -0.025	8	7	45	3
3FESW080-080-08	●	8	0 -0.025	8	8	45	3
3FESW100-080-07	●	10	0 -0.025	8	7	45	3
3FESW100-080-10	●	10	0 -0.025	8	10	45	3
3FESW120-080-10	●	12	0 -0.025	8	10	45	3

● : Standard Stock

(Unit : mm)

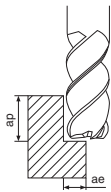
Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
4FESW030-030-04	●	3	0 -0.020	3	4	45	4
4FESW035-035-04	●	3.5	0 -0.020	3.5	4	45	4
4FESW040-040-04	●	4	0 -0.020	4	4	45	4
4FESW050-050-06	●	5	0 -0.020	5	6	45	4
4FESW060-060-06	●	6	0 -0.020	6	6	45	4
4FESW070-070-07	●	7	0 -0.025	7	7	45	4
4FESW080-080-07	●	8	0 -0.025	8	7	45	4
4FESW080-080-08	●	8	0 -0.025	8	8	45	4
4FESW100-080-07	●	10	0 -0.025	8	7	45	4
4FESW100-080-10	●	10	0 -0.025	8	10	45	4
4FESW120-080-10	●	12	0 -0.025	8	10	45	4

● : Standard

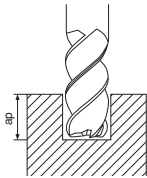


An easy to use total length of 45mm

Recommended Milling Conditions



Shouldering



Slotting

Shouldering

Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	ø3	ø4	ø5	ø6	ø8	Ø10	ø12	ø14
2FESW										
Carbon steel S45C	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	11,000	8,000	6,400	5,300	4,000	3,200	2,700	2,300
		Feed Rate (mm/min)	660	640	640	640	520	450	410	350
Alloy steel SCM, SNCM	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600
		Feed Rate (mm/min)	420	430	430	430	350	300	270	230
Pre-hardened steel NAK, 30-45HRC	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600
		Feed Rate (mm/min)	420	430	430	430	350	300	270	230
Stainless steel SUS304	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900	1,600	1,400
		Feed Rate (mm/min)	320	320	320	320	260	230	210	180
3FESW										
Carbon steel S45C	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	11,000	8,000	6,400	5,300	4,000	3,200	2,700	2,300
		Feed Rate (mm/min)	810	800	800	800	650	560	510	450
Alloy steel SCM, SNCM	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600
		Feed Rate (mm/min)	530	530	530	530	430	370	340	290
Pre-hardened steel NAK, 30-45HRC	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600
		Feed Rate (mm/min)	530	530	530	530	430	370	340	290
Stainless steel SUS304	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900	1,600	1,400
		Feed Rate (mm/min)	400	400	400	400	320	280	260	230
4FESW										
Carbon steel S45C	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	11,000	8,000	6,400	5,300	4,000	3,200	2,700	2,300
		Feed Rate (mm/min)	960	960	960	960	780	680	620	550
Alloy steel SCM, SNCM	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600
		Feed Rate (mm/min)	640	640	640	640	520	450	410	350
Pre-hardened steel NAK, 30-45HRC	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600
		Feed Rate (mm/min)	640	640	640	640	520	450	410	350
Stainless steel SUS304	1Dc x 0.2Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900	1,600	1,400
		Feed Rate (mm/min)	480	480	480	480	390	340	310	280

* Machining with coolant is recommended for stainless steel.

Please refer to page 44 about slotting.

General Purpose

Finishing

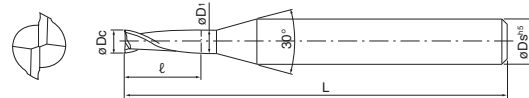


MEGACOAT is applied

Super micro grain carbide

Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESS010-015-04	●	1.0	0 -0.015	1.5	1.1	4	45	2
2FESS015-023-04	●	1.5	0 -0.015	2.3	1.6	4	45	2
2FESS020-030-04	●	2.0	0 -0.015	3.0	2.1	4	45	2
2FESS025-037-04	●	2.5	0 -0.015	3.7	2.6	4	45	2
2FESS030-045-06	●	3.0	0 -0.015	4.5	3.2	6	50	2
2FESS035-052-06	●	3.5	0 -0.015	5.2	3.7	6	50	2
2FESS040-060-06	●	4.0	0 -0.015	6.0	4.2	6	50	2
2FESS045-067-06	●	4.5	0 -0.015	6.7	4.7	6	50	2
2FESS050-075-06	●	5.0	0 -0.015	7.5	5.2	6	50	2

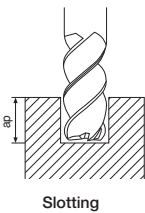
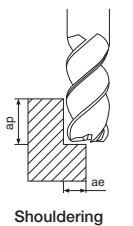
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESS055-082-06	●	5.5	0 -0.015	8.2	5.7	6	50	2
2FESS060-090-06	●	6.0	0 -0.020	9.0	-	6	50	2
2FESS080-120-08	●	8.0	-0.005 -0.025	12.0	-	8	60	2
2FESS100-150-10	●	10.0	-0.005 -0.025	15.0	-	10	70	2
2FESS120-180-12	●	12.0	-0.010 -0.030	18.0	-	12	75	2
2FESS140-210-16	●	14.0	-0.010 -0.030	21.0	14.2	16	75	2
2FESS150-230-16	●	15.0	-0.010 -0.030	23.0	15.2	16	90	2
2FESS160-240-16	●	16.0	-0.010 -0.030	24.0	-	16	90	2

● : Standard Stock

- This product has attained excellent wear resistance by utilizing the new PVD coating technology, "MEGACOAT". It has also achieved fracture resistance and stability of machining with its super micro grain carbide. Stable machining has been realized by greatly reducing welding due to smooth surface quality. Achieves high precision machining with coating and a sharp cutting edge.

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	Spindle Revolution (min ⁻¹)								
			ø0.5	ø1	ø2	ø4	ø6	ø8	ø12	ø16	
Carbon steel S45C	1.2Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	32,000	25,500	13,200	6,600	4,500	3,300	2,200	1,700	
	1.2Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	210	225	230	375	415	420	410	410
Alloy steel SCM, SNCM	1.2Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	27,000	22,000	11,000	5,600	3,700	2,800	1,900	1,400	
	1.2Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	180	195	220	285	315	310	310	310
Pre-hardened steel NAK, 30~45HRC	1.2Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	22,500	12,700	7,200	4,200	3,000	2,200	1,500	1,100	
	1.2Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	50	55	80	100	105	105	110	110
Stainless steel SUS304	1.2Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	27,000	22,000	11,000	5,600	3,700	2,800	1,900	1,400	
	1.2Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	60	95	95	110	115	115	115	115

* Machining with coolant is recommended for stainless steel.

Please refer to page 44 about slotting.

General Purpose

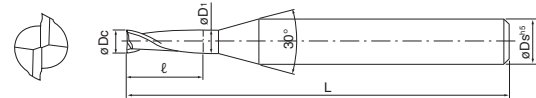
Finishing



MEGACOAT is applied
Super micro grain carbide

Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESM002-004-04	●	0.2	0 -0.015	0.4	0.22	4	45	2
2FESM003-006-04	●	0.3	0 -0.015	0.6	0.32	4	45	2
2FESM004-008-04	●	0.4	0 -0.015	0.8	0.42	4	45	2
2FESM005-010-04	●	0.5	0 -0.015	1.0	0.53	4	45	2
2FESM006-012-04	●	0.6	0 -0.015	1.2	0.63	4	45	2
2FESM007-014-04	●	0.7	0 -0.015	1.4	0.74	4	45	2
2FESM008-016-04	●	0.8	0 -0.015	1.6	0.84	4	45	2
2FESM009-020-04	●	0.9	0 -0.015	2.0	0.95	4	45	2
2FESM010-025-04	●	1.0	0 -0.015	2.5	1.1	4	45	2
2FESM011-025-04	●	1.1	0 -0.015	2.5	1.2	4	45	2
2FESM012-040-04	●	1.2	0 -0.015	4.0	1.3	4	45	2
2FESM013-040-04	●	1.3	0 -0.015	4.0	1.4	4	45	2
2FESM014-040-04	●	1.4	0 -0.015	4.0	1.5	4	45	2
2FESM015-040-04	●	1.5	0 -0.015	4.0	1.6	4	45	2
2FESM016-050-04	●	1.6	0 -0.015	5.0	1.7	4	45	2
2FESM017-050-04	●	1.7	0 -0.015	5.0	1.8	4	45	2
2FESM018-050-04	●	1.8	0 -0.015	5.0	1.9	4	45	2
2FESM019-050-04	●	1.9	0 -0.015	5.0	2.0	4	45	2
2FESM020-060-04	●	2.0	0 -0.015	6.0	2.1	4	45	2
2FESM021-060-04	●	2.1	0 -0.015	6.0	2.2	4	45	2
2FESM022-060-04	●	2.2	0 -0.015	6.0	2.3	4	45	2
2FESM023-060-04	●	2.3	0 -0.015	6.0	2.4	4	45	2
2FESM024-080-04	●	2.4	0 -0.015	8.0	2.5	4	45	2
2FESM025-080-04	●	2.5	0 -0.015	8.0	2.6	4	45	2
2FESM026-080-04	●	2.6	0 -0.015	8.0	2.7	4	45	2
2FESM027-080-04	●	2.7	0 -0.015	8.0	2.8	4	45	2
2FESM028-080-04	●	2.8	0 -0.015	8.0	2.9	4	45	2
2FESM029-080-04	●	2.9	0 -0.015	8.0	3.1	4	45	2
2FESM030-100-06	●	3.0	0 -0.015	10.0	3.2	6	50	2
2FESM031-100-06	●	3.1	0 -0.015	10.0	3.3	6	50	2
2FESM032-100-06	●	3.2	0 -0.015	10.0	3.4	6	50	2
2FESM033-100-06	●	3.3	0 -0.015	10.0	3.5	6	50	2

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESM034-100-06	●	3.4	0 -0.015	10.0	3.6	6	50	2
2FESM035-100-06	●	3.5	0 -0.015	10.0	3.7	6	50	2
2FESM036-100-06	●	3.6	0 -0.015	10.0	3.8	6	50	2
2FESM037-100-06	●	3.7	0 -0.015	10.0	3.9	6	50	2
2FESM038-110-06	●	3.8	0 -0.015	11.0	4.0	6	50	2
2FESM039-110-06	●	3.9	0 -0.015	11.0	4.1	6	50	2
2FESM040-110-06	●	4.0	0 -0.015	11.0	4.2	6	50	2
2FESM041-110-06	●	4.1	0 -0.015	11.0	4.3	6	50	2
2FESM042-110-06	●	4.2	0 -0.015	11.0	4.4	6	50	2
2FESM043-110-06	●	4.3	0 -0.015	11.0	4.5	6	50	2
2FESM044-110-06	●	4.4	0 -0.015	11.0	4.6	6	50	2
2FESM045-110-06	●	4.5	0 -0.015	11.0	4.7	6	50	2
2FESM046-110-06	●	4.6	0 -0.015	11.0	4.8	6	50	2
2FESM047-110-06	●	4.7	0 -0.015	11.0	4.9	6	50	2
2FESM048-130-06	●	4.8	0 -0.015	13.0	5.0	6	50	2
2FESM049-130-06	●	4.9	0 -0.015	13.0	5.1	6	50	2
2FESM050-130-06	●	5.0	0 -0.015	13.0	5.2	6	50	2
2FESM051-130-06	●	5.1	0 -0.015	13.0	5.3	6	50	2
2FESM052-130-06	●	5.2	0 -0.015	13.0	5.4	6	50	2
2FESM053-130-06	●	5.3	0 -0.015	13.0	5.5	6	50	2
2FESM054-130-06	●	5.4	0 -0.015	13.0	5.6	6	50	2
2FESM055-130-06	●	5.5	0 -0.015	13.0	5.7	6	50	2
2FESM056-130-06	●	5.6	0 -0.015	13.0	5.8	6	50	2
2FESM057-130-06	●	5.7	0 -0.015	13.0	-	6	50	2
2FESM058-130-06	●	5.8	0 -0.015	13.0	-	6	50	2
2FESM059-130-06	●	5.9	0 -0.015	13.0	-	6	50	2
2FESM060-130-06	●	6.0	0 -0.020	13.0	-	6	50	2
2FESM061-160-08	●	6.1	0 -0.020	16.0	6.3	8	60	2
2FESM062-160-08	●	6.2	0 -0.020	16.0	6.4	8	60	2
2FESM063-160-08	●	6.3	0 -0.020	16.0	6.5	8	60	2
2FESM064-160-08	●	6.4	0 -0.020	16.0	6.6	8	60	2
2FESM065-160-08	●	6.5	0 -0.020	16.0	6.7	8	60	2

General Purpose

● : Standard Stock

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESM066-160-08	●	6.6	0 -0.020	16.0	6.8	8	60	2
2FESM067-160-08	●	6.7	0 -0.020	16.0	6.9	8	60	2
2FESM068-160-08	●	6.8	0 -0.020	16.0	7.0	8	60	2
2FESM069-160-08	●	6.9	0 -0.020	16.0	7.1	8	60	2
2FESM070-160-08	●	7.0	0 -0.020	16.0	7.2	8	60	2
2FESM071-160-08	●	7.1	0 -0.020	16.0	7.3	8	60	2
2FESM072-160-08	●	7.2	0 -0.020	16.0	7.4	8	60	2
2FESM073-160-08	●	7.3	0 -0.020	16.0	7.5	8	60	2
2FESM074-160-08	●	7.4	0 -0.020	16.0	7.6	8	60	2
2FESM075-190-08	●	7.5	0 -0.020	19.0	7.7	8	60	2
2FESM076-190-08	●	7.6	0 -0.020	19.0	-	8	60	2
2FESM077-190-08	●	7.7	0 -0.020	19.0	-	8	60	2
2FESM078-190-08	●	7.8	0 -0.020	19.0	-	8	60	2
2FESM079-190-08	●	7.9	0 -0.020	19.0	-	8	60	2
2FESM080-190-08	●	8.0	-0.005 -0.025	19.0	-	8	60	2
2FESM081-190-10	●	8.1	-0.005 -0.025	19.0	8.3	10	70	2
2FESM082-190-10	●	8.2	-0.005 -0.025	19.0	8.4	10	70	2
2FESM083-190-10	●	8.3	-0.005 -0.025	19.0	8.5	10	70	2
2FESM084-190-10	●	8.4	-0.005 -0.025	19.0	8.6	10	70	2
2FESM085-190-10	●	8.5	-0.005 -0.025	19.0	8.7	10	70	2
2FESM086-190-10	●	8.6	-0.005 -0.025	19.0	8.8	10	70	2
2FESM087-190-10	●	8.7	-0.005 -0.025	19.0	8.9	10	70	2

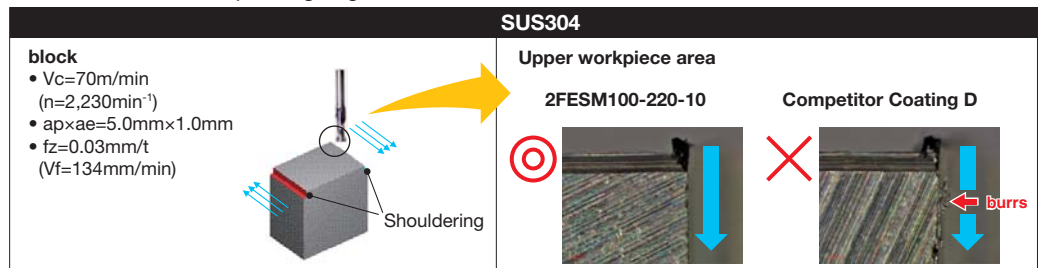
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESM088-190-10	●	8.8	-0.005 -0.025	19.0	9.0	10	70	2
2FESM089-190-10	●	8.9	-0.005 -0.025	19.0	9.1	10	70	2
2FESM090-190-10	●	9.0	-0.005 -0.025	19.0	9.2	10	70	2
2FESM091-190-10	●	9.1	-0.005 -0.025	19.0	9.3	10	70	2
2FESM092-190-10	●	9.2	-0.005 -0.025	19.0	9.4	10	70	2
2FESM093-190-10	●	9.3	-0.005 -0.025	19.0	9.5	10	70	2
2FESM094-190-10	●	9.4	-0.005 -0.025	19.0	9.6	10	70	2
2FESM095-190-10	●	9.5	-0.005 -0.025	19.0	9.7	10	70	2
2FESM096-220-10	●	9.6	-0.005 -0.025	22.0	-	10	70	2
2FESM097-220-10	●	9.7	-0.005 -0.025	22.0	-	10	70	2
2FESM098-220-10	●	9.8	-0.005 -0.025	22.0	-	10	70	2
2FESM099-220-10	●	9.9	-0.005 -0.025	22.0	-	10	70	2
2FESM100-220-10	●	10.0	-0.005 -0.025	22.0	-	10	70	2
2FESM105-220-12	●	10.5	-0.005 -0.025	22.0	10.7	12	75	2
2FESM110-220-12	●	11.0	-0.005 -0.025	22.0	11.2	12	75	2
2FESM115-220-12	●	11.5	-0.005 -0.025	22.0	11.7	12	75	2
2FESM120-260-12	●	12.0	-0.010 -0.030	26.0	-	12	75	2
2FESM130-260-16	●	13.0	-0.010 -0.030	26.0	13.2	16	75	2
2FESM140-260-16	●	14.0	-0.010 -0.030	26.0	14.2	16	75	2
2FESM150-300-16	●	15.0	-0.010 -0.030	30.0	15.2	16	90	2
2FESM160-320-16	●	16.0	-0.010 -0.030	32.0	-	16	90	2

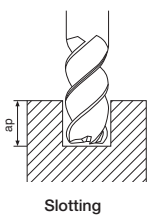
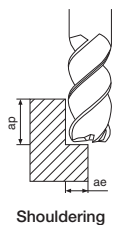
● : Standard Stock

General Purpose

Inhibits burrs with sharp cutting edge



Recommended Milling Conditions



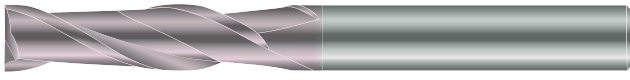
Shouldering

Material	Depth of Cut ($ap \times ae$)(mm)	Outside Dia. (mm)	Spindle Revolution (min^{-1})								
			ø0.5	ø1	ø2	ø4	ø6	ø8	ø12	ø16	
Carbon steel S45C	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min^{-1})	32,000	25,500	13,200	6,600	4,500	3,300	2,200	1,700	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	210	225	230	375	415	420	410	410
Alloy steel SCM, SNCM	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min^{-1})	27,000	22,000	11,000	5,600	3,700	2,800	1,900	1,400	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	180	195	220	285	315	310	310	310
Pre-hardened steel NAK, 30-45HRC	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min^{-1})	22,500	12,700	7,200	4,200	3,000	2,200	1,500	1,100	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	50	55	80	100	105	105	110	110
Stainless steel SUS304	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min^{-1})	27,000	22,000	11,000	5,600	3,700	2,800	1,900	1,400	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	60	95	95	110	115	115	115	115

* Machining with coolant is recommended for stainless steel.

Please refer to page 44 about slotting.

Finishing

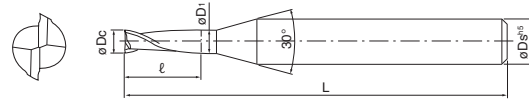


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Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESL010-040-04	●	1.0	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	4.0	1.1	4	45	2
2FESL015-060-04	●	1.5	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	6.0	1.6	4	45	2
2FESL020-090-04	●	2.0	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	9.0	2.1	4	45	2
2FESL025-120-04	●	2.5	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	12.0	2.6	4	45	2
2FESL030-140-06	●	3.0	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	14.0	3.2	6	50	2
2FESL040-170-06	●	4.0	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	17.0	4.2	6	50	2

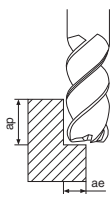
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
2FESL050-200-06	●	5.0	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	20.0	5.2	6	60	2
2FESL060-240-06	●	6.0	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	24.0	-	6	60	2
2FESL080-280-08	●	8.0	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	28.0	-	8	70	2
2FESL100-340-10	●	10.0	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	34.0	-	10	90	2
2FESL120-400-12	●	12.0	$\begin{matrix} -0.010 \\ -0.030 \end{matrix}$	40.0	-	12	90	2
2FESL160-480-16	●	16.0	$\begin{matrix} -0.010 \\ -0.030 \end{matrix}$	48.0	-	16	115	2

General Purpose

● : Standard Stock

Recommended Milling Conditions



Shouldering

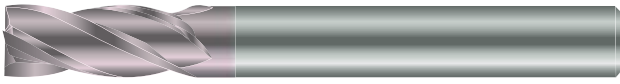
Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	Spindle Revolution (min ⁻¹)							
			ø1	ø2	ø4	ø6	ø8	ø12	ø16	
Carbon steel S45C	2.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	19,000	9,500	4,800	3,200	2,400	1,600	1,200	
	2.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	210	210	210	210	210	210	210
Alloy steel SCM, SNCM	2.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	14,300	7,200	3,600	2,400	2,000	1,300	1,000	
	2.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	155	160	160	160	170	170	150
Pre-hardened steel NAK, 30~45HRC	2.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	11,200	5,600	2,800	1,900	1,600	1,000	800	
	2.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	85	85	90	90	100	95	80
Stainless steel SUS304	2.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	14,300	7,200	3,600	2,400	2,000	1,300	1,000	
	2.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	95	95	95	95	105	105	80

* Machining with coolant is recommended for stainless steel.

Slotting is not recommended.

Finishing

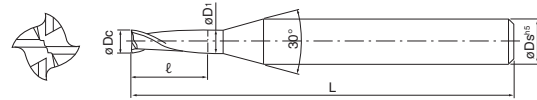


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Recommended Material

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Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
4FESM010-025-04	●	1.0	0 -0.015	2.5	1.1	4	45	4
4FESM015-040-04	●	1.5	0 -0.015	4.0	1.6	4	45	4
4FESM020-060-04	●	2.0	0 -0.015	6.0	2.1	4	45	4
4FESM025-080-04	●	2.5	0 -0.015	8.0	2.6	4	45	4
4FESM030-100-06	●	3.0	0 -0.015	10.0	3.2	6	50	4
4FESM035-100-06	●	3.5	0 -0.015	10.0	3.7	6	50	4
4FESM040-110-06	●	4.0	0 -0.015	11.0	4.2	6	50	4
4FESM045-110-06	●	4.5	0 -0.015	11.0	4.7	6	50	4
4FESM050-130-06	●	5.0	0 -0.015	13.0	5.2	6	50	4

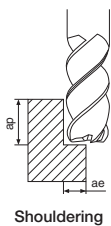
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Shank Dia. øDs	Overall length L	Number of flutes Z
		øDc	tolerance					
4FESM055-130-06	●	5.5	0 -0.015	13.0	5.7	6	50	4
4FESM060-130-06	●	6.0	0 -0.020	13.0	-	6	50	4
4FESM080-190-08	●	8.0	-0.005 -0.025	19.0	-	8	60	4
4FESM100-220-10	●	10.0	-0.005 -0.025	22.0	-	10	70	4
4FESM120-260-12	●	12.0	-0.010 -0.030	26.0	-	12	75	4
4FESM140-260-16	●	14.0	-0.010 -0.030	26.0	14.2	16	75	4
4FESM150-300-16	●	15.0	-0.010 -0.030	30.0	15.2	16	90	4
4FESM160-320-16	●	16.0	-0.010 -0.030	32.0	-	16	90	4

● : Standard Stock

General Purpose

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	Spindle Revolution (min ⁻¹)							
			ø1	ø2	ø4	ø6	ø8	ø12	ø16	
Carbon steel S45C	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	25,500	13,000	6,600	4,400	3,300	2,200	1,700	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	335	345	580	620	625	630	600
Alloy steel SCM, SNCM	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	22,000	11,000	5,600	3,700	2,800	1,900	1,400	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	290	290	395	455	455	470	460
Pre-hardened steel NAK, 30~45HRC	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	12,000	7,200	4,200	3,000	2,200	1,500	1,100	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	105	125	150	160	160	165	140
Stainless steel SUS304	1.5Dc×0.05Dc (Dc<ø3)	Spindle Revolution (min ⁻¹)	22,000	11,000	5,600	3,700	2,800	1,900	1,400	
	1.5Dc×0.1Dc (Dc≥ø3)		Feed Rate (mm/min)	130	145	165	165	170	175	155

* Machining with coolant is recommended for stainless steel.

Slotting is not recommended.

Finishing with land

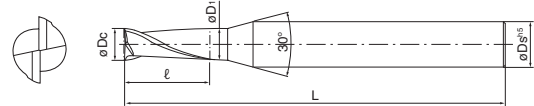


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Recommended Material

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Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Effective Cutting Length	Neck Dia.	Under Neck Length	Shank Dia.	Overall length	Number of flutes
		ϕD_c	ℓ	ϕD_1	ℓ_2	ϕD_s	L	
2FEKS030-045-06	●	3.0	4.5	3.15	6.5	6	49.8	2
2FEKS035-052-06	●	3.5	5.2	3.68	7.2	6	49.8	2
2FEKS040-060-06	●	4.0	6.0	4.2	8.2	6	49.8	2
2FEKS045-067-06	●	4.5	6.7	4.7	8.9	6	49.8	2
2FEKS050-075-06	●	5.0	7.5	5.2	10.1	6	49.8	2
2FEKS055-082-06	●	5.5	8.2	5.7	10.8	6	49.8	2
2FEKS060-090-06	●	6.0	9.0	-	-	6	49.8	2

(Unit : mm)

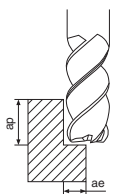
Description	Stock	Outside Dia.	Effective Cutting Length	Neck Dia.	Under Neck Length	Shank Dia.	Overall length	Number of flutes
		ϕD_c	ℓ	ϕD_1	ℓ_2	ϕD_s	L	
2FEKS080-120-08	●	8.0	12.0	-	-	8	59.8	2
2FEKS100-150-10	●	10.0	15.0	-	-	10	69.8	2
2FEKS120-180-12	●	12.0	18.0	-	-	12	74.8	2
2FEKS140-210-16	●	14.0	21.0	14.2	31.4	16	74.8	2
2FEKS150-230-16	●	15.0	23.0	15.2	35	16	89.8	2
2FEKS160-240-16	●	16.0	24.0	-	-	16	89.8	2

● : Standard Stock

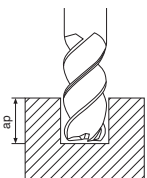
General Purpose

- Corner lands improve the cutting edge strength.

Recommended Milling Conditions



Shouldering



Slotting

Shouldering

Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	$\phi 3$	$\phi 4$	$\phi 6$	$\phi 8$	$\phi 10$	$\phi 12$	$\phi 16$
			Spindle Revolution (min ⁻¹)	Spindle Revolution (min ⁻¹)	Spindle Revolution (min ⁻¹)	Spindle Revolution (min ⁻¹)	Spindle Revolution (min ⁻¹)	Spindle Revolution (min ⁻¹)	Spindle Revolution (min ⁻¹)
Carbon steel S45C	1.2Dc×0.1Dc		9,300	7,000	4,600	3,500	3,000	2,700	2,200
			Feed Rate (mm/min)	450	450	470	470	470	470
Alloy steel SCM, SNCM	1.2Dc×0.1Dc		8,800	6,600	4,400	3,300	2,600	2,200	1,800
			Feed Rate (mm/min)	370	370	380	380	380	380
Pre-hardened steel NAK, 30~45HRC	1.2Dc×0.1Dc		6,400	4,800	3,200	2,400	1,900	1,600	1,200
			Feed Rate (mm/min)	130	130	130	140	140	140
Stainless steel SUS304	1.2Dc×0.1Dc		8,000	6,000	4,000	3,000	2,400	2,000	1,500
			Feed Rate (mm/min)	140	140	140	140	140	140

* Machining with coolant is recommended for stainless steel.

Please refer to page 44 about slotting.

Finishing with land

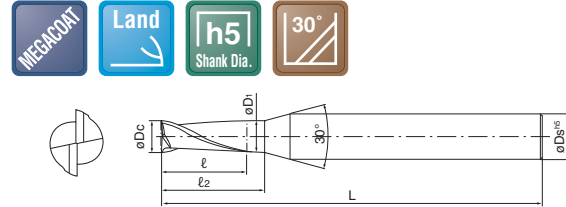


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Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Effective Cutting Length	Neck Dia.	Under Neck Length	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øD1	ℓ2	øDs	L	Z
2FEKM030-100-06	●	3.0	0 -0.015	10.0	3.15	12.0	6	49.8	2
2FEKM035-100-06	●	3.5	0 -0.015	10.0	3.68	12.0	6	49.8	2
2FEKM040-110-06	●	4.0	0 -0.015	11.0	4.2	13.2	6	49.8	2
2FEKM045-110-06	●	4.5	0 -0.015	11.0	4.7	13.2	6	49.8	2
2FEKM050-130-06	●	5.0	0 -0.015	13.0	5.2	15.6	6	49.8	2
2FEKM055-130-06	●	5.5	0 -0.015	13.0	5.7	15.6	6	49.8	2
2FEKM060-130-06	●	6.0	0 -0.020	13.0	-	-	6	49.8	2
2FEKM065-160-08	●	6.5	0 -0.020	16.0	6.7	22.4	8	59.8	2
2FEKM070-160-08	●	7.0	0 -0.020	16.0	7.2	22.4	8	59.8	2
2FEKM075-190-08	●	7.5	0 -0.020	19.0	7.7	26.6	8	59.8	2
2FEKM080-190-08	●	8.0	-0.005 -0.025	19.0	-	-	8	59.8	2

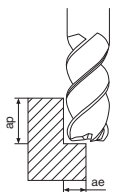
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Effective Cutting Length	Neck Dia.	Under Neck Length	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øD1	ℓ2	øDs	L	Z
2FEKM085-190-10	●	8.5	-0.005 -0.025	19.0	8.7	26.6	10	69.8	2
2FEKM090-190-10	●	9.0	-0.005 -0.025	19.0	9.2	26.6	10	69.8	2
2FEKM095-190-10	●	9.5	-0.005 -0.025	19.0	9.7	26.6	10	69.8	2
2FEKM100-220-10	●	10.0	-0.005 -0.025	22.0	-	-	10	69.8	2
2FEKM110-220-12	●	11.0	-0.005 -0.025	22.0	11.2	30.8	12	74.8	2
2FEKM120-260-12	●	12.0	-0.010 -0.030	26.0	-	-	12	74.8	2
2FEKM130-260-16	●	13.0	-0.010 -0.030	26.0	13.2	36.4	16	74.8	2
2FEKM140-260-16	●	14.0	-0.010 -0.030	26.0	14.2	36.4	16	74.8	2
2FEKM150-300-16	●	15.0	-0.010 -0.030	30.0	15.2	42.0	16	89.8	2
2FEKM160-320-16	●	16.0	-0.010 -0.030	32.0	-	-	16	89.8	2

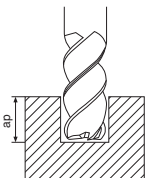
● : Standard Stock

General Purpose

Recommended Milling Conditions



Shouldering



Slotting

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø3	ø4	ø6	ø8	ø10	ø12	ø16
Carbon steel S45C	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	9,300	7,000	4,600	3,500	3,000	2,700	2,200
		Feed Rate (mm/min)	450	450	470	470	470	470	440
Alloy steel SCM, SNCM	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,800	6,600	4,400	3,300	2,600	2,200	1,800
		Feed Rate (mm/min)	370	370	380	380	380	380	360
Pre-hardened steel NAK, 30~45HRC	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,200	2,400	1,900	1,600	1,200
		Feed Rate (mm/min)	130	130	130	140	140	140	140
Stainless steel SUS304	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,000	6,000	4,000	3,000	2,400	2,000	1,500
		Feed Rate (mm/min)	140	140	140	140	140	140	140

* Machining with coolant is recommended for stainless steel.

Please refer to page 44 about slotting.

Finishing with land

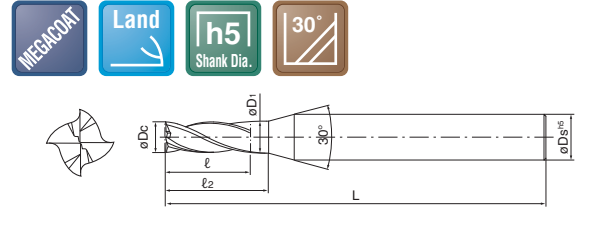


MEGACOAT is applied

Super micro grain carbide

Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Effective Cutting Length	Neck Dia.	Under Neck Length	Shank Dia.	Overall length	Number of flutes
		øDc	0 -0.015	ℓ	øD₁	ℓ₂	øDₛ	L	Z
4FEKM030-100-06	●	3.0	0 -0.015	10.0	3.15	12	6	49.8	4
4FEKM035-100-06	●	3.5	0 -0.015	10.0	3.68	12	6	49.8	4
4FEKM040-110-06	●	4.0	0 -0.015	11.0	4.2	13.2	6	49.8	4
4FEKM045-110-06	●	4.5	0 -0.015	11.0	4.7	13.2	6	49.8	4
4FEKM050-130-06	●	5.0	0 -0.015	13.0	5.2	15.6	6	49.8	4
4FEKM055-130-06	●	5.5	0 -0.015	13.0	5.7	15.6	6	49.8	4
4FEKM060-130-06	●	6.0	0 -0.020	13.0	-	-	6	49.8	4

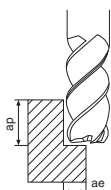
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Effective Cutting Length	Neck Dia.	Under Neck Length	Shank Dia.	Overall length	Number of flutes
		øDc	-0.005 -0.025	ℓ	øD₁	ℓ₂	øDₛ	L	Z
4FEKM080-190-08	●	8.0	-0.005 -0.025	19.0	-	-	8	59.8	4
4FEKM100-220-10	●	10.0	-0.005 -0.025	22.0	-	-	10	69.8	4
4FEKM120-260-12	●	12.0	-0.010 -0.030	26.0	-	-	12	74.8	4
4FEKM140-260-16	●	14.0	-0.010 -0.030	26.0	14.2	36.4	16	74.8	4
4FEKM150-300-16	●	15.0	-0.010 -0.030	30.0	15.2	42	16	89.8	4
4FEKM160-320-16	●	16.0	-0.010 -0.030	32.0	-	-	16	89.8	4

● : Standard Stock

General Purpose

Recommended Milling Conditions



Shouldering

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø3	ø4	ø6	ø8	ø10	ø12	ø16
			Carbon steel S45C	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	10,600	8,000	5,300	4,000
		Feed Rate (mm/min)	680	690	770	770	770	770	770
Alloy steel SCM, SNCM	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,800	6,600	4,400	3,300	2,600	2,200	2,000
		Feed Rate (mm/min)	500	550	620	630	630	630	610
Pre-hardened steel NAK, 30~45HRC	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,200	2,400	1,900	1,600	1,200
		Feed Rate (mm/min)	180	180	180	190	190	190	190
Stainless steel SUS304	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,000	6,000	4,000	3,000	2,300	2,000	1,500
		Feed Rate (mm/min)	190	200	200	200	210	210	210

* Machining with coolant is recommended for stainless steel.

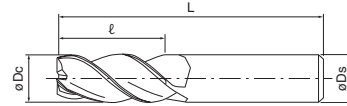
Slotting is not recommended.

Semi Finishing



Recommended Material

★ 1st Recommendation



Stock Items

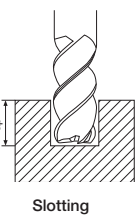
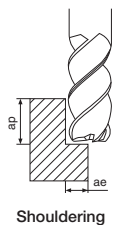
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
3UF5M010-030-04	●	1	-0.014 -0.028	3	4	50	3
3UF5M015-030-04	●	1.5	-0.014 -0.028	3	4	50	3
3UF5M020-030-04	●	2	-0.014 -0.028	3	4	50	3
3UF5M025-040-04	●	2.5	-0.014 -0.028	4	4	50	3
3UF5M030-080-06	●	3	-0.014 -0.028	8	6	50	3
3UF5M040-120-06	●	4	-0.020 -0.038	12	6	50	3
3UF5M050-140-06	●	5	-0.020 -0.038	14	6	50	3
3UF5M060-160-06	●	6	-0.020 -0.038	16	6	50	3
3UF5M080-200-08	●	8	-0.025 -0.047	20	8	63	3
3UF5M100-220-10	●	10	-0.025 -0.047	22	10	76	3
3UF5M120-250-12	●	12	-0.032 -0.059	25	12	76	3
3UF5M160-320-16	●	16	-0.032 -0.059	32	16	89	3
3UF5M200-380-20	●	20	-0.040 -0.073	38	20	104	3

● : Standard Stock

- Products emphasizing high efficiency machining, three flutes type for general semi finishing. It is available for slotting and shouldering of wide range of work materials.

Recommended Milling Conditions



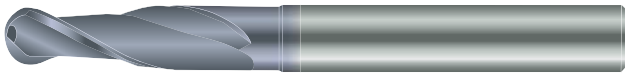
Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	Spindle Speed (min ⁻¹)									
			ø2	ø3	ø4	ø5	ø6	ø8	ø10	ø12	ø16	ø20
Carbon steel, Cast iron 800N/m	1.0Dc×0.1Dc	Spindle Revolution (min ⁻¹)	16,000	10,600	8,000	6,400	5,300	4,000	3,200	2,700	2,000	1,600
			Feed Rate (mm/min)	330	330	390	420	430	450	480	480	510
Alloy steel, SCM (~30HRC)	1.0Dc×0.1Dc	Spindle Revolution (min ⁻¹)	11,000	7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,400	1,100
			Feed Rate (mm/min)	240	290	290	310	330	330	340	340	340
Pre-hardened steel Stainless steel (30~40HRC)	1.0Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,000	5,300	4,000	3,200	2,700	2,000	1,600	1,300	1,000	800
			Feed Rate (mm/min)	140	140	140	170	180	180	190	190	190
Titanium Alloy Heat-resistant Alloy (40~50HRC)	1.0Dc×0.1Dc	Spindle Revolution (min ⁻¹)	4,000	2,700	2,000	1,600	1,300	1,000	800	700	500	400
			Feed Rate (mm/min)	40	50	60	60	70	70	70	70	80
Aluminum Alloy	1.0Dc×0.1Dc	Spindle Revolution (min ⁻¹)	32,000	21,000	16,000	12,800	10,600	8,000	6,400	5,300	4,000	3,200
			Feed Rate (mm/min)	670	700	760	820	860	880	1,000	1,100	1,100

* Machining with coolant is recommended for stainless steel.

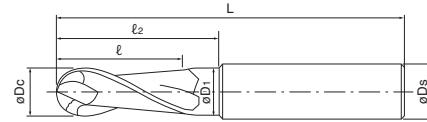
Please refer to page 44 about slotting.

Copying (Ball-nose End Mill with 2 Flutes)



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	*Radius of Ball Nose	Outside Dia.	Outside Dia. tolerance	Length of cut	Neck Dia.	Under Neck Length	Shank Dia.	Overall length
		R	øDc		ℓ	øD₁	ℓ₂	øDs	L
2UEBS010-030-04	●	R0.5	1	-0.014 -0.028	3	-	-	4	50
2UEBS020-030-04	●	R1	2	-0.014 -0.028	3	-	-	4	50
2UEBS030-095-06	●	R1.5	3	-0.014 -0.028	9.5	-	-	6	58
2UEBS040-120-06	●	R2	4	-0.020 -0.038	12	-	-	6	76
2UEBS050-140-06	●	R2.5	5	-0.020 -0.038	14	-	-	6	76
2UEBS060-160-06	●	R3	6	-0.020 -0.038	16	5.5	40	6	100
2UEBS080-200-08	●	R4	8	-0.025 -0.047	20	7.5	40	8	100
2UEBS100-220-10	●	R5	10	-0.025 -0.047	22	9.5	35	10	100
2UEBS120-250-12	●	R6	12	-0.032 -0.059	25	11.5	50	12	125
2UEBS160-320-16	●	R8	16	-0.032 -0.059	32	15.5	60	16	150
2UEBS200-380-20	●	R10	20	-0.040 -0.073	38	19.5	60	20	150

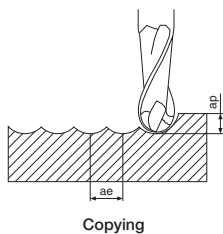
Flutes Z=2

● : Standard Stock

* Actual ball-nose radius will be half of actual measurement of outer diameter.

● Ball-nose end mill with two flutes.

Recommended Milling Conditions



Material		Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø4	ø6	ø8	ø10	ø12	ø16	ø20
Steel	< 42HRC	0.3Dc×0.7Dc	Spindle Revolution (min ⁻¹)	9,600	6,400	4,800	3,800	3,200	2,400	1,900
			Feed Rate (mm/min)	380	420	380	380	340	300	310
	42-48HRC	0.3Dc×0.7Dc	Spindle Revolution (min ⁻¹)	8,000	5,300	4,000	3,200	2,700	2,000	1,600
			Feed Rate (mm/min)	300	330	300	290	270	240	240
	48-52HRC	0.3Dc×0.7Dc	Spindle Revolution (min ⁻¹)	6,400	4,200	3,200	2,500	2,100	1,600	1,300
			Feed Rate (mm/min)	190	210	190	190	170	150	150
Cast Iron	< 180HB	0.3Dc×0.7Dc	Spindle Revolution (min ⁻¹)	12,700	8,500	6,400	5,100	4,200	3,200	2,500
			Feed Rate (mm/min)	760	850	760	750	690	610	610
	> 180HB	0.3Dc×0.7Dc	Spindle Revolution (min ⁻¹)	11,100	7,400	5,600	4,500	3,700	2,800	2,200
			Feed Rate (mm/min)	540	590	540	530	480	420	430

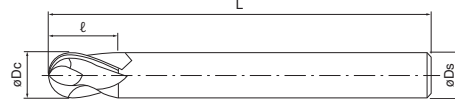
General Purpose

Copying (Ball-nose End Mill with 3 Flutes)



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	*Radius of Ball Nose	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length
		R	øDc		ℓ	øDs	L
3UEBS030-070-06	●	R1.5	3	-0.014 -0.028	7	6	57
3UEBS040-080-06	●	R2	4	-0.020 -0.038	8	6	57
3UEBS050-100-06	●	R2.5	5	-0.020 -0.038	10	6	57
3UEBS060-100-06	●	R3	6	-0.020 -0.038	10	6	57
3UEBS080-160-08	●	R4	8	-0.025 -0.047	16	8	63
3UEBS100-190-10	●	R5	10	-0.025 -0.047	19	10	72
3UEBS120-220-12	●	R6	12	-0.032 -0.059	22	12	83

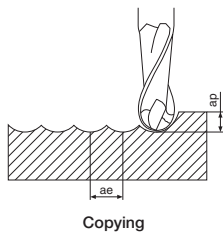
Flutes Z=3

● : Standard Stock

* Actual ball-nose radius will be half of actual measurement of outer diameter.

● Ball-nose end mill with three flutes for machining of machining of difficult-to-cut materials.

Recommended Milling Conditions

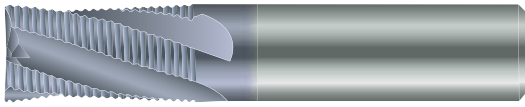


Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø3	ø4	ø5	ø6	ø8	ø10	ø12
Carbon steel < 20HRC	0.2Dc×0.3Dc	Spindle Revolution (min ⁻¹)	13,300	10,000	8,000	6,600	5,000	4,000	3,300
		Feed Rate (mm/min)	600	870	840	850	1,400	1,200	990
Alloy steel < 35HRC	0.2Dc×0.3Dc	Spindle Revolution (min ⁻¹)	10,600	8,000	6,400	5,300	4,000	3,200	2,700
		Feed Rate (mm/min)	410	500	610	640	940	830	730
Pre-hardened steel 30-45HRC	0.1Dc×0.2Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,900
		Feed Rate (mm/min)	220	250	257	280	250	240	230
Stainless steel SUS304	0.05Dc×0.1Dc	Spindle Revolution (min ⁻¹)	5,800	4,400	3,500	2,900	2,200	1,800	1,500
		Feed Rate (mm/min)	160	180	190	180	190	190	170

3RDSM, 4RDSM, 5RDSM

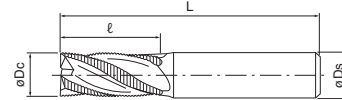
Flutes : 3,4,5

Roughing



Recommended Material

★ 1st Recommendation



Stock Items

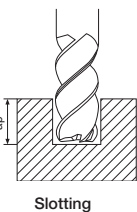
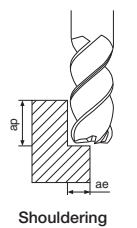
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
3RDSM040-110-06	●	4	-0.030 -0.105	11	6	55	3
3RDSM050-130-06	●	5	-0.030 -0.105	13	6	57	3
3RDSM060-130-06	●	6	-0.030 -0.105	13	6	57	3
3RDSM080-160-08	●	8	-0.040 -0.130	16	8	63	3
4RDSM100-220-10	●	10	-0.040 -0.130	22	10	72	4
4RDSM120-260-12	●	12	-0.050 -0.160	26	12	83	4
4RDSM160-320-16	●	16	-0.050 -0.160	32	16	92	4
4RDSM200-380-20	●	20	-0.065 -0.195	38	20	104	4
5RDSM250-450-25	●	25	-0.065 -0.195	45	25	121	5

● : Standard Stock

- Three, four and five flutes types are available for roughing. They reduce cutting force due to the edge design with sine-curve pattern.

Recommended Milling Conditions



Shouldering

Material		Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16	ø20	ø25
Steel	< 22HRC	1.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	11,100	8,400	6,700	5,600	4,200	3,300	2,700
			Feed Rate (mm/min)	1,000	1,000	1,100	1,120	1,200	1,200	1,340
	22~32HRC	1.5Dc×0.4Dc	Spindle Revolution (min ⁻¹)	9,600	7,200	5,700	4,800	3,600	2,900	2,300
			Feed Rate (mm/min)	720	720	860	860	860	920	1,030
	32~40HRC	1.5Dc×0.4Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900	1,500
			Feed Rate (mm/min)	320	320	410	410	400	400	400
	40~45HRC	1Dc×0.4Dc	Spindle Revolution (min ⁻¹)	4,800	3,600	2,900	2,400	1,800	1,400	1,100
			Feed Rate (mm/min)	220	220	260	260	250	250	250
	45~50HRC	1Dc×0.3Dc	Spindle Revolution (min ⁻¹)	4,200	3,200	2,500	2,100	1,600	1,300	1,000
			Feed Rate (mm/min)	150	150	180	180	170	170	170
Cast Iron	1.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	9,600	7,200	5,700	4,800	3,600	2,900	2,300	
		Feed Rate (mm/min)	850	850	1,030	1,030	1,030	1,100	1,380	

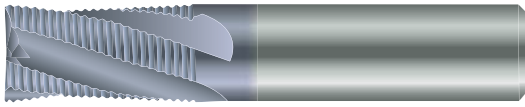
Please refer to page 45 about slotting.

General Purpose

3RDSL, 4RDSL, 5RDSL

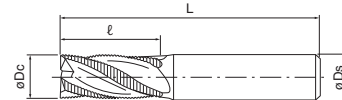
Flutes : **3,4,5**

Roughing



Recommended Material

★ 1st Recommendation



Stock Items

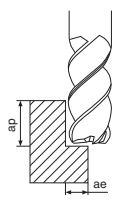
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
3RDSL060-240-06	●	6	-0.030 -0.105	24	6	76	3
3RDSL080-280-08	●	8	-0.040 -0.130	28	8	76	3
4RDSL100-340-10	●	10	-0.040 -0.130	34	10	89	4
4RDSL120-450-12	●	12	-0.050 -0.160	45	12	100	4
4RDSL160-560-16	●	16	-0.050 -0.160	56	16	125	4
4RDSL200-600-20	●	20	-0.065 -0.195	60	20	125	4
5RDSL250-800-25	●	25	-0.065 -0.195	80	25	150	5

● : Standard Stock

General Purpose

Recommended Milling Conditions



Shouldering

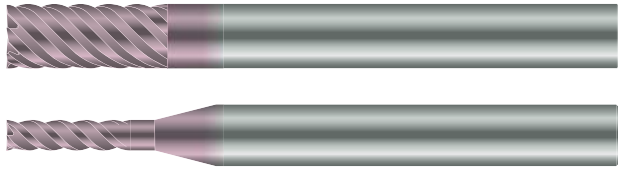
Shouldering

Material		Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16	ø20	ø25
Steel	< 22HRC	2.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	7,800	5,900	4,700	3,900	2,900	2,300	1,900
			Feed Rate (mm/min)	700	700	770	780	840	840	940
	22~32HRC	2.5Dc×0.4Dc	Spindle Revolution (min ⁻¹)	6,700	5,000	4,000	3,400	2,500	2,000	1,600
			Feed Rate (mm/min)	500	500	600	600	600	640	720
	32~40HRC	2.5Dc×0.4Dc	Spindle Revolution (min ⁻¹)	4,500	3,400	2,700	2,200	1,700	1,300	1,100
			Feed Rate (mm/min)	220	220	290	290	280	280	280
	40~45HRC	2.5Dc×0.4Dc	Spindle Revolution (min ⁻¹)	3,400	2,500	2,000	1,700	1,300	1,000	800
			Feed Rate (mm/min)	150	150	180	180	180	180	180
	45~50HRC	2.5Dc×0.3Dc	Spindle Revolution (min ⁻¹)	2,900	2,200	1,800	1,500	1,100	900	700
			Feed Rate (mm/min)	110	110	130	130	120	120	120
Cast Iron	2.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	6,700	5,000	4,000	3,400	2,500	2,000	1,600	
		Feed Rate (mm/min)	600	600	720	720	720	770	970	

Slotting is not recommended.

4HFSS, 5HFSS, 6HFSS, 7HFSS Flutes : 4,5,6,7

Finishing of Hardened Materials



MEGACOAT is applied

Super micro grain carbide

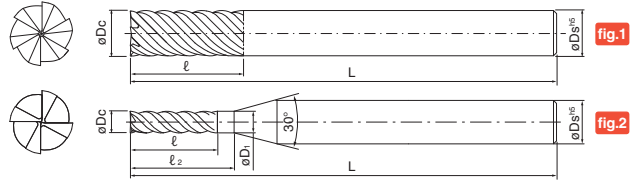
Stock Items

(Unit : mm)

Description	Stock	Outside Dia. ϕD_c	Outside Dia. tolerance	Length of cut ℓ	Neck Dia. ϕD_1	Under Neck Length ℓ_2	Shank Dia. ϕD_s	Overall length L	Number of flutes Z
4HFSS010-040-06 fig.2	●	1	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	4	1.05	4.8	6	60	4
4HFSS020-060-06 fig.2	●	2	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	6	2.10	7.2	6	60	4
4HFSS030-080-06 fig.2	●	3	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	8	3.15	9.6	6	60	4
4HFSS040-100-06 fig.2	●	4	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	10	4.2	12.0	6	60	4
4HFSS050-120-06 fig.2	●	5	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	12	5.2	14.4	6	60	4
5HFSS040-100-06 fig.2	●	4	$\begin{matrix} 0 \\ -0.015 \end{matrix}$	10	4.2	12.0	6	60	5
6HFSS060-140-06 fig.1	●	6	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	14	-	-	6	60	6

Recommended Material

★ 1st Recommendation



(Unit : mm)

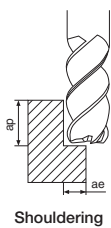
Description	Stock	Outside Dia. ϕD_c	Outside Dia. tolerance	Length of cut ℓ	Neck Dia. ϕD_1	Under Neck Length ℓ_2	Shank Dia. ϕD_s	Overall length L	Number of flutes Z
6HFSS080-180-08 fig.1	●	8	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	18	-	-	8	70	6
6HFSS100-220-10 fig.1	●	10	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	22	-	-	10	80	6
6HFSS120-260-12 fig.1	●	12	$\begin{matrix} -0.010 \\ -0.030 \end{matrix}$	26	-	-	12	90	6
7HFSS060-140-06 fig.1	●	6	$\begin{matrix} 0 \\ -0.020 \end{matrix}$	14	-	-	6	60	7
7HFSS080-180-08 fig.1	●	8	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	18	-	-	8	70	7
7HFSS100-220-10 fig.1	●	10	$\begin{matrix} -0.005 \\ -0.025 \end{matrix}$	22	-	-	10	80	7
7HFSS120-260-12 fig.1	●	12	$\begin{matrix} -0.010 \\ -0.030 \end{matrix}$	26	-	-	12	90	7

● : Standard Stock

- New PVD coating "MEGACOAT Hard" for hardened materials. Achieves high rigidity by ensuring a large core diameter, longer tool life and stable machining. Also increases cutting edge strength and chip evacuation with a negative rake angle.

Hardened Material

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	$\phi 1$	$\phi 2$	$\phi 4$	$\phi 6$	$\phi 8$	$\phi 12$	$\phi 16$
Steel (< 40HRC), Pre-hardened steel	1.5Dc×0.05D (D<φ3)	Spindle Revolution (min ⁻¹)	20,700	20,000	11,100	7,400	5,600	3,700	2,800
	1.5Dc×0.1Dc (φ3≤D)	Feed Rate (mm/min)	910	1,750	2,000	2,900	2,930	2,930	2,720
Steel, Hardened Steel (40~45HRC), Pre-hardened steel	1.5Dc×0.05D (D<φ3)	Spindle Revolution (min ⁻¹)	20,700	20,000	9,900	6,600	5,000	3,300	2,500
	1.5Dc×0.1Dc (φ3≤D)	Feed Rate (mm/min)	910	1,750	1,800	2,630	2,650	2,650	2,400
Hardened Steel 45~55HRC	1.5Dc×0.05D	Spindle Revolution (min ⁻¹)	20,700	16,000	8,000	5,300	4,000	2,700	2,000
		Feed Rate (mm/min)	910	1,400	1,400	2,100	2,100	2,100	1,900
Hardened Steel 55~60HRC	1.5Dc×0.02Dc	Spindle Revolution (min ⁻¹)	20,700	12,000	6,000	4,000	3,000	2,000	1,500
		Feed Rate (mm/min)	640	730	740	1,100	1,100	1,100	1,050
Hardened Steel 60~65HRC	1.5Dc×0.02Dc	Spindle Revolution (min ⁻¹)	20,700	11,100	5,600	3,700	2,800	1,900	1,400
		Feed Rate (mm/min)	550	600	600	880	880	880	910
Hardened Steel 65~70HRC	1.5Dc×0.02Dc	Spindle Revolution (min ⁻¹)	15,900	8,000	4,000	2,700	2,000	1,330	1,000
		Feed Rate (mm/min)	370	370	370	560	560	550	550

Slotting is not recommended.

4HFSM, 5HFSM, 6HFSM, 7HFSM Flutes : 4,5,6,7

Finishing of Hardened Materials

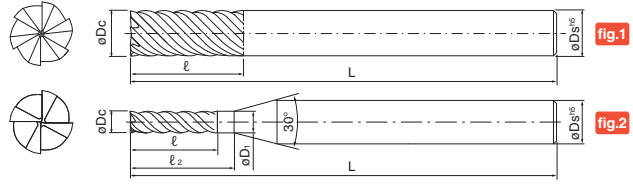


MEGACOAT is applied

Super micro grain carbide

Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

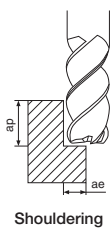
Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Neck Dia. øD1	Under Neck Length ℓ₂	Shank Dia. øDs	Overall length L	Number of flutes Z
4HFSM010-050-06 fig.2	●	1	0 -0.015	5	1.05	6	6	60	4
4HFSM020-090-06 fig.2	●	2	0 -0.015	9	2.10	10.8	6	60	4
4HFSM030-120-06 fig.2	●	3	0 -0.015	12	3.15	14.4	6	60	4
4HFSM040-140-06 fig.2	●	4	0 -0.015	14	4.2	16.8	6	60	4
4HFSM050-170-06 fig.2	●	5	0 -0.015	17	5.2	20.4	6	60	4
5HFSM040-140-06 fig.2	●	4	0 -0.015	14	4.2	16.8	6	60	5
6HFSM060-170-06 fig.1	●	6	0 -0.020	17	-	-	6	60	6
6HFSM080-230-08 fig.1	●	8	-0.005 -0.025	23	-	-	8	70	6
6HFSM100-280-10 fig.1	●	10	-0.005 -0.025	28	-	-	10	80	6

(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Neck Dia. øD1	Under Neck Length ℓ₂	Shank Dia. øDs	Overall length L	Number of flutes Z
6HFSM120-330-12 fig.1	●	12	-0.010 -0.030	33	-	-	12	90	6
6HFSM140-370-16 fig.2	●	14	-0.010 -0.030	37	14.2	44.4	16	105	6
6HFSM150-420-16 fig.2	●	15	-0.010 -0.030	42	15.2	50.4	16	105	6
6HFSM160-420-16 fig.1	●	16	-0.010 -0.030	42	-	-	16	105	6
7HFSM060-170-06 fig.1	●	6	0 -0.020	17	-	-	6	60	7
7HFSM080-230-08 fig.1	●	8	-0.005 -0.025	23	-	-	8	70	7
7HFSM100-280-10 fig.1	●	10	-0.005 -0.025	28	-	-	10	80	7
7HFSM120-330-12 fig.1	●	12	-0.010 -0.030	33	-	-	12	90	7
7HFSM160-420-16 fig.1	●	16	-0.010 -0.030	42	-	-	16	105	7

● : Standard Stock

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	Spindle Speed (min⁻¹)							
			ø1	ø2	ø4	ø6	ø8	ø12	ø16	
Steel (< 40HRC), Pre-hardened steel	1.5Dc×0.05D (D<ø3) 1.5Dc×0.1Dc (ø3≤D)	Spindle Revolution (min⁻¹)	20,700	20,000	11,100	7,400	5,600	3,700	2,800	
		Feed Rate (mm/min)	910	1,750	2,000	2,900	2,930	2,930	2,720	
Steel, Hardened Steel (40~45HRC), Pre-hardened steel	1.5Dc×0.05D (D<ø3) 1.5Dc×0.1Dc (ø3≤D)	Spindle Revolution (min⁻¹)	20,700	20,000	9,900	6,600	5,000	3,300	2,500	
		Feed Rate (mm/min)	910	1,750	1,800	2,630	2,650	2,650	2,400	
Hardened Steel 45~55HRC	1.5Dc×0.05D	Spindle Revolution (min⁻¹)	20,700	16,000	8,000	5,300	4,000	2,700	2,000	
		Feed Rate (mm/min)	910	1,400	1,400	2,100	2,100	2,100	1,900	
Hardened Steel 55~60HRC	1.5Dc×0.02Dc	Spindle Revolution (min⁻¹)	20,700	12,000	6,000	4,000	3,000	2,000	1,500	
		Feed Rate (mm/min)	640	730	740	1,100	1,100	1,100	1,050	
Hardened Steel 60~65HRC	1.5Dc×0.02Dc	Spindle Revolution (min⁻¹)	20,700	11,100	5,600	3,700	2,800	1,900	1,400	
		Feed Rate (mm/min)	550	600	600	880	880	880	910	
Hardened Steel 65~70HRC	1.5Dc×0.02Dc	Spindle Revolution (min⁻¹)	15,900	8,000	4,000	2,700	2,000	1,330	1,000	
		Feed Rate (mm/min)	370	370	370	560	560	550	550	

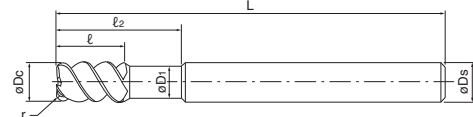
Slotting is not recommended.

Deep Slotting and Finishing of Hardened Material (Radius)



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Under Neck Length ℓ2	Shank Dia. øDs	Overall length L	Spec of Corners r
		øDc	tolerance						
4PGRM030-045-06-R025	●	3	-0.014 -0.028	4.5	2.7	9	6	57	R 0.25
4PGRM030-045-06-R050	●	3	-0.014 -0.028	4.5	2.7	9	6	57	R 0.5
4PGRM040-060-06-R025	●	4	-0.020 -0.038	6	3.7	12	6	57	R 0.25
4PGRM040-060-06-R050	●	4	-0.020 -0.038	6	3.7	12	6	57	R 0.5
4PGRM050-075-06-R025	●	5	-0.020 -0.038	7.5	4.6	15	6	76	R 0.25
4PGRM050-075-06-R050	●	5	-0.020 -0.038	7.5	4.6	15	6	76	R 0.5
4PGRM060-090-06-R025	●	6	-0.020 -0.038	9	5.5	18	6	76	R 0.25
4PGRM060-090-06-R050	●	6	-0.020 -0.038	9	5.5	18	6	76	R 0.5
4PGRM060-090-06-R075	●	6	-0.020 -0.038	9	5.5	18	6	76	R 0.75
4PGRM060-090-06-R100	●	6	-0.020 -0.038	9	5.5	18	6	76	R 1.0
4PGRM080-120-08-R050	●	8	-0.025 -0.047	12	7.4	24	8	100	R 0.5
4PGRM080-120-08-R100	●	8	-0.025 -0.047	12	7.4	24	8	100	R 1.0
4PGRM080-120-08-R150	●	8	-0.025 -0.047	12	7.4	24	8	100	R 1.5

(Unit : mm)

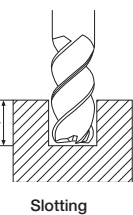
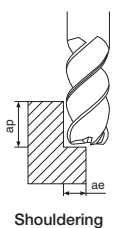
Description	Stock	Outside Dia.	Outside Dia.	Length of cut ℓ	Neck Dia. øD1	Under Neck Length ℓ2	Shank Dia. øDs	Overall length L	Spec of Corners r
		øDc	tolerance						
4PGRM080-120-08-R200	●	8	-0.025 -0.047	12	7.4	24	8	100	R 2.0
4PGRM100-150-10-R050	●	10	-0.025 -0.047	15	9.2	30	10	100	R 0.5
4PGRM100-150-10-R100	●	10	-0.025 -0.047	15	9.2	30	10	100	R 1.0
4PGRM100-150-10-R150	●	10	-0.025 -0.047	15	9.2	30	10	100	R 1.5
4PGRM100-150-10-R200	●	10	-0.025 -0.047	15	9.2	30	10	100	R 2.0
4PGRM120-180-12-R050	●	12	-0.032 -0.059	18	11	36	12	125	R 0.5
4PGRM120-180-12-R100	●	12	-0.032 -0.059	18	11	36	12	125	R 1.0
4PGRM120-180-12-R150	●	12	-0.032 -0.059	18	11	36	12	125	R 1.5
4PGRM120-180-12-R200	●	12	-0.032 -0.059	18	11	36	12	125	R 2.0
4PGRM160-240-16-R050	●	16	-0.032 -0.059	24	15	48	16	125	R 0.5
4PGRM160-240-16-R150	●	16	-0.032 -0.059	24	15	48	16	125	R 1.5
4PGRM200-300-20-R050	●	20	-0.040 -0.073	30	19	60	20	150	R 0.5
4PGRM200-300-20-R200	●	20	-0.040 -0.073	30	19	60	20	150	R 2.0

Flutes Z=4

● : Standard Stock

- Radius type with 4 flutes. The diameter of the neck portion is thinner than the cutting diameter and it is suitable for deep slotting. Due to the corner R on the cutting edge, it is applicable for finishing of sloped workpiece.

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (ap×ae)(mm)	Depth of Cut (ap×ae)(mm)		Outside Dia. (mm)	ø3	ø6	ø8	ø10	ø12	ø16	ø20
		Roughing	Finishing								
Steel	< 30HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	21,200	10,600	8,000	6,400	5,300	4,000	3,200
				Feed Rate (mm/min)	2,400	2,400	2,400	2,400	2,400	2,400	
	30~40HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	19,100	9,600	7,200	5,700	4,800	3,600	2,900
				Feed Rate (mm/min)	1,900	1,900	1,900	1,950	1,950	2,010	1,950
	40~45HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	17,000	8,500	6,400	5,100	4,200	3,200	2,500
				Feed Rate (mm/min)	1,400	1,400	1,400	1,430	1,400	1,400	1,330
	45~50HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	12,700	6,400	4,800	3,800	3,200	2,400	1,900
				Feed Rate (mm/min)	820	820	860	860	890	860	840
	50~55HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,500	4,200	3,200	2,500	2,100	1,600	1,300
				Feed Rate (mm/min)	3,500	350	380	410	380	380	380
	> 55HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	7,400	3,700	2,800	2,200	1,900	1,400	1,100
				Feed Rate (mm/min)	250	250	250	270	270	280	270

Please refer to page 46 about slotting.

Hardened Material

4PGSS, 5PGSS

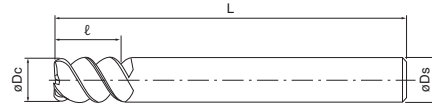
Flutes : 4,5

Deep Slotting and Semi-Finishing of Hardened Materials



Recommended Material

★ 1st Recommendation



Stock Items

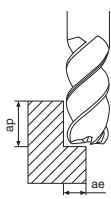
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc	tolerance	ℓ	øDs	L	Z
4PGSS030-045-06	●	3	-0.014 -0.028	4.5	6	57	4
4PGSS040-060-06	●	4	-0.020 -0.038	6	6	57	4
4PGSS050-075-06	●	5	-0.020 -0.038	7.5	6	76	4
4PGSS060-090-06	●	6	-0.020 -0.038	9	6	76	4
4PGSS080-120-08	●	8	-0.025 -0.047	12	8	100	4
4PGSS100-150-10	●	10	-0.025 -0.047	15	10	100	4
4PGSS120-180-12	●	12	-0.032 -0.059	18	12	125	4
4PGSS160-240-16	●	16	-0.032 -0.059	24	16	125	4
4PGSS200-300-20	●	20	-0.040 -0.073	30	20	150	4
5PGSS250-380-25	●	25	-0.040 -0.073	38	25	150	5

● : Standard Stock

● Web thickness ratio is 60% between the cutting edge and 1Dc and 80% for the rest. Good chip evacuation and high rigidity.

Recommended Milling Conditions



Shouldering

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Depth of Cut (ap×ae)(mm)		Outside Dia. (mm)	ø3	ø6	ø8	ø10	ø12	ø16	ø20	ø25
		Roughing	Finishing									
Steel	< 30HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	21,200	10,600	8,000	6,400	5,300	4,000	3,200	2,500
				Feed Rate (mm/min)	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
	30~40HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	19,100	9,600	7,200	5,700	4,800	3,600	2,900	2,300
				Feed Rate (mm/min)	1,900	1,900	1,900	1,900	1,900	2,000	2,000	2,100
	40~45HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	17,000	8,500	6,400	5,100	4,200	3,200	2,500	2,000
				Feed Rate (mm/min)	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,700
	45~50HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	12,700	6,400	4,800	3,800	3,200	2,400	1,900	1,500
				Feed Rate (mm/min)	850	850	860	860	870	870	870	1,000
	50~55HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,500	4,200	3,200	2,500	2,100	1,600	1,300	1,000
				Feed Rate (mm/min)	400	400	400	410	410	410	410	450
	> 55HRC	1Dc×0.2Dc	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	7,400	3,700	2,800	2,200	1,900	1,400	1,100	900
				Feed Rate (mm/min)	250	250	250	260	260	280	280	310

Slotting is not recommended.

Hardened Material

4PGSM, 5PGSM, 6PGSM

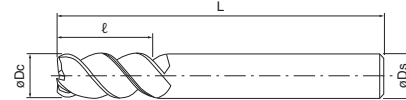
Flutes : 4,5,6

Semi-Finishing of Hardened Materials



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

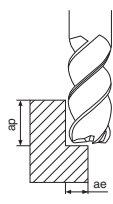
Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
4PGSM060-150-06	●	6	-0.020 -0.038	15	6	76	4
4PGSM080-200-08	●	8	-0.025 -0.047	20	8	100	4
5PGSM100-250-10	●	10	-0.025 -0.047	25	10	100	5
6PGSM120-300-12	●	12	-0.032 -0.059	30	12	125	6
6PGSM160-400-16	●	16	-0.032 -0.059	40	16	125	6
6PGSM200-500-20	●	20	-0.040 -0.073	50	20	150	6
6PGSM250-630-25	●	25	-0.040 -0.073	63	25	150	6

● : Standard Stock

- Four, five and six flutes types are available for semi finishing of hardened materials. Web thickness ratio is 60% between the cutting edge and 1Dc and 80% for the rest. Good chip evacuation and high rigidity.

Hardened Material

Recommended Milling Conditions



Shouldering

Shouldering

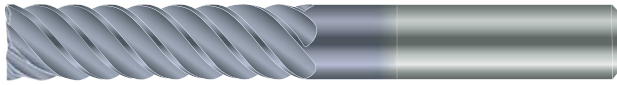
Material	Depth of Cut (ap×ae)(mm)	Depth of Cut (ap×ae)(mm)		Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16	ø20	ø25
		Roughing	Finishing								
Steel	< 30HRC	1Dc×0.2Dc	2.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	10,700	8,000	6,400	5,300	4,000	3,200	2,500
				Feed Rate (mm/min)	2,240	2,240	2,870	3,500	3,580	3,440	3,060
	30~40HRC	1Dc×0.2Dc	2.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	9,600	7,200	5,700	4,800	3,600	2,900	2,300
				Feed Rate (mm/min)	1,710	1,720	2,440	2,870	3,010	2,920	2,610
	40~45HRC	1Dc×0.2Dc	2.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,500	6,400	5,100	4,200	3,200	2,500	2,000
				Feed Rate (mm/min)	1,360	1,400	1,780	2,040	2,000	2,000	2,080
	45~50HRC	1Dc×0.2Dc	2.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900	1,500
				Feed Rate (mm/min)	760	860	1,050	1,340	1,290	1,260	1,260
	50~55HRC	1Dc×0.2Dc	2.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	4,200	3,200	2,500	2,100	1,600	1,300	1,000
				Feed Rate (mm/min)	340	380	510	570	570	570	550
	> 55HRC	1Dc×0.2Dc	2.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,100	900
				Feed Rate (mm/min)	220	220	330	390	420	400	380

Slotting is not recommended.

4PGSL, 5PGSL, 6PGSL

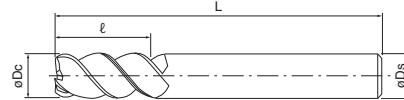
Flutes : 4,5,6

Semi-Finishing of Hardened Materials



Recommended Material

★ 1st Recommendation



Stock Items

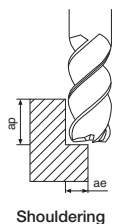
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
4PGSL060-210-06	●	6	-0.020 -0.038	21	6	76	4
4PGSL080-280-08	●	8	-0.025 -0.047	28	8	100	4
5PGSL100-350-10	●	10	-0.025 -0.047	35	10	100	5
6PGSL120-420-12	●	12	-0.032 -0.059	42	12	125	6
6PGSL160-560-16	●	16	-0.032 -0.059	56	16	125	6
6PGSL200-700-20	●	20	-0.040 -0.073	70	20	150	6
6PGSL250-880-25	●	25	-0.040 -0.073	88	25	150	6

● : Standard Stock

- Web thickness ratio is 60% between the cutting edge and 1Dc and 80% for the rest. Good chip evacuation and high rigidity.

Recommended Milling Conditions



Shouldering

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Depth of Cut (ap×ae)(mm)		Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16	ø20	ø25
		Roughing	Finishing								
Steel	< 30HRC	1Dc×0.2Dc	3.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	10,700	8,000	6,400	5,300	4,000	3,200	2,500
				Feed Rate (mm/min)	2,230	2,230	2,870	3,500	3,580	3,440	3,060
	30~40HRC	1Dc×0.2Dc	3.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	9,600	7,200	5,700	4,800	3,600	2,900	2,300
				Feed Rate (mm/min)	1,810	1,820	2,440	2,870	3,010	2,920	2,610
	40~45HRC	1Dc×0.2Dc	3.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,500	6,400	5,100	4,200	3,200	2,500	2,000
				Feed Rate (mm/min)	1,360	1,400	1,780	2,040	2,080	2,080	2,080
	45~50HRC	1Dc×0.2Dc	3.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200	2,400	1,900	1,500
				Feed Rate (mm/min)	760	860	1,050	1,340	1,290	1,280	1,280
	50~55HRC	1Dc×0.2Dc	3.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	4,200	3,200	2,500	2,100	1,600	1,300	1,000
				Feed Rate (mm/min)	340	380	510	570	570	570	550
	> 55HRC	1Dc×0.2Dc	3.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,100	900
				Feed Rate (mm/min)	220	220	330	390	420	400	380

Slotting is not recommended.

4UGSM, 6UGSM

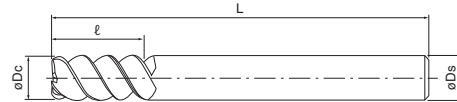
Flutes : 4,6

Semi-Finishing of Hardened Materials



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

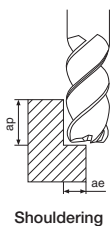
Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
4UGSM030-080-06	●	3	-0.014 -0.028	8	6	50	4
4UGSM040-120-06	●	4	-0.020 -0.038	12	6	57	4
4UGSM050-130-06	●	5	-0.020 -0.038	13	6	57	4
6UGSM060-150-06	●	6	-0.020 -0.038	15	6	60	6
6UGSM080-200-08	●	8	-0.025 -0.047	20	8	75	6
6UGSM100-250-10	●	10	-0.025 -0.047	25	10	80	6
6UGSM120-300-12	●	12	-0.032 -0.059	30	12	100	6
6UGSM160-400-16	●	16	-0.032 -0.059	40	16	110	6

● : Standard Stock

Hardened Material

- In order to achieve stable machining of hardened materials, negative type rake angle is adopted. Also, to attain high efficiency we provide a six-flute type for diameters over 6mm.

Recommended Milling Conditions



Shouldering

Material		Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø4	ø6	ø8	ø10	ø12	ø16
Steel	45-55HRC	1Dc×0.05Dc	Spindle Revolution (min ⁻¹)	11,900	8,000	6,000	4,800	4,000	3,000
			Feed Rate (mm/min)	810	1,200	1,200	1,000	980	900
	55-60HRC	1Dc×0.05Dc	Spindle Revolution (min ⁻¹)	8,000	5,300	4,000	3,200	2,700	2,000
			Feed Rate (mm/min)	510	760	740	610	610	540
	60-65HRC	1Dc×0.2Dc	Spindle Revolution (min ⁻¹)	5,200	3,500	2,600	2,100	1,700	1,300
			Feed Rate (mm/min)	290	480	450	390	370	330
	65-70HRC	1Dc×0.2Dc	Spindle Revolution (min ⁻¹)	2,800	1,900	1,400	1,100	900	700
			Feed Rate (mm/min)	150	250	230	200	200	170

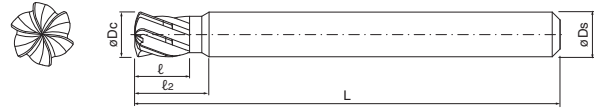
Slotting is not recommended.

Semi-Finishing of Hardened Materials



Recommended Material

★ 1st Recommendation



Stock Items

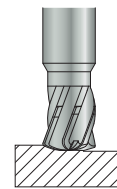
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Under Neck Length	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ₂	ℓ	øDs	L	Z
6PDRS060-045-06	●	6	-0.020 -0.038	9	4.5	6	57	6
6PDRS080-060-08	●	8	-0.025 -0.047	12	6	8	63	6
6PDRS100-075-10	●	10	-0.025 -0.047	15	7.5	10	72	6
6PDRS120-090-12	●	12	-0.032 -0.059	18	9	12	83	6

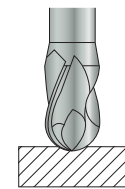
● : Standard Stock

Hardened Material

- Increased rigidity with large core diameter. 6 edge design enables high feed rate cutting. Achieves large machining allowance and high efficiency machining with special corner-R shape. Ramping and arc machining are possible.

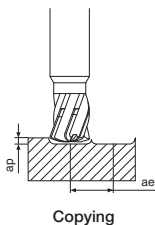


PDR type



General Purpose Ball-Nosed End Mill

Recommended Milling Conditions



Material		Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø6	ø8	ø10	ø12
Pre-hardened steel (AISI P20, C)	52HRC	ø6 :0.32mm×0.55Dc ø8 :0.42mm×0.55Dc ø10:0.53mm×0.55Dc ø12:0.63mm×0.55Dc	Spindle Revolution (min ⁻¹)	6,400	4,800	3,800	3,200
			Feed Rate (mm/min)	7,600	7,200	6,900	7,600
SNCM439 (AISI 4340, C)	45HRC		Spindle Revolution (min ⁻¹)	8,500	6,400	5,100	4,200
			Feed Rate (mm/min)	15,300	15,300	15,300	12,700

For ramping and arc machining, please refer to page 47.

4RFSM, 6RFSM

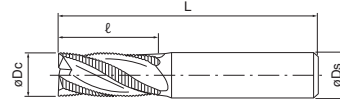
Flutes : 4,6

Roughing of Hardened Materials



Recommended Material

★ 1st Recommendation



Stock Items

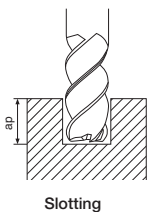
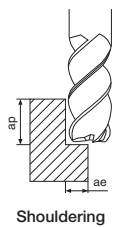
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
4RFSM060-130-06	●	6	-0.030 -0.105	13	6	57	4
4RFSM080-160-08	●	8	-0.040 -0.130	16	8	63	4
4RFSM100-220-10	●	10	-0.040 -0.130	22	10	72	4
4RFSM120-260-12	●	12	-0.050 -0.160	26	12	83	4
4RFSM160-320-16	●	16	-0.050 -0.160	32	16	92	4
4RFSM200-380-20	●	20	-0.065 -0.195	38	20	104	4
6RFSM160-320-16	●	16	-0.050 -0.160	32	16	92	6
6RFSM200-380-20	●	20	-0.065 -0.195	38	20	104	6
6RFSM250-450-25	●	25	-0.065 -0.195	45	25	121	6

● : Standard Stock

- Due to the strong cutting edge with large flat surface, it is suitable for hardened materials and titanium alloy. Four flute type and six flute type are available.

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16		ø20		ø25	
							4 flute	6 flute	4 flute	6 flute		
Steel	35~45HRC	1.5Dc×0.4Dc	Spindle Revolution (min ⁻¹)	8,000	6,000	4,800	4,000	3,000	3,000	2,400	2,400	1,900
			Feed Rate (mm/min)	630	630	630	640	640	900	640	930	800
	45~55HRC	1.5Dc×0.33Dc	Spindle Revolution (min ⁻¹)	5,800	4,400	3,500	2,900	2,200	2,200	1,800	1,800	1,400
			Feed Rate (mm/min)	350	350	350	350	350	530	350	530	460
	55~60HRC	1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	4,800	3,600	2,900	2,400	1,800	1,800	1,400	1,400	1,100
			Feed Rate (mm/min)	190	220	230	240	220	320	230	340	310
Titanium Alloy	< 40HRC	1.5Dc×0.33Dc	Spindle Revolution (min ⁻¹)	3,700	2,800	2,200	1,900	1,400	1,400	1,100	1,100	900
			Feed Rate (mm/min)	390	390	390	390	390	590	390	540	450
	> 40HRC	1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	3,200	2,400	1,900	1,600	1,200	1,200	1,000	1,000	800
			Feed Rate (mm/min)	300	300	300	300	300	430	300	430	370
Inconel	1Dc×0.2Dc	Spindle Revolution (min ⁻¹)	1,600	1,200	1,000	800	600	600	500	500	400	
		Feed Rate (mm/min)	100	100	100	100	100	140	100	140	130	

Please refer to page 46 about slotting.

3RFRS, 4RFRS

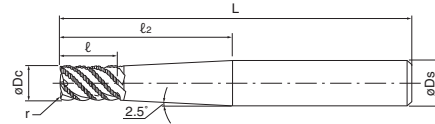
Flutes : **3,4**

Rough Copying (Radius)



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

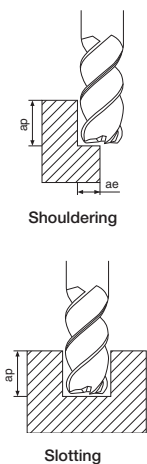
Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Spec of Corners	Under Neck Length	Number of flutes
		øDc		ℓ	øDs	L	r	ℓ ₂	Z
3RFRS040-040-06-R075	●	4	-0.030 -0.105	4	6	75	R 0.75	27.5	3
3RFRS050-050-06-R075	●	5	-0.030 -0.105	5	6	75	R 0.75	17	3
4RFRS060-060-10-R075	●	6	-0.030 -0.105	6	10	100	R 0.75	52.5	4
4RFRS080-080-10-R075	●	8	-0.040 -0.130	8	10	100	R 0.75	31.5	4
4RFRS100-100-12-R075	●	10	-0.040 -0.130	10	12	125	R 0.75	33.5	4
4RFRS120-120-16-R100	●	12	-0.050 -0.160	12	16	125	R 1.0	58.5	4

● : Standard Stock

- Available for roughing and semi-finishing, but especially suitable for rough copying of mold. Shank diameter is larger than the cutting diameter and it is highly rigid. Due to the strong cutting edge with large flat surface, it is suitable for hardened materials and titanium alloy.

It can provide good surface roughness of 2.5 to 4.9 (µmRa).

Recommended Milling Conditions



Shouldering

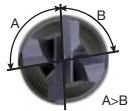
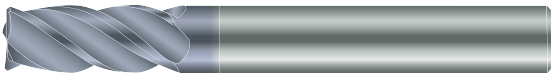
Material		Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø4	ø5	ø6	ø8	ø10	ø12
Steel	< 30HRC	0.8Dc×0.5Dc	Spindle Revolution (min ⁻¹)	14,300	11,500	9,600	7,200	5,700	4,800
			Feed Rate (mm/min)	860	860	1,150	1,150	1,150	1,150
	30~40HRC	0.8Dc×0.4Dc	Spindle Revolution (min ⁻¹)	9,600	7,600	6,400	4,800	3,800	3,200
			Feed Rate (mm/min)	430	460	640	610	610	570
	40~50HRC	0.8Dc×0.4Dc	Spindle Revolution (min ⁻¹)	6,400	5,100	4,200	3,200	2,500	2,100
			Feed Rate (mm/min)	190	230	320	320	320	340
	50~60HRC	0.8Dc×0.25Dc	Spindle Revolution (min ⁻¹)	4,800	3,800	3,200	2,400	1,900	1,600
			Feed Rate (mm/min)	100	100	130	140	150	160
	60~70HRC	0.8Dc×0.2Dc	Spindle Revolution (min ⁻¹)	3,200	2,500	2,100	1,600	1,300	1,100
			Feed Rate (mm/min)	60	60	70	70	80	90

Please refer to page 46 about slotting.

4YECM, 4YERM, 4YEKM

Flutes : 4

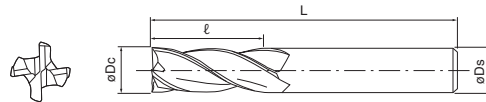
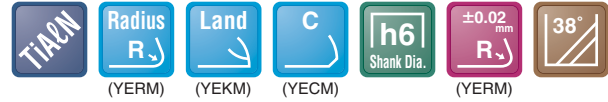
Semi-Finishing of Difficult-to-Cut Materials



4YECM varied interval flute

Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Shank Dia. øDs	Overall length L	Spec of Corners	Number of flutes Z
4YECM040-120-06-C04	●	4	-0.020 -0.038	12	6	55	C 0.4	4
4YECM050-130-06-C04	●	5	-0.020 -0.038	13	6	57	C 0.4	4
4YECM060-130-06-C04	●	6	-0.020 -0.038	13	6	57	C 0.4	4
4YECM080-160-08-C04	●	8	-0.025 -0.047	16	8	63	C 0.4	4
4YECM090-190-10-C05	●	9	-0.025 -0.047	19	10	72	C 0.5	4
4YECM100-220-10-C05	●	10	-0.025 -0.047	22	10	72	C 0.5	4
4YECM120-260-12-C05	●	12	-0.032 -0.059	26	12	83	C 0.5	4
4YECM160-320-16-C05	●	16	-0.032 -0.059	32	16	92	C 0.5	4
4YECM200-380-20-C05	●	20	-0.040 -0.073	38	20	104	C 0.5	4
4YECM250-450-25-C05	●	25	-0.040 -0.073	45	25	121	C 0.5	4
4YERM040-120-06-R020	●	4	-0.020 -0.038	12	6	55	R 0.2	4
4YERM050-130-06-R020	●	5	-0.020 -0.038	13	6	57	R 0.2	4
4YERM060-130-06-R020	●	6	-0.020 -0.038	13	6	57	R 0.2	4
4YERM080-160-08-R020	●	8	-0.025 -0.047	16	8	63	R 0.2	4
4YERM090-190-10-R020	●	9	-0.025 -0.047	19	10	72	R 0.2	4

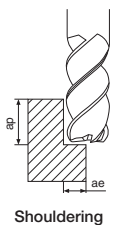
(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Shank Dia. øDs	Overall length L	Spec of Corners	Number of flutes Z
4YERM100-220-10-R030	●	10	-0.025 -0.047	22	10	72	R 0.3	4
4YERM120-260-12-R030	●	12	-0.032 -0.059	26	12	83	R 0.3	4
4YERM160-320-16-R030	●	16	-0.032 -0.059	32	16	92	R 0.3	4
4YERM200-380-20-R030	●	20	-0.040 -0.073	38	20	104	R 0.3	4
4YERM250-450-25-R030	●	25	-0.040 -0.073	45	25	121	R 0.3	4
4YEKM040-120-06	●	4	-0.020 -0.038	12	6	55	-	4
4YEKM050-130-06	●	5	-0.020 -0.038	13	6	57	-	4
4YEKM060-130-06	●	6	-0.020 -0.038	13	6	57	-	4
4YEKM080-160-08	●	8	-0.025 -0.047	16	8	63	-	4
4YEKM090-190-10	●	9	-0.025 -0.047	19	10	72	-	4
4YEKM100-220-10	●	10	-0.025 -0.047	22	10	72	-	4
4YEKM120-260-12	●	12	-0.032 -0.059	26	12	83	-	4
4YEKM160-320-16	●	16	-0.032 -0.059	32	16	92	-	4
4YEKM200-380-20	●	20	-0.040 -0.073	38	20	104	-	4
4YEKM250-450-25	●	25	-0.040 -0.073	45	25	121	-	4

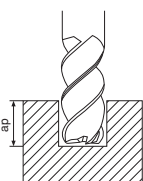
● : Standard Stock

- Unequally partitioned flute design prevents vibration and reduces cutting force at slotting. This design allows for high speed and high feed machining. Three types of edge shapes for different applications: Radius, Corner Land and Corner Chamfered type.

Recommended Milling Conditions



Shouldering



Slotting

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø4	ø5	ø6	ø8	ø10	ø12	ø16	ø20	ø25
Stainless steel SUS304	1Dc×0.5Dc	Spindle Revolution (min ⁻¹)	8,200	6,600	5,500	4,100	3,300	2,700	2,100	1,600	1,300
		Feed Rate (mm/min)	790	790	880	820	790	710	570	490	390
Heat-resistant Alloy	1Dc×0.2Dc	Spindle Revolution (min ⁻¹)	2,400	1,900	1,600	1,200	1,000	800	600	500	400
		Feed Rate (mm/min)	100	100	110	130	120	120	120	110	80
Soft Steel	1Dc×0.5Dc	Spindle Revolution (min ⁻¹)	13,100	10,500	8,800	6,600	5,300	4,400	3,300	2,600	2,100
		Feed Rate (mm/min)	1,310	1,260	1,400	1,580	1,260	1,230	990	950	840
Titanium Alloy	1Dc×0.5Dc	Spindle Revolution (min ⁻¹)	4,400	3,500	2,900	2,200	1,800	1,500	1,100	900	700
		Feed Rate (mm/min)	210	210	230	260	220	220	200	210	200
Gray Cast Iron	1Dc×0.5Dc	Spindle Revolution (min ⁻¹)	10,700	8,600	7,200	5,400	4,300	3,600	2,700	2,200	1,700
		Feed Rate (mm/min)	1,070	1,070	1,150	1,290	1,030	1,000	810	770	690

* Machining with coolant is recommended for stainless steel.

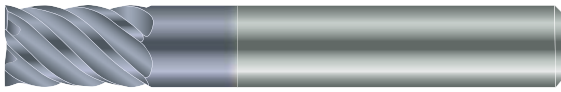
4YEKM is not recommended for slotting.
Please refer to page 45 for slotting with 4YECM/4YERM.

Difficult-to-Cut Material

4YFSM, 6YFSM

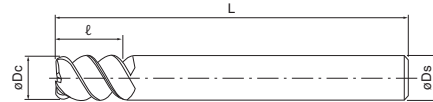
Flutes : 4,6

Semi-Finishing of Difficult-to-Cut Materials



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

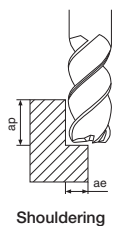
Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
4YFSM040-130-06	●	4	-0.020 -0.038	13	6	50	4
4YFSM050-130-06	●	5	-0.020 -0.038	13	6	50	4
6YFSM060-130-06	●	6	-0.020 -0.038	13	6	50	6
6YFSM080-190-08	●	8	-0.025 -0.047	19	8	63	6
6YFSM100-220-10	●	10	-0.025 -0.047	22	10	76	6
6YFSM120-260-12	●	12	-0.032 -0.059	26	12	76	6
6YFSM160-320-16	●	16	-0.032 -0.059	32	16	89	6
6YFSM200-380-20	●	20	-0.040 -0.073	38	20	104	6

● : Standard Stock

- Multiple flutes type with excellent chip evacuation. (web thickness ratio: 60%) It has positive type rake angle and suitable for semi finishing of difficult-to-cut materials such as stainless steel and inconel.

Difficult
-to-Cut
Material

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	ø							
			ø4	ø5	ø6	ø8	ø10	ø12	ø16	ø20
Carbon steel < 20HRC	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	10,000	8,000	6,600	5,000	4,000	3,300	2,500	2,000
		Feed Rate (mm/min)	800	800	1,340	1,340	1,340	1,350	1,490	1,610
Alloy steel < 30HRC	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	8,000	6,400	5,300	4,000	3,200	2,700	2,000	1,600
		Feed Rate (mm/min)	570	570	960	960	960	960	1,080	1,150
Pre-hardened steel 30~45HRC	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	6,000	4,800	4,000	3,000	2,400	2,000	1,500	1,200
		Feed Rate (mm/min)	360	360	620	660	660	660	740	790
Stainless steel SUS304	1.5Dc×0.1Dc	Spindle Revolution (min ⁻¹)	5,200	4,100	3,500	2,600	2,100	1,700	1,300	1,000
		Feed Rate (mm/min)	270	280	520	540	550	550	620	650
Heat-resistant Alloy	1Dc×0.05Dc	Spindle Revolution (min ⁻¹)	3,600	2,900	2,400	1,800	1,400	1,200	900	700
		Feed Rate (mm/min)	160	170	340	360	360	360	410	410
Titanium Alloy	1Dc×0.05Dc	Spindle Revolution (min ⁻¹)	3,600	2,900	2,400	1,800	1,400	1,200	900	700
		Feed Rate (mm/min)	160	170	340	360	360	360	410	410

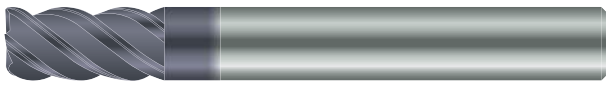
* Machining with coolant is recommended for stainless steel.

Slotting is not recommended.

5DERM, 5DEKM

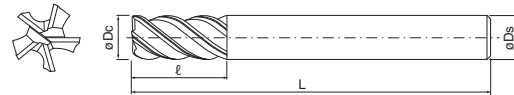
Flutes : 5

Semi-Finishing of Difficult-to-Cut Materials (High Feed Rate)



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Shank Dia. øDs	Overall length L	Spec of Corners	Number of flutes Z
5DERM040-120-06-R025	●	4	-0.020 -0.038	12	6	55	0.25	5
5DERM050-130-06-R025	●	5	-0.020 -0.038	13	6	57	0.25	5
5DERM060-130-06-R040	●	6	-0.020 -0.038	13	6	57	0.4	5
5DERM080-160-08-R050	●	8	-0.025 -0.047	16	8	63	0.5	5
5DERM090-190-10-R050	●	9	-0.025 -0.047	19	10	72	0.5	5
5DERM100-220-10-R050	●	10	-0.025 -0.047	22	10	72	0.5	5
5DERM120-260-12-R075	●	12	-0.032 -0.059	26	12	83	0.75	5
5DERM160-320-16-R075	●	16	-0.032 -0.059	32	16	92	0.75	5
5DERM200-380-20-R075	●	20	-0.040 -0.073	38	20	104	0.75	5
5DERM250-450-25-R075	●	25	-0.040 -0.073	45	25	121	0.75	5

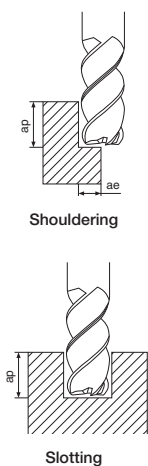
(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Shank Dia. øDs	Overall length L	Number of flutes Z
5DEKM040-120-06	●	4	-0.020 -0.038	12	6	55	5
5DEKM050-130-06	●	5	-0.020 -0.038	13	6	57	5
5DEKM060-130-06	●	6	-0.020 -0.038	13	6	57	5
5DEKM080-160-08	●	8	-0.025 -0.047	16	8	63	5
5DEKM090-190-10	●	9	-0.025 -0.047	19	10	72	5
5DEKM100-220-10	●	10	-0.025 -0.047	22	10	72	5
5DEKM120-260-12	●	12	-0.032 -0.059	26	12	83	5
5DEKM160-320-16	●	16	-0.032 -0.059	32	16	92	5
5DEKM200-380-20	●	20	-0.040 -0.073	38	20	104	5
5DEKM250-450-25	●	25	-0.040 -0.073	45	25	121	5

● : Standard Stock

- 5 edge design enables high feed rate cutting. Unequally partitioned flute design prevents vibration. 5DERM is suitable for 0.8Dc slotting.

Recommended Milling Conditions



Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø								
			ø4	ø5	ø6	ø8	ø10	ø12	ø16	ø20	ø25
Medium and high carbon steel > 0.3%C	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	16,000	12,700	10,600	8,000	6,400	5,300	4,000	3,200	2,500
		Feed Rate (mm/min)	2,400	2,500	2,700	2,400	2,200	1,900	1,600	1,600	1,400
Alloy steel and alloy tool steel < 330HB, < 35HRC	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	14,300	11,500	9,600	7,200	5,700	4,800	3,600	2,900	2,300
		Feed Rate (mm/min)	2,100	1,700	1,900	1,800	1,700	1,700	1,400	1,300	1,100
Alloy steel and alloy tool steel 340-450HB, 36-48HRC	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	13,000	10,000	8,500	6,400	5,100	4,200	3,200	2,500	2,000
		Feed Rate (mm/min)	1,300	1,500	1,700	1,300	1,300	1,300	1,100	1,000	1,000
Austenitic Stainless Steel (302, 303, 304)	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	9,200	7,300	6,100	4,600	3,700	3,100	2,300	1,800	1,500
		Feed Rate (mm/min)	1,400	1,100	1,200	1,100	1,100	1,100	920	820	730
Austenitic Stainless Steel (316, 316L)	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	6,400	5,100	4,200	3,200	2,500	2,100	1,600	1,300	1,000
		Feed Rate (mm/min)	640	760	640	640	640	640	560	510	410
Gray Cast Iron	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	14,000	11,000	9,000	6,800	5,400	4,500	3,400	2,700	2,200
		Feed Rate (mm/min)	2,000	2,200	2,300	2,000	2,200	1,800	1,700	1,600	1,400
Nodular Cast Iron CGI and malleable cast iron	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	10,000	8,300	6,900	5,200	4,100	3,500	2,600	2,100	1,700
		Feed Rate (mm/min)	1,000	1,200	1,000	1,300	1,000	1,000	910	830	830
Heat-resistant Alloy	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	3,200	2,500	2,100	1,600	1,300	1,100	800	640	510
		Feed Rate (mm/min)	160	130	210	240	190	210	200	190	180
Titanium Alloy	5DERM: 1.5Dc×0.5Dc 5DEKM: 1.5Dc×0.25Dc	Spindle Revolution (min ⁻¹)	4,800	3,800	3,200	2,400	1,900	1,600	1,200	960	760
		Feed Rate (mm/min)	480	380	480	480	380	400	360	380	340

Please refer to page 45 about slotting.

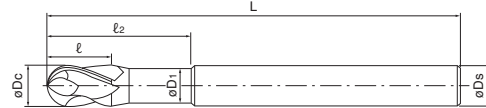
Difficult-to-Cut Material

Semi-Finishing of Difficult-to-Cut Material (Ball-nose End Mill with 4 Flutes)



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	*Radius of Ball Nose	Outside Dia.	Outside Dia. tolerance	Length of cut	Neck Dia.	Under Neck Length	Shank Dia.	Overall length
		R	øDc		ℓ	øD1	ℓ2	øDs	L
4YEBM050-090-06	●	R2.5	5	-0.020 -0.038	9	4.5	15	6	57
4YEBM060-100-06	●	R3	6	-0.020 -0.038	10	5.5	15	6	57
4YEBM080-120-08	●	R4	8	-0.025 -0.047	12	7.4	20	8	63
4YEBM100-140-10	●	R5	10	-0.025 -0.047	14	9.2	25	10	72
4YEBM120-160-12	●	R6	12	-0.032 -0.059	16	11	30	12	83
4YEBM160-220-16	●	R8	16	-0.032 -0.059	22	15	38	16	92
4YEBM200-260-20	●	R10	20	-0.040 -0.073	26	19	50	20	104

Flutes Z=4

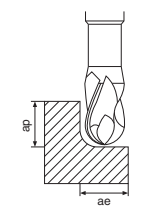
● : Standard Stock

* Actual ball-nose radius will be half of actual measurement of outer diameter.

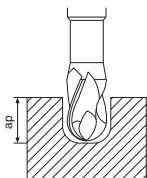
- Ball-nose end mill for semi finishing of difficult-to-cut materials.

Difficult-to-Cut Material

Recommended Milling Conditions



Shouldering



Slotting

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø5	ø6	ø8	ø10	ø12	ø16	ø20
Stainless steel SUS304	1Dc×0.5Dc	Spindle Revolution (min ⁻¹)	5,700	4,800	3,600	2,900	2,400	1,800	1,400
		Feed Rate (mm/min)	620	630	630	640	560	450	390
Heat-resistant Alloy	1Dc×0.2Dc	Spindle Revolution (min ⁻¹)	1,700	1,400	1,000	800	700	500	400
		Feed Rate (mm/min)	70	80	100	80	90	90	80
Soft Steel	1Dc×0.5Dc	Spindle Revolution (min ⁻¹)	9,400	7,900	5,900	4,700	3,900	2,900	2,400
		Feed Rate (mm/min)	1,020	1,130	1,270	1,020	990	800	760
Titanium Alloy	1Dc×0.3Dc	Spindle Revolution (min ⁻¹)	3,200	2,700	2,000	1,600	1,300	1,000	800
		Feed Rate (mm/min)	180	190	220	170	170	160	160
Gray Cast Iron	1Dc×0.4Dc	Spindle Revolution (min ⁻¹)	7,800	6,500	4,900	3,900	3,200	2,400	1,900
		Feed Rate (mm/min)	840	930	1,050	840	820	660	630

* Machining with coolant is recommended for stainless steel.

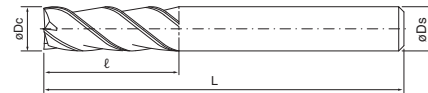
Please refer to page 45 about slotting.

Finishing of Aluminum



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

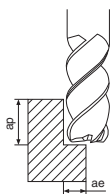
Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
3NESM030-120-06	●	3	-0.014 -0.028	12	6	50	3
3NESM040-120-06	●	4	-0.020 -0.038	12	6	50	3
3NESM050-140-06	●	5	-0.020 -0.038	14	6	50	3
3NESM060-160-06	●	6	0 -0.008	16	6	50	3
3NESM080-200-08	●	8	0 -0.009	20	8	63	3
3NESM100-220-10	●	10	0 -0.009	22	10	76	3
3NESM120-250-12	●	12	0 -0.011	25	12	76	3
3NESM160-320-16	●	16	0 -0.011	32	16	89	3
3NESM200-380-20	●	20	0 -0.013	38	20	104	3

* Cutting edge of over 6mm øDc has margin.

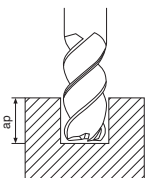
● : Standard Stock

- A wiper is attached at the lower edge for improving the bottom surface finish. Chattering is controlled with cutting edge slots at varied intervals, and finishing of lateral surfaces is improved.

Recommended Milling Conditions



Shouldering



Slotting

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø3	ø6	ø8	ø10	ø12	ø16	ø20
			Aluminum Alloy	1.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	34,000	17,000	13,000	10,200
Feed Rate (mm/min)	2,750	2,750			2,750	2,750	2,750	2,750	2,750

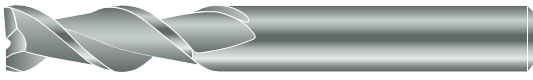
Please refer to page 46 about slotting.

Aluminum & Non Ferrous Material

2NFSM, 3NFSM

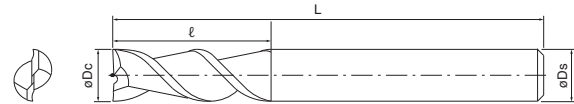
Flutes : 2,3

Semi-Finishing of Aluminum



Recommended Material

★ 1st Recommendation



Stock Items

(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Shank Dia. øDs	Overall length L	Number of flutes Z
2NFSM010-040-04	●	1	-0.014 -0.028	4	4	38	2
2NFSM015-060-04	●	1.5	-0.014 -0.028	6	4	38	2
2NFSM020-080-04	●	2	-0.014 -0.028	8	4	38	2
2NFSM025-080-04	●	2.5	-0.014 -0.028	8	4	38	2
2NFSM030-080-06	●	3	-0.014 -0.028	8	6	50	2
2NFSM040-080-06	●	4	-0.020 -0.038	8	6	50	2
2NFSM050-140-06	●	5	-0.020 -0.038	14	6	50	2
2NFSM060-160-06	●	6	0 -0.008	16	6	50	2
2NFSM080-200-08	●	8	0 -0.009	20	8	63	2
2NFSM100-220-10	●	10	0 -0.009	22	10	76	2
2NFSM120-250-12	●	12	0 -0.011	25	12	76	2

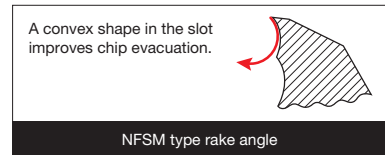
(Unit : mm)

Description	Stock	Outside Dia. øDc	Outside Dia. tolerance	Length of cut ℓ	Shank Dia. øDs	Overall length L	Number of flutes Z
2NFSM160-320-16	●	16	0 -0.011	32	16	89	2
2NFSM200-380-20	●	20	0 -0.013	38	20	104	2
3NFSM030-120-06	●	3	-0.014 -0.028	12	6	50	3
3NFSM040-120-06	●	4	-0.020 -0.038	12	6	50	3
3NFSM050-140-06	●	5	-0.020 -0.038	14	6	50	3
3NFSM060-160-06	●	6	0 -0.008	16	6	50	3
3NFSM080-200-08	●	8	0 -0.009	20	8	63	3
3NFSM100-220-10	●	10	0 -0.009	22	10	76	3
3NFSM120-250-12	●	12	0 -0.011	25	12	76	3
3NFSM160-320-16	●	16	0 -0.011	32	16	89	3
3NFSM200-380-20	●	20	0 -0.013	38	20	104	3

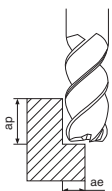
* Cutting edge of over 6mm øDc has margin.

● : Standard Stock

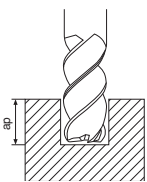
- Sharpness oriented for aluminum machining. Good chip evacuation from the 45 degree helix angle.



Recommended Milling Conditions



Shouldering



Slotting

Shouldering

2 Flutes

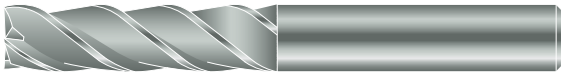
Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	ø3	ø6	ø8	ø10	ø12	ø16	ø20
			Aluminum Alloy	1Dc x 0.5Dc	Spindle Revolution (min ⁻¹)	26,500	13,300	10,000	8,000
High-silicon Aluminum	1Dc x 0.5Dc	Spindle Revolution (min ⁻¹)				19,100	9,600	7,200	5,700
			Aluminum Alloy	1Dc x 0.5Dc	Feed Rate (mm/min)	690	950	950	1,130
High-silicon Aluminum	1Dc x 0.5Dc	Feed Rate (mm/min)				420	500	500	600

3 Flutes

Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	ø3	ø6	ø8	ø10	ø12	ø16	ø20
			Aluminum Alloy	1Dc x 0.5Dc	Spindle Revolution (min ⁻¹)	26,500	13,300	10,000	8,000
High-silicon Aluminum	1Dc x 0.5Dc	Spindle Revolution (min ⁻¹)				19,100	9,600	7,200	5,700
			Aluminum Alloy	1Dc x 0.5Dc	Feed Rate (mm/min)	1,040	1,400	1,400	1,700
High-silicon Aluminum	1Dc x 0.5Dc	Feed Rate (mm/min)				630	750	750	890

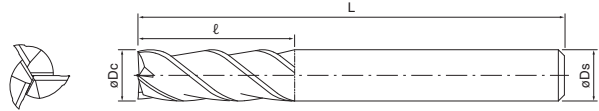
Please refer to page 46 about slotting.

Semi-Finishing of Aluminum



Recommended Material

★ 1st Recommendation



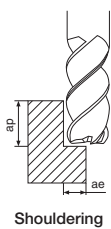
Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia.	Length of cut	Shank Dia.	Overall length	Number of flutes
		ϕDc	tolerance	ℓ	ϕDs	L	Z
3NFSL030-190-06	●	3	-0.014 -0.028	19	6	63	3
3NFSL040-190-06	●	4	-0.020 -0.038	19	6	63	3
3NFSL050-200-06	●	5	-0.020 -0.038	20	6	63	3
3NFSL060-280-06	●	6	0 -0.008	28	6	76	3
3NFSL080-300-08	●	8	0 -0.009	30	8	76	3
3NFSL100-340-10	●	10	0 -0.009	34	10	89	3
3NFSL120-450-12	●	12	0 -0.011	45	12	100	3
3NFSL160-560-16	●	16	0 -0.011	56	16	125	3
3NFSL200-600-20	●	20	0 -0.013	60	20	125	3

● : Standard Stock

Recommended Milling Conditions



Shouldering

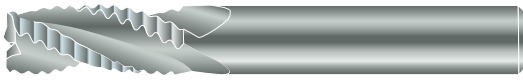
Shouldering

Material	Depth of Cut (ap x ae)(mm)	Outside Dia. (mm)	$\phi 6$	$\phi 8$	$\phi 10$	$\phi 12$	$\phi 16$	$\phi 20$	$\phi 25$
			Aluminum Alloy	2.5Dc x 0.5Dc	Spindle Revolution (min ⁻¹)	18,500	9,300	7,000	5,600
Feed Rate (mm/min)	730	980				980	1,200	1,320	1,040
	High-silicon Aluminum	1.5Dc x 0.5Dc	Spindle Revolution (min ⁻¹)	13,400	6,700	5,000	4,000	3,400	2,500
Feed Rate (mm/min)				440	530	530	620	700	810

Slotting is not recommended.

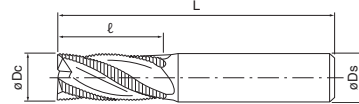
Aluminum & Non Ferrous Material

Roughing of Aluminum



Recommended Material

★ 1st Recommendation



Stock Items

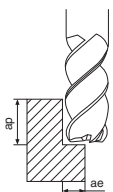
(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Spec of Corners	Number of flutes
		øDc		ℓ	øDs	L	C	Z
3AESM060-130-06	●	6	-0.030 -0.105	13	6	57	0.6	3
3AESM080-160-08	●	8	-0.040 -0.130	16	8	63	0.6	3
3AESM100-220-10	●	10	-0.040 -0.130	22	10	72	0.6	3
3AESM120-260-12	●	12	-0.050 -0.160	26	12	83	1	3
3AESM160-320-16	●	16	-0.050 -0.160	32	16	92	1	3
3AESM200-380-20	●	20	-0.065 -0.195	38	20	104	1	3
3AESM250-450-25	●	25	-0.065 -0.195	45	25	121	1	3

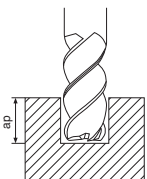
● : Standard Stock

- Three flutes type for roughing of aluminum. With corner chamfering.

Recommended Milling Conditions



Shouldering



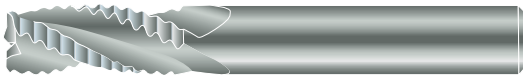
Slotting

Shouldering

Material	Depth of Cut (ap×ae)(mm)	Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16	ø20	ø25
			Aluminum Alloy	1.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	33,200	24,900	19,900	16,600
Feed Rate (mm/min)	5,370	5,150			5,080	4,980	4,890	4,840	4,780
High-silicon Aluminum	1.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	10,600	8,000	6,400	5,300	4,000	3,200	2,500
		Feed Rate (mm/min)	1,430	1,390	1,360	1,320	1,300	1,290	1,280

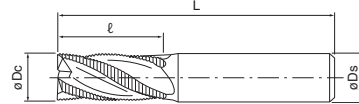
Please refer to page 46 about slotting.

Roughing of Aluminum



Recommended Material

★ 1st Recommendation



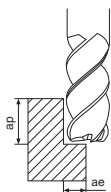
Stock Items

(Unit : mm)

Description	Stock	Outside Dia.	Outside Dia. tolerance	Length of cut	Shank Dia.	Overall length	Number of flutes
		øDc		ℓ	øDs	L	Z
3AESL060-240-06	●	6	-0.030 -0.105	24	6	76	3
3AESL080-280-08	●	8	-0.040 -0.130	28	8	76	3
3AESL100-340-10	●	10	-0.040 -0.130	34	10	89	3
3AESL120-450-12	●	12	-0.050 -0.160	45	12	100	3
3AESL160-560-16	●	16	-0.050 -0.160	56	16	125	3
3AESL200-600-20	●	20	-0.065 -0.195	60	20	125	3
3AESL250-800-25	●	25	-0.065 -0.195	80	25	150	3

● : Standard Stock

Recommended Milling Conditions



Shouldering

Shouldering

Material	Depth of Cut (apxae)(mm)	Outside Dia. (mm)	ø6	ø8	ø10	ø12	ø16	ø20	ø25
			Aluminum Alloy	2.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	23,000	17,500	14,000	11,600
Feed Rate (mm/min)	3,760	3,600			3,560	3,490	3,420	3,390	3,350
High-silicon Aluminum	2.5Dc×0.5Dc	Spindle Revolution (min ⁻¹)	7,400	5,600	4,500	3,700	2,800	2,200	1,800
		Feed Rate (mm/min)	1,000	970	950	920	910	900	900

Slotting is not recommended.

Aluminum & Non Ferrous Material

Recommended Milling Conditions - Slotting (1)

Material	Depth of Cut (ap)(mm)	Outside Dia. (mm)	ø0.5	ø1	ø2	ø4	ø6	ø8	ø12	ø16				
2FESS 2FESM (P.12~P.14)														
Carbon steel S45C	0.1Dc(Dc<ø1) 0.3Dc(ø1≤Dc<ø3) 0.5Dc(Dc≥ø3)	Spindle Revolution (min ⁻¹)	19,000	15,300	8,000	4,000	2,700	2,000	1,300	1,000				
		Feed Rate (mm/min)	130	135	140	225	250	250	245	245				
Alloy steel SCM, SNCM	0.1Dc(Dc<ø1) 0.3Dc(ø1≤Dc<ø3) 0.5Dc(Dc≥ø3)	Spindle Revolution (min ⁻¹)	16,000	13,000	6,600	3,400	2,200	1,700	1,200	900				
		Feed Rate (mm/min)	105	115	130	170	190	185	185	185				
Pre-hardened steel NAK, 30~45HRC	0.1Dc(Dc<ø1) 0.3Dc(ø1≤Dc<ø3) 0.5Dc(Dc≥ø3)	Spindle Revolution (min ⁻¹)	13,500	7,600	4,300	2,500	1,800	1,300	900	700				
		Feed Rate (mm/min)	30	35	50	60	63	63	65	65				
Stainless steel SUS304	0.1Dc(Dc<ø1) 0.3Dc(ø1≤Dc<ø3) 0.5Dc(Dc≥ø3)	Spindle Revolution (min ⁻¹)	16,000	13,000	6,600	3,400	2,200	1,700	1,200	900				
		Feed Rate (mm/min)	35	60	60	65	70	70	70	70				
2FEKS 2FEKM (P.17~P.18)														
Carbon steel S45C	0.5Dc	Spindle Revolution (min ⁻¹)		7,500	6,000	5,000	4,400	3,300	2,700	2,300	2,100	1,900		
		Feed Rate (mm/min)		240	260	310	340	340	340	340	330	320		
Alloy steel SCM, SNCM	0.5Dc	Spindle Revolution (min ⁻¹)		7,200	5,400	4,300	3,600	2,700	2,200	1,800	1,600	1,500		
		Feed Rate (mm/min)		270	270	270	270	270	270	270	270	270		
Pre-hardened steel NAK, 30~45HRC	0.5Dc	Spindle Revolution (min ⁻¹)		5,300	4,000	3,200	2,600	2,000	1,600	1,300	1,100	1,000		
		Feed Rate (mm/min)		120	120	120	120	120	120	120	120	120		
Stainless steel SUS304	0.5Dc	Spindle Revolution (min ⁻¹)		5,300	4,000	3,200	2,600	2,000	1,600	1,300	1,100	1,000		
		Feed Rate (mm/min)		80	90	90	100	100	100	90	90	90		
2FESW (P.10~P.11)														
Carbon steel S45C	0.2Dc	Spindle Revolution (min ⁻¹)		11,000	8,000	6,400	5,300	4,000	3,200	2,700	2,300			
		Feed Rate (mm/min)		660	640	640	640	520	450	410	350			
Alloy steel SCM, SNCM	0.2Dc	Spindle Revolution (min ⁻¹)		7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600			
		Feed Rate (mm/min)		420	430	430	430	350	300	270	230			
Pre-hardened steel NAK, 30~45HRC	0.2Dc	Spindle Revolution (min ⁻¹)		7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600			
		Feed Rate (mm/min)		420	430	430	430	350	300	270	230			
Stainless steel SUS304	0.2Dc	Spindle Revolution (min ⁻¹)		6,400	4,800	3,800	3,200	2,400	1,900	1,600	1,400			
		Feed Rate (mm/min)		320	320	320	320	260	230	210	180			
3FESW (P.10~P.11)														
Carbon steel S45C	0.2Dc	Spindle Revolution (min ⁻¹)		11,000	8,000	6,400	5,300	4,000	3,200	2,700	2,300			
		Feed Rate (mm/min)		810	800	800	800	650	560	510	450			
Alloy steel SCM, SNCM	0.2Dc	Spindle Revolution (min ⁻¹)		7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600			
		Feed Rate (mm/min)		530	530	530	530	430	370	340	290			
Pre-hardened steel NAK, 30~45HRC	0.2Dc	Spindle Revolution (min ⁻¹)		7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600			
		Feed Rate (mm/min)		530	530	530	530	430	370	340	290			
Stainless steel SUS304	0.2Dc	Spindle Revolution (min ⁻¹)		6,400	4,800	3,800	3,200	2,400	1,900	1,600	1,400			
		Feed Rate (mm/min)		400	400	400	400	320	280	260	230			
4FESW (P.10~P.11)														
Carbon steel S45C	0.2Dc	Spindle Revolution (min ⁻¹)		11,000	8,000	6,400	5,300	4,000	3,200	2,700	2,300			
		Feed Rate (mm/min)		960	960	960	960	780	680	620	550			
Alloy steel SCM, SNCM	0.2Dc	Spindle Revolution (min ⁻¹)		7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600			
		Feed Rate (mm/min)		640	640	640	640	520	450	410	350			
Pre-hardened steel NAK, 30~45HRC	0.2Dc	Spindle Revolution (min ⁻¹)		7,400	5,600	4,500	3,700	2,800	2,200	1,900	1,600			
		Feed Rate (mm/min)		640	640	640	640	520	450	410	350			
Stainless steel SUS304	0.2Dc	Spindle Revolution (min ⁻¹)		6,400	4,800	3,800	3,200	2,400	1,900	1,600	1,400			
		Feed Rate (mm/min)		480	480	480	480	390	340	310	280			
3UFMS (P.20)														
Steel	< 42HRC	0.25Dc	Spindle Revolution (min ⁻¹)	19,000	12,700	9,500	7,600	6,400	4,800	3,800	3,200		2,400	1,900
			Feed Rate (mm/min)	570	495	513	456	480	461	456	432		360	285
			Spindle Revolution (min ⁻¹)	16,000	10,600	8,000	6,400	5,300	4,000	3,200	2,700		2,000	1,600
	42~48HRC	0.25Dc	Feed Rate (mm/min)	384	331	346	307	318	307	307	292		240	240
			Spindle Revolution (min ⁻¹)	12,700	8,500	6,400	5,100	4,300	3,200	2,500	2,100		1,600	1,300
			Feed Rate (mm/min)	274	239	249	220	232	221	216	204		173	176
48~52HRC	0.25Dc	Spindle Revolution (min ⁻¹)	25,500	17,000	13,000	10,200	8,500	6,400	5,100	4,200		3,200	2,500	
		Feed Rate (mm/min)	765	663	702	612	638	614	612	567		480	375	
		Spindle Revolution (min ⁻¹)	22,300	15,000	11,000	8,900	7,400	5,600	4,500	3,700		2,800	2,200	
> 180HB	0.5Dc	Feed Rate (mm/min)	669	585	594	534	555	538	540	500		420	330	
		Spindle Revolution (min ⁻¹)	16,000	10,600	8,000	6,400	5,300	4,000	3,200	2,700		2,000	1,600	
		Feed Rate (mm/min)	389	389	389	432	464	464	443	400		300	250	
Stainless steel SUS304	0.25Dc	Spindle Revolution (min ⁻¹)	16,000	10,600	8,000	6,400	5,300	4,000	3,200	2,700		2,000	1,600	
		Feed Rate (mm/min)	382	382	382	424	456	456	435	392		300	250	
Titanium Alloy	0.25Dc	Spindle Revolution (min ⁻¹)	16,000	10,600	8,000	6,400	5,300	4,000	3,200	2,700		2,000	1,600	
		Feed Rate (mm/min)	382	382	382	424	456	456	435	392		300	250	

Recommended Milling Conditions - Slotting (2)

Material	Depth of Cut (ap)(mm)	Outside Dia. (mm)	ø2	ø3	ø4	ø5	ø6	ø8	ø10	ø12	ø16	ø20	ø25	
3RDSM 4RDSM 5RDSM (P.23)														
Steel	< 22HRC	0.75Dc	Spindle Revolution (min ⁻¹)	--	--	13,900	11,100	9,300	6,900	5,600	4,600	3,500	2,800	2,200
			Feed Rate (mm/min)			750	770	800	800	1,000	1,030	1,040	1,050	1,110
	22~32HRC	0.75Dc	Spindle Revolution (min ⁻¹)			11,900	9,500	7,900	5,900	4,800	4,000	3,000	2,400	1,900
			Feed Rate (mm/min)			540	540	550	550	740	740	740	760	860
	32~40HRC	0.6Dc	Spindle Revolution (min ⁻¹)			8,000	6,400	5,300	4,000	3,200	2,600	2,000	1,600	1,300
			Feed Rate (mm/min)			240	250	260	260	340	340	330	330	330
	40~45HRC	0.5Dc	Spindle Revolution (min ⁻¹)			6,400	5,100	4,300	3,200	2,600	2,200	1,600	1,300	1,000
			Feed Rate (mm/min)			150	170	180	180	240	230	230	220	220
	45~50HRC	0.4Dc	Spindle Revolution (min ⁻¹)			5,700	4,500	3,800	2,900	2,300	1,900	1,400	1,100	900
			Feed Rate (mm/min)			140	140	140	140	170	160	160	150	150
Cast Iron	1Dc	Spindle Revolution (min ⁻¹)	11,900	9,500	7,900	5,900	4,800	4,000	3,000	2,400	1,900			
		Feed Rate (mm/min)	640	660	700	700	900	900	900	910	1,140			
4YECM 4YERM (P.35)														
Stainless steel SUS304	1Dc	Spindle Revolution (min ⁻¹)	--	--	7,200	5,700	4,800	3,600	2,900	2,400	1,800	1,400	1,100	
		Feed Rate (mm/min)			700	700	760	720	690	620	500	430	340	
Heat-resistant Alloy	0.3Dc	Spindle Revolution (min ⁻¹)			2,000	1,600	1,300	1,000	800	700	500	400	300	
		Feed Rate (mm/min)			80	80	90	110	100	100	100	90	70	
Soft Steel	1Dc	Spindle Revolution (min ⁻¹)			11,900	9,600	8,000	6,000	4,800	4,000	3,000	2,400	1,900	
		Feed Rate (mm/min)			1,150	1,150	1,300	1,400	1,100	1,100	900	900	800	
Titanium Alloy	1Dc	Spindle Revolution (min ⁻¹)			4,000	3,200	2,700	2,000	1,600	1,300	1,000	800	600	
		Feed Rate (mm/min)			190	190	210	240	200	200	180	180	180	
Gray Cast Iron	1Dc	Spindle Revolution (min ⁻¹)			9,600	7,600	6,400	4,800	3,800	3,200	2,400	1,900	1,500	
		Feed Rate (mm/min)			950	950	1,020	1,150	920	900	720	690	610	
4YEPM (P.38)														
Stainless steel SUS304	1Dc	Spindle Revolution (min ⁻¹)	--	--	--	5,100	4,200	3,200	2,500	2,100	--	1,600	1,300	
		Feed Rate (mm/min)				550	610	570	550	500		400	350	
Heat-resistant Alloy	0.5Dc	Spindle Revolution (min ⁻¹)				1,400	1,200	900	700	600		400	400	
		Feed Rate (mm/min)				60	70	80	80	80		80	70	70
Soft Steel	1Dc	Spindle Revolution (min ⁻¹)				8,600	7,200	5,400	4,300	3,600		2,700	2,200	
		Feed Rate (mm/min)				930	1,030	1,160	930	900		730	700	
Titanium Alloy	0.5Dc	Spindle Revolution (min ⁻¹)				2,900	2,400	1,800	1,400	1,200		900	700	
		Feed Rate (mm/min)				160	170	190	170	170		160	160	
Gray Cast Iron	1Dc	Spindle Revolution (min ⁻¹)				7,000	5,800	4,400	3,500	2,900		2,200	1,800	
		Feed Rate (mm/min)				760	840	950	760	740		600	570	
5DERM, 5DEKM (P.37)														
Medium and high carbon steel > 0.3%C	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	16,000	12,700	10,600	8,000	6,400	5,300	4,000	3,200	2,500			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	2,400	2,500	2,700	2,400	2,200	1,900	1,600	1,600	1,400			
Alloy steel and alloy tool steel < 330HB, < 35HRC	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	14,300	11,500	9,600	7,200	5,700	4,800	3,600	2,900	2,300			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	2,100	1,700	1,900	1,800	1,700	1,700	1,400	1,300	1,100			
Alloy steel and alloy tool steel 340~450HB, 36~48HRC	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	13,000	10,000	8,500	6,400	5,100	4,200	3,200	2,500	2,000			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	1,300	1,500	1,700	1,300	1,300	1,300	1,100	1,000	1,000			
Austenitic Stainless Steel (302, 303, 304)	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	9,200	7,300	6,100	4,600	3,700	3,100	2,300	1,800	1,500			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	1,400	1,100	1,200	1,100	1,100	1,100	920	820	730			
Austenitic Stainless Steel (316, 316L)	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	6,400	5,100	4,200	3,200	2,500	2,100	1,600	1,300	1,000			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	640	760	640	640	640	640	560	510	410			
Gray Cast Iron	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	14,000	11,000	9,000	6,800	5,400	4,500	3,400	2,700	2,200			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	2,000	2,200	2,300	2,000	2,200	1,800	1,700	1,600	1,400			
Nodular Cast Iron CGI and malleable cast iron	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	10,000	8,300	6,900	5,200	4,100	3,500	2,600	2,100	1,700			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	1,000	1,200	1,000	1,300	1,000	1,000	910	830	830			
Heat-resistant Alloy	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	3,200	2,500	2,100	1,600	1,300	1,100	800	640	510			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	160	130	210	240	190	210	200	190	180			
Titanium Alloy	5DERM: 0.8Dc	Spindle Revolution (min ⁻¹)	4,800	3,800	3,200	2,400	1,900	1,600	1,200	960	760			
	5DEKM: 0.25Dc	Feed Rate (mm/min)	480	380	480	480	380	400	360	380	340			

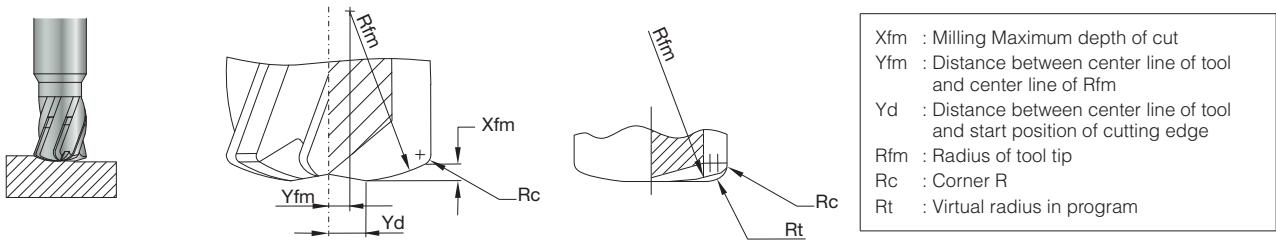
Recommended Milling Conditions - Slotting (3)

Material	Depth of Cut (ap)(mm)	Outside Dia. (mm)	ø2	ø3	ø4	ø5	ø6	ø8	ø10	ø12	ø16	ø20	ø25											
4PGRM (P.27)																								
Steel	< 30HRC	0.5Dc	Spindle Revolution (min ⁻¹)	—	—	—	—	—	—	—	—	—	—											
			Feed Rate (mm/min)											8,500	6,400	5,100	4,200	3,200	2,500	2,100	1,600	1,300		
	30~40HRC	0.5Dc	Spindle Revolution (min ⁻¹)											900	900	900	900	900	920	930	960	920		
			Feed Rate (mm/min)											7,600	5,700	4,500	3,800	2,900	2,300	1,900	1,400	1,100		
	40~45HRC	0.5Dc	Spindle Revolution (min ⁻¹)											770	770	770	770	770	780	780	800	780		
			Feed Rate (mm/min)											6,800	5,100	4,100	3,400	2,500	2,000	1,700	1,300	1,000		
	45~50HRC	0.5Dc	Spindle Revolution (min ⁻¹)											570	570	570	570	570	570	560	560	530		
			Feed Rate (mm/min)											5,100	3,800	3,100	2,500	1,900	1,500	1,300	1,000	800		
	50~55HRC	0.5Dc	Spindle Revolution (min ⁻¹)											320	320	320	320	340	340	360	340	340		
			Feed Rate (mm/min)											3,400	2,500	2,000	1,700	1,300	1,000	800	600	500		
	> 55HRC	0.25Dc	Spindle Revolution (min ⁻¹)											150	150	150	150	150	160	150	150	150		
			Feed Rate (mm/min)											3,000	2,200	1,800	1,500	1,100	900	700	600	400		
3FRFS 4FRFS (P.34)																								
Steel	< 30HRC	0.8Dc	Spindle Revolution (min ⁻¹)	—	—	—	—	—	—	—	—	—	—											
			Feed Rate (mm/min)											11,500	9,200	7,600	5,700	4,600	3,800					
	30~40HRC	0.8Dc	Spindle Revolution (min ⁻¹)											690	690	920	920	920	920					
			Feed Rate (mm/min)											7,600	6,100	5,100	3,800	3,100	2,500					
	40~50HRC	0.5Dc	Spindle Revolution (min ⁻¹)											340	370	490	490	490	460					
			Feed Rate (mm/min)											5,100	4,100	3,400	2,500	2,000	1,700					
	50~60HRC	0.3Dc	Spindle Revolution (min ⁻¹)											150	180	260	260	260	270					
			Feed Rate (mm/min)											3,800	3,100	2,500	1,900	1,500	1,300					
	60~70HRC	0.25Dc	Spindle Revolution (min ⁻¹)											80	80	100	120	120	130					
			Feed Rate (mm/min)											2,500	2,000	1,700	1,300	1,000	800					
	4RFSM 6RFSM (P.33)																							
	Steel	35~45HRC	0.5Dc											Spindle Revolution (min ⁻¹)	—	—	—	—	—	—	—	—	—	—
Feed Rate (mm/min)				6,400	4,800	3,800	3,200	2,400	2,400	1,900	1,900	1,500												
45~55HRC		0.5Dc	Spindle Revolution (min ⁻¹)	480	480	490	500	500	720	500	750	640												
			Feed Rate (mm/min)	4,700	3,500	2,800	2,300	1,800	1,800	1,400	1,400	1,100												
55~60HRC		0.3Dc	Spindle Revolution (min ⁻¹)	280	280	280	280	280	420	280	420	370												
			Feed Rate (mm/min)	3,800	2,900	2,300	1,900	1,400	1,400	1,100	1,100	900												
Titanium Alloy	< 40HRC	0.5Dc	Spindle Revolution (min ⁻¹)	150	170	180	180	180	260	180	280	250												
			Feed Rate (mm/min)	3,000	2,200	1,800	1,500	1,100	1,100	900	900	700												
	> 40HRC	0.3Dc	Spindle Revolution (min ⁻¹)	310	310	310	310	310	470	310	430	360												
Inconel	0.25Dc	Spindle Revolution (min ⁻¹)	2,500	1,900	1,500	1,300	1,000	1,000	800	800	600													
		Feed Rate (mm/min)	230	230	230	230	230	340	230	340	290													
3NESM (P.39)																								
Aluminum Alloy	1Dc	Spindle Revolution (min ⁻¹)	26,500	13,000	9,800	8,000	6,600	5,000	4,000															
		Feed Rate (mm/min)	1,900	1,900	1,900	1,900	1,900	1,900	1,900															
2NFSM (P.40)																								
Aluminum Alloy	1Dc	Spindle Revolution (min ⁻¹)	21,200	10,600	8,000	6,400	5,300	4,000	3,200	2,500														
		Feed Rate (mm/min)	550	750	750	900	1,010	800	700	660														
High-silicon Aluminum	1Dc	Spindle Revolution (min ⁻¹)	15,900	7,900	5,900	4,800	4,000	3,000	2,400	1,900														
		Feed Rate (mm/min)	350	420	420	500	560	640	480	420														
3NFSM (P.40)																								
Aluminum Alloy	1Dc	Spindle Revolution (min ⁻¹)	21,200	10,600	8,000	6,400	5,300	4,000	3,200	2,500														
		Feed Rate (mm/min)	830	1,100	1,100	1,360	1,510	1,290	1,050	920														
High-silicon Aluminum	1Dc	Spindle Revolution (min ⁻¹)	15,900	7,900	5,900	4,800	4,000	3,000	2,400	1,900														
		Feed Rate (mm/min)	520	630	630	740	830	960	710	630														
3AESM (P.42)																								
Aluminum Alloy	1Dc	Spindle Revolution (min ⁻¹)	39,800	19,900	14,900	11,900	10,000	7,500	6,000	4,800														
		Feed Rate (mm/min)	3,700	3,230	3,090	3,050	2,990	2,930	2,900	2,870														
High-silicon Aluminum	1Dc	Spindle Revolution (min ⁻¹)	12,700	6,400	4,800	3,800	3,200	2,400	1,900	1,500														
		Feed Rate (mm/min)	920	860	830	810	790	780	770	770														

Column1

■ Ramping / Arc Machining

■ Details of 6PDRS cutting edge shape

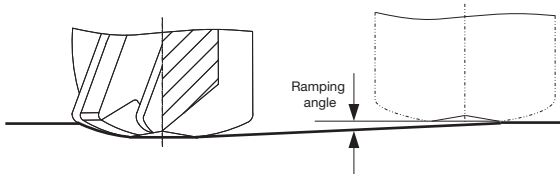


Description	Outside Dia.	Milling Maximum depth of cut	Radius of tool tip	Corner R	Distance between center line of tool and center line of R_{fm}	Distance between center line of tool and start position of cutting edge	Virtual radius in program
	ϕD_c	X_{fm}	R_{fm}	R_c	Y_{fm}	Y_d	R_t
6PDRS060-045-06	6	0.32	6	0.62	0.75	1.32	0.62
6PDRS080-060-08	8	0.42	8	0.83	1.00	1.76	0.83
6PDRS100-075-10	10	0.53	10	1.04	1.25	2.20	1.04
6PDRS120-090-12	12	0.63	12	1.24	1.50	2.64	1.24

- We do not recommend machining with a cut amount exceeding the X_{fm} value.

■ About Ramping

- During ramping, please reduce the table feed rate with the ratio of the chart on the right.



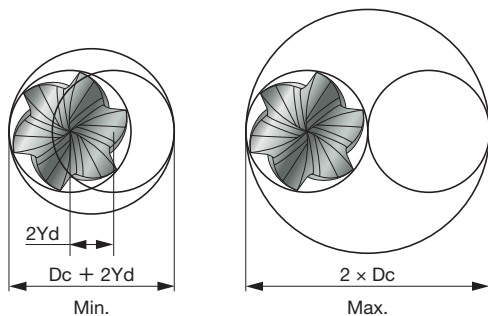
Ramping angle	1°	2°	3°	4°	5°
Feed rate when ramping	100%	70%	50%	30%	10%

Please refer to page 32 for standard cutting conditions.

- During pocket machining, set the recess angle at 0.5 degrees.
- We do not recommend vertical milling.

■ About Arc Machining

- Please use the range of the chart on the right, for one pass of machining hole diameter.



Description	Min.	Max.
6PDRS060-045-06	8.64	12.00
6PDRS080-060-08	11.52	16.00
6PDRS100-075-10	14.40	20.00
6PDRS120-090-12	17.28	24.00

Case Studies

1.0718	
<ul style="list-style-type: none"> • OA parts • $V_c = 88\text{m/min}$ ($n=3,500\text{min}^{-1}$) • $a_p=0.5\text{mm}$ • $fz=0.23\text{mm/t}$ ($v_f=3200\text{mm/min}$) • With coolant • 4FESM080-190-08 	
MEGACOAT	230pcs /edge
Competitor Coating E	100pcs /edge
<ul style="list-style-type: none"> • Kyocera showed 2.3 times longer tool life than Competitor E. • Kyocera's new coating technology resolved edge fracturing and provided stability compared with Competitor E. • Kyocera showed superior finished surface compared with Competitor E. 	
<p>MEGACOAT (Number of workpiece processed : 230pcs/edge)</p>	<p>Competitor Coating E (Number of workpiece processed : 100pcs/edge)</p>
Evaluation by the user	

1.7027	
<ul style="list-style-type: none"> • Automotive parts • $V_c = 40\text{m/min}$ ($n=3,200\text{min}^{-1}$) • $a_p=0.1\text{mm}$ • $fz=0.01\text{mm/t}$ ($v_f=70\text{mm/min}$) • With coolant • 2FESM040-110-06 	
MEGACOAT	700pcs /edge
Competitor Coating F	350pcs /edge
<ul style="list-style-type: none"> • Kyocera processed twice as many workpieces compared to Competitor F. • Competitor H is limited to 350 workpieces due to excessive wear. Kyocera prevents chipping thereby enabling long-life and stabilized machining. 	
<p>MEGACOAT (Number of workpiece processed : 700pcs/edge)</p>	<p>Competitor Coating F (Number of workpiece processed : 350pcs/edge)</p>
Evaluation by the user	

C45	
<ul style="list-style-type: none"> • Machine parts • $V_c=100\text{m/min}$ ($n=3980\text{min}^{-1}$) • $a_p=0.45\text{mm}$ • $fz=0.05\text{mm/t}$ ($v_f=800\text{mm/min}$) • With coolant • 4 flutes • Tool life 4000pcs/ edge • 4FESW080-080-08 	
4FESW080-080-08	Table feed Vf=800mm/min
Competitor Coating G	Table feed Vf=200mm/min
<p>[Competitor Coating G] $\phi 8 \times 4$ flutes $V_c=63\text{m/min}$ ($n=2508\text{min}^{-1}$) $a_p=0.45\text{mm}$ Tool life 4000pcs/ edge $fz=0.02\text{mm/t}$ ($V_f=200\text{mm/min}$)</p>	<p>User comments • Was able to increase both cutting speed and table feed rate. • Despite the increase in machining conditions, burr formation decreased.</p>
Evaluation by the user	

Free cutting carbon steel	
<ul style="list-style-type: none"> • Machine parts • $V_c=100\text{m/min}$ ($n=3200\text{min}^{-1}$) • $a_p \times a_e=3.5 \times 3.0\text{mm}$ • $fz=0.05\text{mm/t}$ ($v_f=640\text{mm/min}$) • With coolant • 4 flutes • 4FESW100-080-10 	
4FESW100-080-10	Table feed Vf=640mm/min
Competitor Coating H	Table feed Vf=400mm/min
<p>[Competitor Coating H] $\phi 7 \times 4$ flutes $V_c=44\text{m/min}$ ($n=2000\text{min}^{-1}$) $a_p \times a_e=3.5 \times 3.0\text{mm}$ $fz=0.05\text{mm/t}$ ($V_f=400\text{mm/min}$)</p>	<p>User comments • Automatic general purpose end mills have a shorter edge length with improved rigidity, which enabled an increase from conventional $\phi 7$ to $\phi 10$, thus improving machining conditions. • Compared to conventional tools, tool life improved five times.</p>
Evaluation by the user	

Hardened steel (60HRC)	
<ul style="list-style-type: none"> • Mold • $V_c=60\text{m/min}$ ($n=1194\text{min}^{-1}$) • $a_p \times a_e=40 \times 0.3\text{mm}$ • $fz=0.056\text{mm/t}$ ($V_f=400\text{mm/min}$) • 6 flutes • 6HFSM160-420-16 	
6HFSM160-420-16	Amount of chip extraction 4.8cc/min Tool life 10pcs/ edge
Competitor Coating I	Amount of chip extraction 2.4cc/min Tool life 5pcs/ edge
<p>[Competitor Coating I] $\phi 16 \times 6$ flutes $V_c=30\text{m/min}$ ($n=597\text{min}^{-1}$) $a_p \times a_e=40 \times 0.3\text{mm}$ $fz=0.056\text{mm/t}$ ($V_f=200\text{mm/min}$)</p>	<p>User comments The cutting speed and table feed rate is doubled compared to competitor's coated product I. The cutting edge conditions are excellent and the tool life is also doubled.</p>
Evaluation by the user	

X155CrVMo121 / 1.2379 (63HRC)	
<ul style="list-style-type: none"> • Block • $V_c=70\text{m/min}$ ($n=3700\text{min}^{-1}$) • $a_p \times a_e=3 \times 0.12\text{mm}$ • $fz=0.04\text{mm/t}$ ($V_f=800\text{mm/min}$) • With coolant • 6 flutes • 6HFSM060-170-06 	
6HFSM060-170-06	
Competitor Coating J,K,L	
<p>[Competitor Coating J,K,L] $\phi 6 \times 6$ flutes $V_c=70\text{m/min}$ ($n=3700\text{min}^{-1}$) $a_p \times a_e=3 \times 0.12\text{mm}$ $fz=0.04\text{mm/t}$ ($V_f=800\text{mm/min}$)</p>	<p>Shouldering Compared to competitor's coated products, the 6HFSM has a three times as much tool life.</p>
Internal evaluation	

THE NEW VALUE FRONTIER



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