MOLDINO
The Edge To Innovation

EMXR-TH / EMXN-TH

Epoch MIRUS series

Mitsubishi Hitachi Tool Engineering, Ltd.

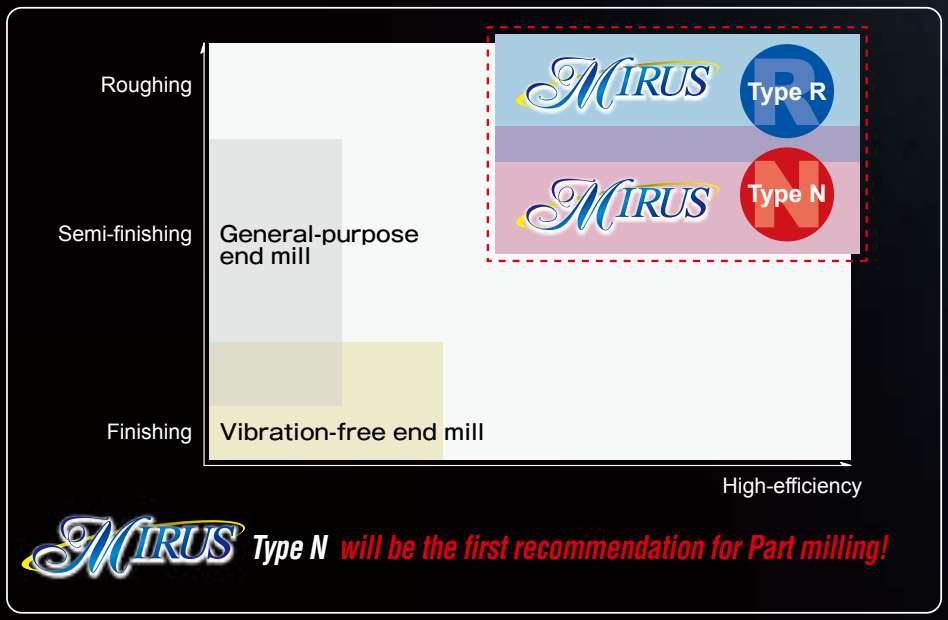
New Product News | No.0908E-5 | 2019-4

When the word "Mirus" is traced, it leads to Marvel

Epoch M

Since long ago Marvels gave us
Now, MIRUS is creating a new Marvel for

For parts milling



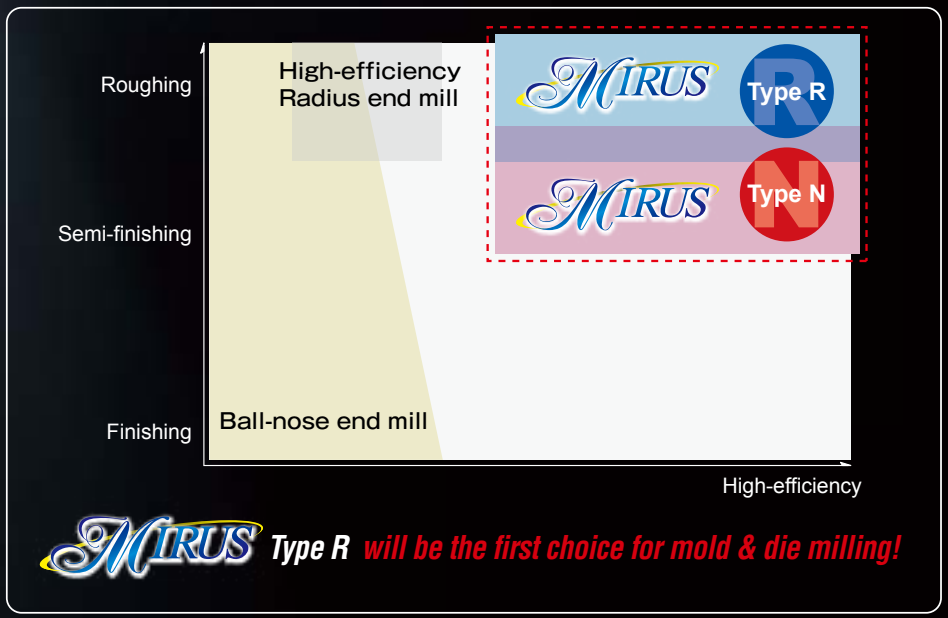
MIRUS Type N will be the first recommendation for Part milling!

(something wonderful or astonishing), and Smile.

MIRUS Series

many surprises and happiness...
the world. More benefits and more smiles...

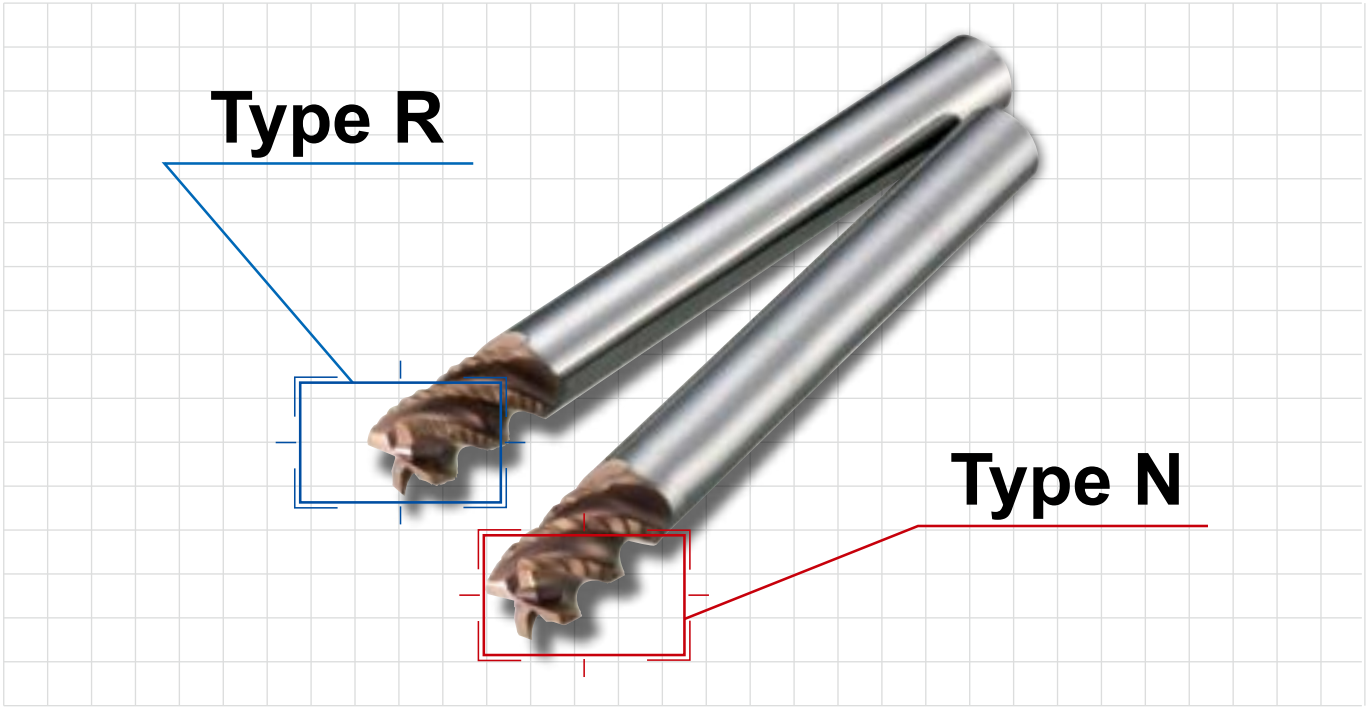
For mold & die milling



MIRUS *Type R will be the first choice for mold & die milling!*

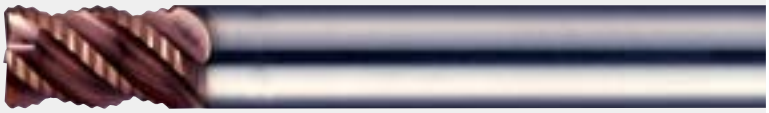
Pat.No.4694647

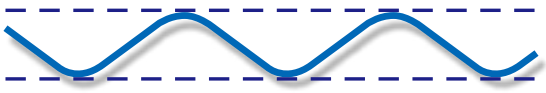
Roughing and Semi-finishing for Die-mold & Parts machining



Type R — Wave peripheral form

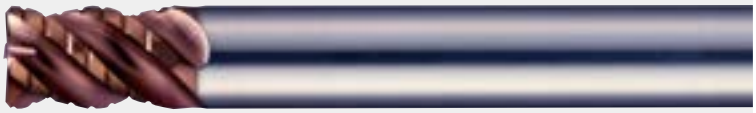
Low cutting force





Type N — Chip breaker peripheral form

High chipping resistance

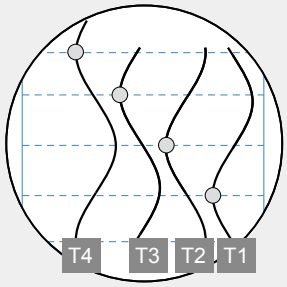


Unequal phase

Type R

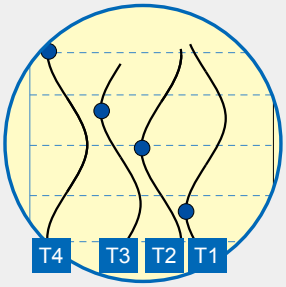
Phase of peripheral edge in one rotation

Conventional phase



Equal cutting volume

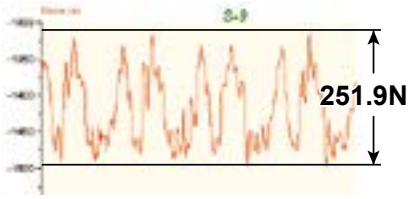
Unequal phase



Unequal cutting volume

Cutting force

Slotting
Work material：S50C
Tool：ϕ8×4NT
Revolution：n=8,000min^{-1}
Feed rate：v_f=3,000mm/min
a_p=8mm a_e=8mm



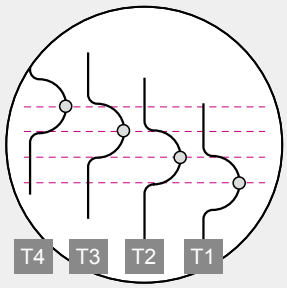
Conventional phase end mil

MIRUS
EMXR4080-TH

Type N

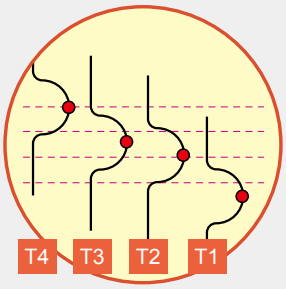
Phase of peripheral edge in one rotation

Conventional phase



Equal cutting volume

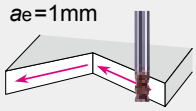
Unequal phase

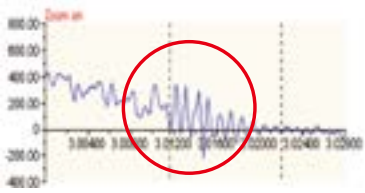


Unequal cutting volume

Cutting force

Work material：S50C
Tool：ϕ8×4NT
Revolution：n=5,000min^{-1}
Feed rate：v_f=1,500mm/min
a_p=8mm a_e=1mm





Conventional phase end mil

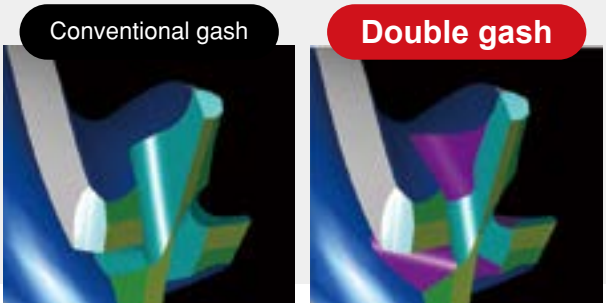
MIRUS
EMXN4080-TH

Effectively reduce vibration and achieve high efficiency!

Double gush guarantees high performance in vertical and horizontal feed!

Double Gash achieves perfect balance in rigidity and chip evacuation!

- First gash around tip of cutter for high rigidity.
- Secondary gash near peripheral for high chip-evacuation



New TH Coating

Features

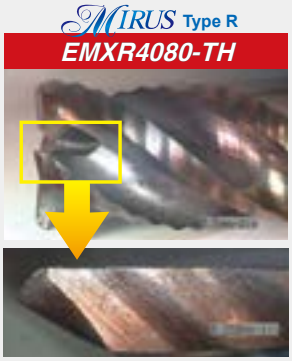
- Hardness and oxidation resistance of TH coatings is further improved. Enables longer life and higher efficient when cutting high-hardness materials.
  Hardness: 3800HV; Oxidation temperature: 1200°C
  (Si nano composite coating with finer crystal particles)
- Exhibits amazing performance in ultra high-efficiency machining.
- Long life for both dry cutting and wet cutting

Field data

01 Pocketing

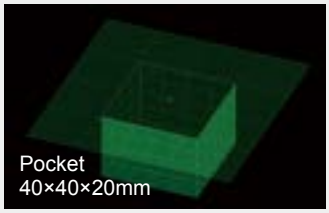
Work material : Pre-hardened steel (40HRC)
Spindle : HSK-A63
Tool : ϕ8×4NT
No. of rotation : n=6,000min^{-1}(v_c=150m/min)
Feed rate : v_f=1,920mm/min(f_z=0.08mm/t)
a_p×a_e=8.0mm×2.0mm OH=28mm
Ramping angle : 10°
Ramping feed : v_f=1,200mm/min

Metal Removal Rate Q=30.7cm^3/min



02 Pocketing

Work material : Equivalent to SUS420J2(52HRC)
Spindle : HSK-A63
Tool : ϕ8

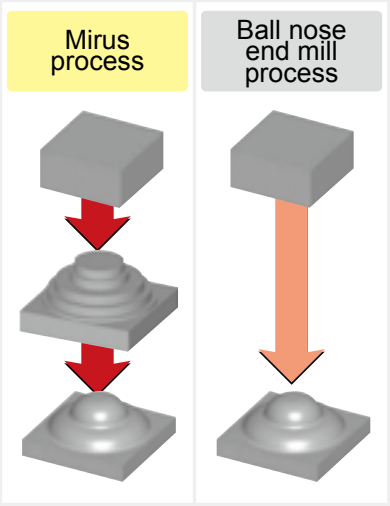


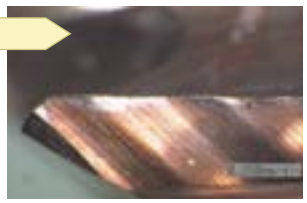
Item code	MIRUS Type R EMXR4080-TH	Conventional ball nose end mill
No. of rotation	6,000min^{-1}	7,950min^{-1}
Feed rate	1,920mm/min	2,050mm/min
Depth of cut a_p	8mm	0.4mm
Width of cut a_e	0.8mm	0.8mm
Ramping angle	3°	3°
Ramping feed	1,200mm/min	1,200mm/min
Metal Removal Rate	12.3cm^3/min	0.66cm^3/min

03 3D milling

MIRUS v.s. Ball End Mill

Work material : S50C
Spindle : HSK-A63
size : 100mm×100mm×80mm
Tool : ϕ8

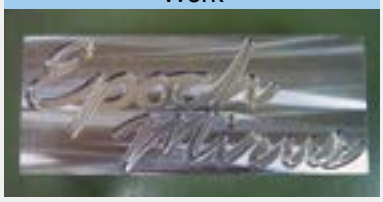


		MIRUS Type R EMXR4080-TH	Ball nose end mill
Process 1	Machining strategy	Z-constant milling	Z-constant milling
	No. of rotation	8,000min^{-1}	12,000min^{-1}
	Feed rate	4,200mm/min	3,500mm/min
	$a_p \times a_e$	8mm×4mm	0.8mm×2.4mm
	Cutting time	5min.	80min.
Process 2	Machining strategy	Two-way profiling	
	No. of rotation	8,000min^{-1}	
	Feed rate	4,200mm/min	
	a_e	3mm	
	Cutting time	5min.	
	Total cutting time	10min.	80min.
	Used tools	 EMXR4080-TH	 Ball nose end mill

04 Slotting

Work material : Equivalent to P20(32HRC)
Spindle : HSK-A63
Work size : 100mm×250mm×100mm
Tool : ϕ8×4NT

Work



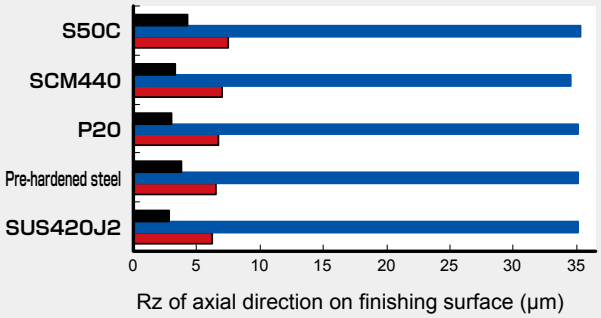
Used tool

Item code	MIRUS Type N EMXN4080-TH
No. of rotation	7,000min^{-1}
Feed rate	2,200mm/min
Depth of cut a_p	4mm
Width of cut a_e	8mm
Z Plunging Feed	400mm/min
Metal Removal Rate	70cm^3/min

05 Surface roughness

Tool : ■ Generous-purpose square end mill ■ EMXR4080-TH Type R ■ EMXN4080-TH Type N

Tool : ϕ8×4NT
Machining strategy : Side milling



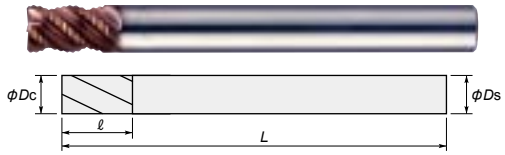
Rz of axial direction on finishing surface (μm)

Cutting conditions	No.of rotation n min^{-1}	Feed rate V_f mm/min	a_e mm	a_p mm
S50C	7,000	2,240	0.8	8
SCM440	6,400	1,640	0.8	8
P20 (30HRC)	6,400	1,640	0.8	8
Pre-hardened steel (40HRC)	5,600	1,250	0.8	8
SUS420J2 (52HRC)	4,800	920	0.8	8

Type R Dimensions

Carbide | ATH Coated | Helix 45° | 0 −0.050

4 flutes, Square, Straight



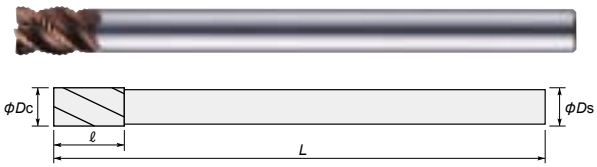
h5 (ϕ6~12) / h6 (ϕ16,ϕ20)

Ds≦6 : 0~−0.005
6<Ds≦10 : 0~−0.006
10<Ds≦12 : 0~−0.008
Ds=16 : 0~−0.011
Ds=20 : 0~−0.013 (mm)

EMXR4○○○-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Overall length L	Shank dia. Ds	No. of flutes
EMXR4060-TH	●	6	9	60	6	4
EMXR4080-TH	●	8	12	75	8	4
EMXR4100-TH	●	10	15	80	10	4
EMXR4120-TH	●	12	18	100	12	4
EMXR4160-TH	●	16	24	110	16	4
EMXR4200-TH	●	20	30	125	20	4

4 flutes, Square, Semi long shank



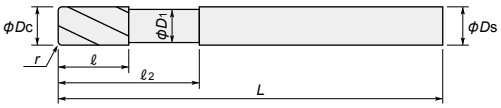
h6

Ds≦6 : 0~−0.008
6<Ds≦10 : 0~−0.009
10<Ds : 0~−0.011 (mm)

EMXR4○○○-SR-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Overall length L	Shank dia. Ds	No. of flutes
EMXR4070-SR-TH	●	7	9	90	6	4
EMXR4090-SR-TH	●	9	12	100	8	4
EMXR4110-SR-TH	●	11	15	110	10	4
EMXR4130-SR-TH	●	13	18	120	12	4

4 flutes, Radius, Straight 3Dc



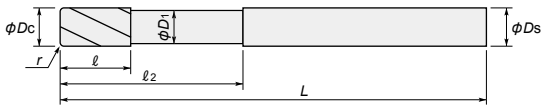
Corner Radius | h5

Ds≦6 : 0~−0.005
6<Ds≦10 : 0~−0.006
10<Ds : 0~−0.008 (mm)

EMXR4○○○-○○-○○-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Corner radius r	Neck dia. D1	Under neck length ℓ2	Overall length L	Shank dia. Ds	No. of flutes
EMXR4060-18-15-TH	●	6	9	1.5	5.5	18	60	6	4
EMXR4080-24-20-TH	●	8	12	2	7.3	24	75	8	4
EMXR4100-30-20-TH	●	10	15	2	9.1	30	80	10	4
EMXR4120-36-20-TH	●	12	18	2	11	36	100	12	4

4 flutes, Radius, Straight 5Dc



Corner Radius | h5

Ds≦6 : 0~−0.005
6<Ds≦10 : 0~−0.006
10<Ds : 0~−0.008 (mm)

EMXR4○○○-○○-○○-TH

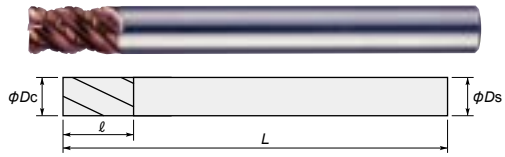
Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Corner radius r	Neck dia. D1	Under neck length ℓ2	Overall length L	Shank dia. Ds	No. of flutes
EMXR4060-30-15-TH	●	6	9	1.5	5.5	30	75	6	4
EMXR4080-40-20-TH	●	8	12	2	7.3	40	85	8	4
EMXR4100-50-20-TH	●	10	15	2	9.1	50	100	10	4
EMXR4120-60-20-TH	●	12	18	2	11.0	60	110	12	4

● : Stoked Items.

Type N Dimensions

Carbide | ATH Coated | Helix 45° | 0 -0.030

4 flutes, Square, Straight



h5 (ϕ6~12) h6 (ϕ16,ϕ20)

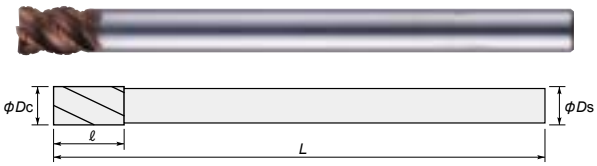
Ds≦6 : 0~−0.005
6<Ds≦10 : 0~−0.006
10<Ds≦12 : 0~−0.008
Ds=16 : 0~−0.011
Ds=20 : 0~−0.013 (mm)

EMXN4○○○-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Overall length L	Shank dia. Ds	No. of flutes
EMXN4060-TH	●	6	9	60	6	4
EMXN4080-TH	●	8	12	75	8	4
EMXN4100-TH	●	10	15	80	10	4
EMXN4120-TH	●	12	18	100	12	4
EMXN4160-TH	●	16	24	110	16	4
EMXN4200-TH	●	20	30	125	20	4

● : Stoked Items.

4 flutes, Square, Semi long shank



h6

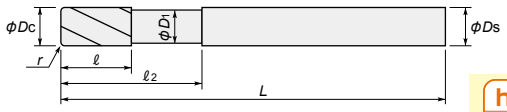
Ds≦6 : 0~−0.008
6<Ds≦10 : 0~−0.009
10<Ds : 0~−0.011 (mm)

EMXN4○○○-SR-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Overall length L	Shank dia. Ds	No. of flutes
EMXN4070-SR-TH	●	7	9	90	6	4
EMXN4090-SR-TH	●	9	12	100	8	4
EMXN4110-SR-TH	●	11	15	110	10	4
EMXN4130-SR-TH	●	13	18	120	12	4

● : Stoked Items.

4 flutes, Radius, Straight 3Dc



Corner Radius

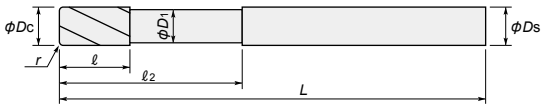
h5

Ds≦6 : 0~−0.005
6<Ds≦10 : 0~−0.006
10<Ds : 0~−0.008 (mm)

EMXN4○○○-○○-○○-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Corner radius r	Neck dia. D1	Under neck length ℓ2	Overall length L	Shank dia. Ds	No. of flutes
EMXN4060-18-05-TH	●	6	9	0.5	5.5	18	60	6	4
EMXN4060-18-15-TH	●		9	1.5	5.5	18	60	6	4
EMXN4080-24-05-TH	●	8	12	0.5	7.3	24	75	8	4
EMXN4080-24-20-TH	●		12	2	7.3	24	75	8	4
EMXN4100-30-05-TH	●	10	15	0.5	9.1	30	80	10	4
EMXN4100-30-20-TH	●		15	2	9.1	30	80	10	4
EMXN4120-36-05-TH	●	12	18	0.5	11	36	100	12	4
EMXN4120-36-20-TH	●		18	2	11	36	100	12	4

4 flutes, Radius, Straight 5Dc



Corner Radius

h5

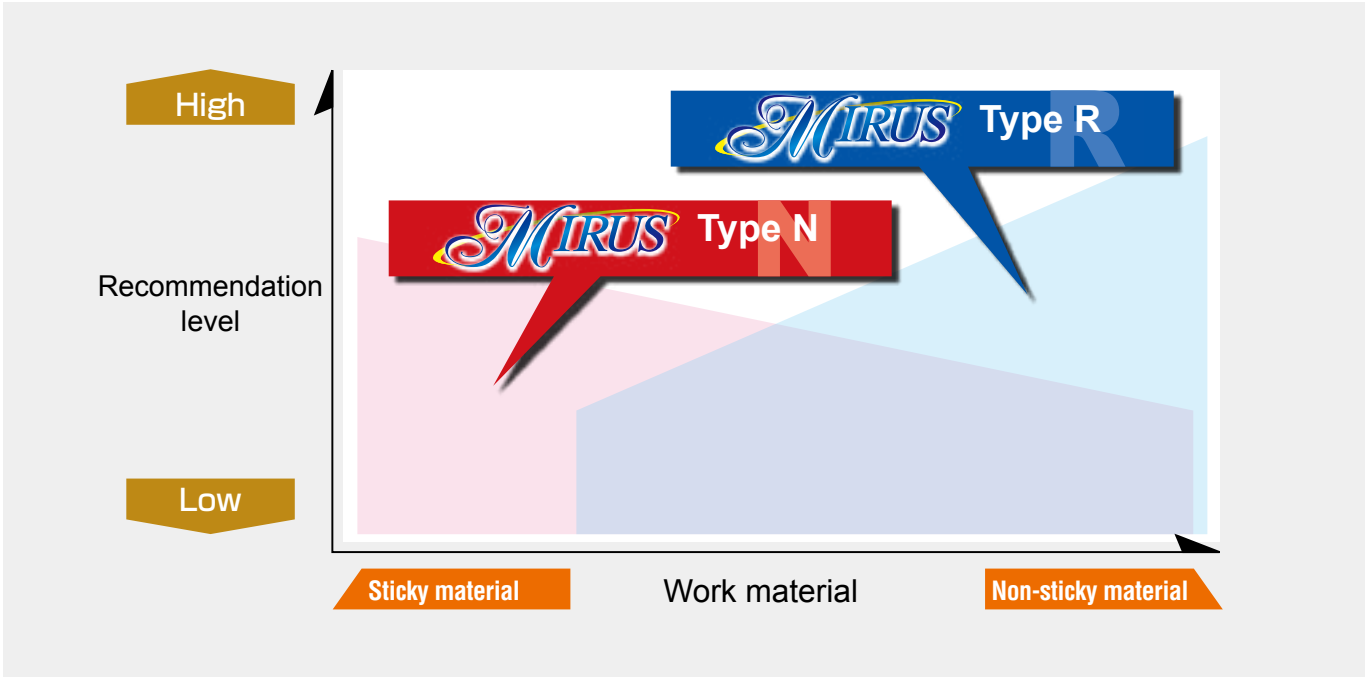
Ds≦6 : 0~−0.005
6<Ds≦10 : 0~−0.006
10<Ds : 0~−0.008 (mm)

EMXN4○○○-○○-○○-TH

Item code	Stock	Size (mm) Tool dia. Dc	Flute length ℓ	Corner radius r	Neck dia. D1	Under neck length ℓ2	Overall length L	Shank dia. Ds	No. of flutes
EMXN4060-30-15-TH	●	6	9	1.5	5.5	30	75	6	4
EMXN4080-40-20-TH	●	8	12	2	7.3	40	85	8	4
EMXN4100-50-20-TH	●	10	15	2	9.1	50	100	10	4
EMXN4120-60-20-TH	●	12	18	2	11.0	60	110	12	4

● : Stoked Items.

Recommendation based on work material type



Special geometry is adopted on tip of square type, for chipping resistance. please set up tool corner R with approx R for both type listed in following table.

Type R	Approx radius
φ6～φ7	0.4mm
φ8～φ12	0.5mm
φ13～φ20	0.7mm

Type N	Approx radius
φ6～φ7	0.4mm
φ8～φ13	0.5mm
φ14～φ20	0.7mm

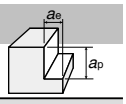
Most recommendable field

Work material	Recommendation items	Type R		Type N	
Cast iron Carbon steel Alloy steel (150～250HB) FC, S50C, SCM	Suitability	◎		◎	
	Process	Roughing	Semi-finishing	Roughing	Semi-finishing
	Slotting	○		○	
	Side milling	○		○	
	Z plunging	○		○	
	Max ramping angle	30˚ or less		20˚ or less	
Stainless steels (25～35HRC) SUS304	Suitability	×		○	
	Process	Roughing	Semi-finishing	Roughing	Semi-finishing
	Slotting	–		△	
	Side milling	–		○	
	Z plunging	–		×	
	Max ramping angle	–		5˚ or less	
Titanium alloy Ti-6Al-4V	Suitability	×		○	
	Process	Roughing	Semi-finishing	Roughing	Semi-finishing
	Slotting	–		○	
	Side milling	–		○	
	Z plunging	–		△	
	Max ramping angle	–		10˚ or less	
Pre-hardened steels (32～45HRC) PX5, HPM, NAK80	Suitability	◎		○	
	Process	Roughing	Semi-finishing	Roughing	Semi-finishing
	Slotting	○		○	
	Side milling	○		○	
	Z plunging	△		○	
	Max ramping angle	15˚ or less		10˚ or less	
Hardened steels (45～55HRC) SKD61, HPM38, STAVAX	Suitability	◎		○	
	Process	Roughing	Semi-finishing	Roughing	Semi-finishing
	Slotting	△		△	
	Side milling	○		○	
	Z plunging	×		×	
	Max ramping angle	5˚ or less		5˚ or less	

Recommended Cutting Conditions

4 flutes, Square, Straight EMXR-TH EMXN-TH

Side milling



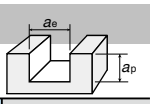
Type R

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	a_p=1.0D_c a_e=0.5D_c		a_p=1.0D_c a_e=0.375D_c		a_p=1.0D_c a_e=0.25D_c		a_p=1.0D_c a_e=0.125D_c	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	8,000	1,380	7,200	1,000	6,400	710	5,600	500
φ8	6,000	1,460	5,400	1,050	4,800	750	4,200	520
φ10	4,800	1,460	4,300	1,050	3,800	740	3,300	510
φ12	4,000	1,380	3,600	1,000	3,200	710	2,800	500
φ16	3,000	1,310	2,700	940	2,400	670	2,100	470
φ20	2,400	1,150	2,100	810	1,900	580	1,700	420

Type N

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	a_p=1.0D_c a_e=0.5D_c		a_p=1.0D_c a_e=0.375D_c		a_p=1.0D_c a_e=0.375D_c		a_p=1.0D_c a_e=0.25D_c		a_p=1.0D_c a_e=0.125D_c	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	7,400	1,280	6,600	910	6,600	270	5,800	640	5,000	440
φ8	5,600	1,360	5,000	970	5,000	290	4,400	680	3,800	470
φ10	4,500	1,370	4,000	970	4,000	290	3,500	680	3,000	470
φ12	3,700	1,280	3,300	910	3,300	270	2,900	640	2,500	440
φ16	2,800	1,220	2,500	870	2,500	260	2,200	610	1,900	420
φ20	2,200	1,060	2,000	770	2,000	230	1,800	550	1,500	370

Slotting



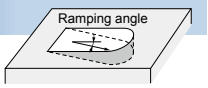
Type R

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	a_p=1.0D_c		a_p=0.8D_c		a_p=0.5D_c		a_p=0.2D_c	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	6,900	950	6,100	670	5,300	470	4,500	320
φ8	5,200	1,010	4,600	720	4,000	500	3,400	340
φ10	4,100	1,000	3,700	720	3,200	500	2,700	340
φ12	3,400	940	3,100	690	2,700	480	2,300	330
φ16	2,600	910	2,300	640	2,000	450	1,700	300
φ20	2,100	810	1,800	550	1,600	390	1,400	280

Type N

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	a_p=1.0D_c		a_p=0.8D_c		a_p=0.8D_c		a_p=0.5D_c		a_p=0.2D_c	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	6,400	880	5,600	620	5,600	190	4,800	420	4,000	280
φ8	4,800	930	4,200	650	4,200	200	3,600	450	3,000	300
φ10	3,800	920	3,300	640	3,300	190	2,900	450	2,400	300
φ12	3,200	880	2,800	620	2,800	190	2,400	420	2,000	280
φ16	2,400	840	2,100	580	2,100	170	1,800	400	1,500	270
φ20	1,900	730	1,700	520	1,700	160	1,400	340	1,200	240

Ramping



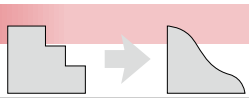
Type R

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Max. ramping angle	30° or less		15° or less		15° or less		5° or less	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	6,900	750	6,100	530	5,300	370	4,500	250
φ8	5,200	790	4,600	560	4,000	390	3,400	260
φ10	4,100	780	3,700	560	3,200	390	2,700	260
φ12	3,400	730	3,100	540	2,700	370	2,300	250
φ16	2,600	710	2,300	500	2,000	350	1,700	240
φ20	2,100	630	1,800	430	1,600	310	1,400	220

Type N

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Max. ramping angle	20° or less		10° or less		5°or less		10° or less		5° or less	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	6,400	690	5,600	480	5,600	140	4,800	330	4,000	220
φ8	4,800	730	4,200	510	4,200	150	3,600	350	3,000	230
φ10	3,800	720	3,300	500	3,300	150	2,900	350	2,400	230
φ12	3,200	690	2,800	480	2,800	140	2,400	330	2,000	220
φ16	2,400	650	2,100	460	2,100	140	1,800	310	1,500	210
φ20	1,900	570	1,700	410	1,700	120	1,400	270	1,200	180

Two-way profiling



Type R

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	max. a_e=0.5D_c		max. a_e=0.375D_c		max. a_e=0.25D_c		max. a_e=0.125D_c	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	8,000	1,730	7,200	1,240	6,400	880	5,600	620
φ8	6,000	1,820	5,400	1,310	4,800	930	4,200	650
φ10	4,800	1,820	4,300	1,310	3,800	920	3,300	640
φ12	4,000	1,730	3,600	1,240	3,200	880	2,800	620
φ16	3,000	1,630	2,700	1,180	2,400	840	2,100	580
φ20	2,400	1,440	2,100	1,010	1,900	730	1,700	520

Type N

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	max. a_e=0.5D_c		max. a_e=0.375D_c		max. a_e=0.375D_c		max. a_e=0.25D_c		max. a_e=0.125D_c	
Tool dia. D_c(mm)	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min	Revolution n min^{-1}	Feed rate V_f mm/min
φ6	7,400	1,600	6,600	1,140	6,600	340	5,800	800	5,000	550
φ8	5,600	1,700	5,000	1,220	5,000	370	4,400	860	3,800	590
φ10	4,500	1,710	4,000	1,220	4,000	370	3,500	850	3,000	580
φ12	3,700	1,600	3,300	1,140	3,300	340	2,900	800	2,500	550
φ16	2,800	1,520	2,500	1,090	2,500	330	2,200	770	1,900	530
φ20	2,200	1,320	2,000	960	2,000	290	1,800	690	1,500	460

※Type R is not recommendable for milling stainless steel or Ti alloy.

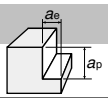
Features MIRUS has the capability of two-way profiling a work from geometry as figure 1 shown. Please refer to side milling cutting conditions for previous process.

Note
① Please use rpm and 1/3 those of slotting cutting conditions respectively for Z plunging.
② Use a highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.
⑤Please ensure that air blow or coolant is correctly positioned in order to remove the chip immediately.
⑥In order to avoid clamping looseness, Please adjust cutting conditions according to type of machine center and holder.

Recommended Cutting Conditions

4 flutes, Square, Semi long shank EMXR-SR-TH EMXN-SR-TH

Side milling



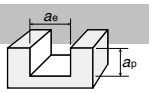
Type R

Tool dia. Dc (mm)	L/D	Ratio to standard depth of cut	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)			ap=1.0Dc, ae=0.5Dc × Ratio to standard depth of cut		ap=1.0Dc, ae=0.375Dc × Ratio to standard depth of cut		ap=1.0Dc, ae=0.25Dc × Ratio to standard depth of cut		ap=1.0Dc, ae=0.125Dc × Ratio to standard depth of cut	
			Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ7	4	100%	6,800	1,370	6,100	980	5,500	710	4,800	500
	5	70%	4,800	960	4,300	690	3,900	500	3,400	350
	6	50%	3,400	690	3,100	490	2,800	360	2,400	250
ϕ9	4	100%	5,300	1,450	4,800	1,050	4,200	740	3,700	520
	5	70%	3,700	1,020	3,400	740	2,900	520	2,600	360
	6	50%	2,700	730	2,400	530	2,100	370	1,900	260
ϕ11	4	100%	4,300	1,440	3,900	1,040	3,500	750	3,000	510
	5	70%	3,000	1,010	2,700	730	2,500	530	2,100	360
	6	50%	2,200	720	2,000	520	1,800	380	1,500	260
ϕ13	4	100%	3,700	1,390	3,300	990	2,900	690	2,600	500
	5	70%	2,600	970	2,300	690	2,000	480	1,800	350
	6	50%	1,900	700	1,700	500	1,500	350	1,300	250

Type N

Tool dia. Dc (mm)	L/D	Ratio to standard depth of cut	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)			ap=1.0Dc × Ratio to standard depth of cut		ap=0.8Dc × Ratio to standard depth of cut		ap=0.8Dc × Ratio to standard depth of cut		ap=0.25Dc × Ratio to standard depth of cut		ap=0.125Dc × Ratio to standard depth of cut	
			Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ7	4	100%	6,400	1,290	5,700	920	5,700	280	5,000	650	4,300	440
	5	70%	4,500	900	4,000	640	4,000	190	3,500	460	3,000	310
	6	50%	3,200	650	2,900	460	2,900	140	2,500	330	2,200	220
ϕ9	4	100%	5,000	1,370	4,400	960	4,400	290	3,900	680	3,400	480
	5	70%	3,500	960	3,100	670	3,100	200	2,700	480	2,400	340
	6	50%	2,500	690	2,200	480	2,200	140	2,000	340	1,700	240
ϕ11	4	100%	4,100	1,370	3,600	960	3,600	290	3,200	680	2,700	460
	5	70%	2,900	960	2,500	670	2,500	200	2,200	480	1,900	320
	6	50%	2,100	690	1,800	480	1,800	140	1,600	340	1,400	230
ϕ13	4	100%	3,400	1,270	3,100	930	3,100	280	2,700	650	2,300	440
	5	70%	2,400	890	2,200	650	2,200	200	1,900	460	1,600	310
	6	50%	1,700	640	1,600	470	1,600	140	1,400	330	1,200	220

Slotting



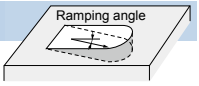
Type R

Tool dia. Dc (mm)	L/D	Ratio to standard depth of cut	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)			ap=1.0Dc × Ratio to standard depth of cut		ap=0.8Dc × Ratio to standard depth of cut		ap=0.5Dc × Ratio to standard depth of cut		ap=0.2Dc × Ratio to standard depth of cut	
			Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ7	4	100%	5,900	950	5,200	670	4,500	460	3,900	320
	5	70%	3,500	570	3,100	400	2,700	280	2,300	190
	6	50%	1,800	290	1,600	200	1,400	140	1,200	100
ϕ9	4	100%	4,600	1,010	4,100	720	3,500	490	3,000	340
	5	70%	2,800	610	2,500	430	2,100	290	1,800	200
	6	50%	1,400	300	1,200	220	1,100	150	900	100
ϕ11	4	100%	3,800	1,020	3,300	710	2,900	500	2,500	340
	5	70%	2,300	610	2,000	430	1,700	300	1,500	200
	6	50%	1,100	310	1,000	210	900	150	800	100
ϕ13	4	100%	3,200	960	2,800	670	2,400	460	2,100	320
	5	70%	1,900	580	1,700	400	1,400	280	1,300	190
	6	50%	1,000	290	800	200	700	140	600	100

Type N

Tool dia. Dc (mm)	L/D	Ratio to standard depth of cut	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)			ap=1.0Dc × Ratio to standard depth of cut		ap=0.8Dc × Ratio to standard depth of cut		ap=0.8Dc × Ratio to standard depth of cut		ap=0.5Dc × Ratio to standard depth of cut		ap=0.2Dc × Ratio to standard depth of cut	
			Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ7	4	100%	5,500	890	4,800	620	4,800	190	4,100	420	3,400	280
	5	70%	3,300	530	2,900	370	2,900	110	2,500	250	2,000	170
	6	50%	1,700	270	1,400	190	1,400	60	1,200	130	1,000	80
ϕ9	4	100%	4,200	920	3,700	650	3,700	200	3,200	450	2,700	300
	5	70%	2,500	550	2,200	390	2,200	120	1,900	270	1,600	180
	6	50%	1,300	280	1,100	200	1,100	60	1,000	140	800	90
ϕ11	4	100%	3,500	940	3,000	640	3,000	190	2,600	450	2,200	300
	5	70%	2,100	560	1,800	380	1,800	110	1,600	270	1,300	180
	6	50%	1,100	280	900	190	900	60	800	140	700	90
ϕ13	4	100%	2,900	870	2,600	620	2,600	190	2,200	420	1,800	280
	5	70%	1,700	520	1,600	370	1,600	110	1,300	250	1,100	170
	6	50%	900	260	800	190	800	60	700	130	500	80

Ramping



Type R

Tool dia. Dc (mm)	L/D	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Max. ramping angle		30° or less		15° or less		15° or less		5° or less	
		Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ7	4	5,900	740	5,200	520	4,500	360	3,900	250
	5	4,100	520	3,600	360	3,200	250	2,700	180
	6	3,000	370	2,600	260	2,300	180	2,000	130
ϕ9	4	4,600	790	4,100	560	3,500	380	3,000	260
	5	3,200	550	2,900	390	2,500	270	2,100	180
	6	2,300	400	2,100	280	1,800	190	1,500	130
ϕ11	4	3,800	790	3,300	550	2,900	390	2,500	270
	5	2,700	550	2,300	390	2,000	270	1,800	190
	6	1,900	400	1,700	280	1,500	200	1,300	140
ϕ13	4	3,200	750	2,800	520	2,400	360	2,100	250
	5	2,200	530	2,000	360	1,700	250	1,500	180
	6	1,600	380	1,400	260	1,200	180	1,100	130

Type N

Tool dia. Dc (mm)	L/D	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Max. ramping angle		20° or less		10° or less		5° or less		10° or less		5° or less	
		Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ7	4	5,500	690	4,800	480	4,800	140	4,100	330	3,400	220
	5	3,900	480	3,400	340	3,400	100	2,900	230	2,400	150
	6	2,800	350	2,400	240	2,400	70	2,100	170	1,700	110
ϕ9	4	4,200	720	3,700	510	3,700	150	3,200	350	2,700	240
	5	2,900	500	2,600	360	2,600	110	2,200	250	1,900	170
	6	2,100	360	1,900	260	1,900	80	1,600	180	1,400	120
ϕ11	4	3,500	730	3,000	500	3,000	150	2,600	350	2,200	240
	5	2,500	510	2,100	350	2,100	110	1,800	250	1,500	170
	6	1,800	370	1,500	250	1,500	80	1,300	180	1,100	120
ϕ13	4	2,900	680	2,600	490	2,600	150	2,200	330	1,800	220
	5	2,000	480	1,800	340	1,800	100	1,500	230	1,300	150
	6	1,500	340	1,300	250	1,300	80	1,100	170	900	110

※Type R is not recommendable for milling stainless steel or Ti alloy.

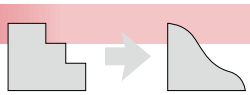
Note
① Please use rpm and 1/3 those of slotting cutting conditions respectively for Z plunging.
② Use a highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.
⑤ Please ensure that air blow or coolant is correctly positioned in order to remove the chip immediately.
⑥ In order to avoid clamping looseness, Please adjust cutting conditions according to type of machine center and holder.
⑦ Please change ratio to standard depth of cut in the appllication with more than 4Dc tool overhang.

4 flutes, Square, Semi long shank EMXR-SR-TH EMXN-SR-TH

Two-way profiling

Type R

Type N

Fig.1 

			Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4		Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)			max. *ae*=0.5*Dc* × Ratio to standard depth of cut		max. *ae*=0.375*Dc* × Ratio to standard depth of cut		max. *ae*=0.25*Dc* × Ratio to standard depth of cut		max. *ae*=0.125*Dc* × Ratio to standard depth of cut		max. *ae*=0.5*Dc* × Ratio to standard depth of cut		max. *ae*=0.375*Dc* × Ratio to standard depth of cut		max. *ae*=0.375*Dc* × Ratio to standard depth of cut		max. *ae*=0.25*Dc* × Ratio to standard depth of cut		max. *ae*=0.125*Dc* × Ratio to standard depth of cut	
Tool dia. *Dc* (mm)	L/D	Ratio to standard depth of cut	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ7	4	100%	6,800	1,710	6,100	1,230	5,500	890	4,800	620	6,400	1,610	5,700	1,150	5,700	350	5,000	810	4,300	550
	5	70%	4,800	1,200	4,300	860	3,900	620	3,400	430	4,500	1,130	4,000	810	4,000	240	3,500	570	3,000	390
	6	50%	3,400	860	3,100	620	2,800	450	2,400	310	3,200	810	2,900	580	2,900	170	2,500	410	2,200	280
φ9	4	100%	5,300	1,810	4,800	1,310	4,200	920	3,700	650	5,000	1,710	4,400	1,200	4,400	360	3,900	850	3,400	600
	5	70%	3,700	1,270	3,400	920	2,900	640	2,600	460	3,500	1,200	3,100	840	3,100	250	2,700	600	2,400	420
	6	50%	2,700	910	2,400	660	2,100	460	1,900	330	2,500	860	2,200	600	2,200	180	2,000	430	1,700	300
φ11	4	100%	4,300	1,800	3,900	1,300	3,500	940	3,000	640	4,100	1,710	3,600	1,200	3,600	360	3,200	860	2,700	580
	5	70%	3,000	1,260	2,700	910	2,500	660	2,100	450	2,900	1,200	2,500	840	2,500	250	2,200	600	1,900	410
	6	50%	2,200	900	2,000	650	1,800	470	1,500	320	2,100	860	1,800	600	1,800	180	1,600	430	1,400	290
φ13	4	100%	3,700	1,730	3,300	1,240	2,900	870	2,600	620	3,400	1,590	3,100	1,160	3,100	350	2,700	810	2,300	550
	5	70%	2,600	1,210	2,300	870	2,000	610	1,800	430	2,400	1,110	2,200	810	2,200	240	1,900	570	1,600	390
	6	50%	1,900	870	1,700	620	1,500	440	1,300	310	1,700	800	1,600	580	1,600	170	1,400	410	1,200	280

※Type R is not recommendable for milling stainless steel or Ti alloy.

Features MIRUS has the capability of two-way profiling a work from geometry as figure 1 shown. Please refer to side milling cutting conditions for previous process.

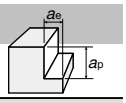
Note Please refer to the precautions in page 12.

4 flutes, Radius, Straight 3Dc EMXR-CR-TH EMXN-CR-TH

Side milling

Type R

Type N

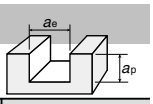


	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4		Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	*ap*=1.0*Dc* *ae*=0.5*Dc*		*ap*=1.0*Dc* *ae*=0.375*Dc*		*ap*=1.0*Dc* *ae*=0.25*Dc*		*ap*=1.0*Dc* *ae*=0.125*Dc*		*ap*=1.0*Dc* *ae*=0.5*Dc*		*ap*=1.0*Dc* *ae*=0.375*Dc*		*ap*=1.0*Dc* *ae*=0.375*Dc*		*ap*=1.0*Dc* *ae*=0.25*Dc*		*ap*=1.0*Dc* *ae*=0.125*Dc*	
Tool dia. *Dc*(mm)	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ6	8,000	1,380	7,200	1,000	6,400	710	5,600	500	7,400	1,280	6,600	910	6,600	270	5,800	640	5,000	440
φ8	6,000	1,460	5,400	1,050	4,800	750	4,200	520	5,600	1,360	5,000	970	5,000	290	4,400	680	3,800	470
φ10	4,800	1,460	4,300	1,050	3,800	740	3,300	510	4,500	1,370	4,000	970	4,000	290	3,500	680	3,000	470
φ12	4,000	1,380	3,600	1,000	3,200	710	2,800	500	3,700	1,280	3,300	910	3,300	270	2,900	640	2,500	440

Slotting

Type R

Type N



	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4		Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	*ap*=1.0*Dc*		*ap*=0.8*Dc*		*ap*=0.5*Dc*		*ap*=0.2*Dc*		*ap*=1.0*Dc*		*ap*=0.8*Dc*		*ap*=0.8*Dc*		*ap*=0.5*Dc*		*ap*=0.2*Dc*	
Tool dia. *Dc*(mm)	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ6	6,900	950	6,100	670	5,300	470	4,500	320	6,400	880	5,600	620	5,600	190	4,800	420	4,000	280
φ8	5,200	1,010	4,600	720	4,000	500	3,400	340	4,800	930	4,200	650	4,200	200	3,600	450	3,000	300
φ10	4,100	1,000	3,700	720	3,200	500	2,700	340	3,800	920	3,300	640	3,300	190	2,900	450	2,400	300
φ12	3,400	940	3,100	690	2,700	480	2,300	330	3,200	880	2,800	620	2,800	190	2,400	420	2,000	280

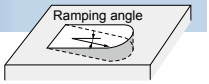
※Type R is not recommendable for milling stainless steel or Ti alloy.

Note
① Radius type is not recommendable for Z plunging.
② Use a highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.
⑤Please ensure that air blow or coolant is correctly positioned in order to remove the chip immediately.
⑥In order to avoid clamping looseness, Please adjust cutting conditions according to type of machine center and holder.

Recommended Cutting Conditions

4 flutes, Radius, Straight 3Dc EMXR-CR-TH EMXN-CR-TH

Ramping



Type R

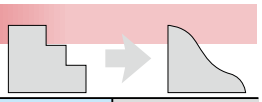
	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Max. ramping angle	30° or less		15° or less		15° or less		5° or less	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	6,900	750	6,100	530	5,300	370	4,500	250
ϕ8	5,200	790	4,600	560	4,000	390	3,400	260
ϕ10	4,100	780	3,700	560	3,200	390	2,700	260
ϕ12	3,400	730	3,100	540	2,700	370	2,300	250

Type N

	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Max. ramping angle	20° or less		10° or less		5° or less		10° or less		5° or less	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	6,400	690	5,600	480	5,600	140	4,800	330	4,000	220
ϕ8	4,800	730	4,200	510	4,200	150	3,600	350	3,000	230
ϕ10	3,800	720	3,300	500	3,300	150	2,900	350	2,400	230
ϕ12	3,200	690	2,800	480	2,800	140	2,400	330	2,000	220

Two-way profiling

Fig.1



Type R

	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Max. ramping angle	max. ae=0.5Dc		max. ae=0.375Dc		max. ae=0.25Dc		max. ae=0.125Dc	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	8,000	1,730	7,200	1,240	6,400	880	5,600	620
ϕ8	6,000	1,820	5,400	1,310	4,800	930	4,200	650
ϕ10	4,800	1,820	4,300	1,310	3,800	920	3,300	640
ϕ12	4,000	1,730	3,600	1,240	3,200	880	2,800	620

Type N

	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Max. ramping angle	max. ae=0.5Dc		max. ae=0.375Dc		max. ae=0.375Dc		max. ae=0.25Dc		max. ae=0.125Dc	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	7,400	1,600	6,600	1,140	6,600	340	5,800	800	5,000	550
ϕ8	5,600	1,700	5,000	1,220	5,000	370	4,400	860	3,800	590
ϕ10	4,500	1,710	4,000	1,220	4,000	370	3,500	850	3,000	580
ϕ12	3,700	1,600	3,300	1,140	3,300	340	2,900	800	2,500	550

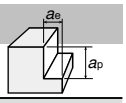
※Type R is not recommendable for milling stainless steel or Ti alloy.

Features MIRUS has the capability of two-way profiling a work from geometry as figure 1 shown. Please refer to side milling cutting conditions for previous process.

Note Please refer to the precautions in page 13.

4 flutes, Radius, Straight 5Dc EMXR-CR-TH EMXN-CR-TH

Side milling



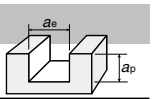
Type R

	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Depth of cut (mm)	ap=0.7Dc ae=0.35Dc		ap=0.7Dc ae=0.26Dc		ap=0.7Dc ae=0.175Dc		ap=0.7Dc ae=0.087Dc	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	5,600	970	4,800	660	4,000	440	3,200	280
ϕ8	4,200	1,020	3,600	700	3,000	470	2,400	300
ϕ10	3,300	1,000	2,900	710	2,400	470	1,900	300
ϕ12	2,800	970	2,400	660	2,000	440	1,600	280

Type N

	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Depth of cut (mm)	ap=0.7Dc ae=0.35Dc		ap=0.7Dc ae=0.26Dc		ap=0.7Dc ae=0.26Dc		ap=0.7Dc ae=0.175Dc		ap=0.7Dc ae=0.087Dc	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	5,300	920	4,500	620	4,500	190	3,700	410	2,900	260
ϕ8	4,000	970	3,400	660	3,400	200	2,800	440	2,200	270
ϕ10	3,200	970	2,700	660	2,700	200	2,200	430	1,800	280
ϕ12	2,700	930	2,300	640	2,300	190	1,900	420	1,500	270

Slotting



Type R

	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Depth of cut (mm)	ap=0.7Dc		ap=0.56Dc		ap=0.35Dc		ap=0.14Dc	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	4,200	580	3,400	380	2,700	240	1,900	130
ϕ8	3,200	620	2,600	400	2,000	250	1,400	140
ϕ10	2,500	610	2,100	410	1,600	250	1,100	140
ϕ12	2,100	580	1,700	380	1,300	230	900	130

Type N

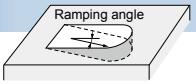
	Cast iron, Carbon steels Alloy steels (150~250HB) FC, S50C, SCM		Tool steels (25~35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35~45HRC) NAK80, CENA1		Hardened steels (45~55HRC) SKD61, SKT4	
Depth of cut (mm)	ap=0.7Dc		ap=0.56Dc		ap=0.56Dc		ap=0.35Dc		ap=0.14Dc	
Tool dia. Dc(mm)	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min	Revolution n min-1	Feed rate Vf mm/min
ϕ6	3,700	510	2,900	320	2,900	100	2,100	190	1,300	90
ϕ8	2,800	540	2,200	340	2,200	100	1,600	200	1,000	100
ϕ10	2,200	540	1,800	350	1,800	110	1,300	200	800	100
ϕ12	1,900	530	1,500	330	1,500	100	1,100	190	700	100

※Type R is not recommendable for milling stainless steel or Ti alloy.

Note
① Radius type is not recommendable for Z plunging.
② Use a highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.
⑤Please ensure that air blow or coolant is correctly positioned in order to remove the chip immediately.
⑥In order to avoid clamping looseness, Please adjust cutting conditions according to type of machine center and holder.

4 flutes, Radius, Straight 5Dc EMXR-CR-TH EMXN-CR-TH

Ramping



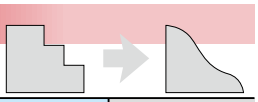
Type R

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Max. ramping angle	30° or less		15° or less		15° or less		5° or less	
Tool dia. *Dc*(mm)	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ6	4,800	520	4,000	350	3,200	220	2,400	130
φ8	3,600	550	3,000	360	2,400	230	1,800	140
φ10	2,900	550	2,400	360	1,900	230	1,400	140
φ12	2,400	520	2,000	350	1,600	220	1,200	130

Type N

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Max. ramping angle	20° or less		10° or less		5° or less		10° or less		5° or less	
Tool dia. *Dc*(mm)	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ6	4,500	490	3,700	320	3,700	100	2,900	200	2,100	120
φ8	3,400	520	2,800	340	2,800	100	2,200	210	1,600	120
φ10	2,700	510	2,200	330	2,200	100	1,800	220	1,300	130
φ12	2,300	500	1,900	330	1,900	100	1,500	210	1,100	120

Two-way profiling


図① Fig.1

Type R

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	max. *ae*=0.35*Dc*		max. *ae*=0.26*Dc*		max. *ae*=0.175*Dc*		max. *ae*=0.087*Dc*	
Tool dia. *Dc*(mm)	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ6	5,600	1,210	4,800	830	4,000	550	3,200	350
φ8	4,200	1,280	3,600	880	3,000	580	2,400	370
φ10	3,300	1,250	2,900	880	2,400	580	1,900	370
φ12	2,800	1,210	2,400	830	2,000	550	1,600	350

Type N

	Cast iron, Carbon steels Alloy steels (150～250HB) FC, S50C, SCM		Tool steels (25～35HRC) SKD		Stainless steels SUS		Pre-hardened steels (35～45HRC) NAK80, CENA1		Hardened steels (45～55HRC) SKD61, SKT4	
Depth of cut (mm)	max. *ae*=0.35*Dc*		max. *ae*=0.26*Dc*		max. *ae*=0.26*Dc*		max. *ae*=0.175*Dc*		max. *ae*=0.087*Dc*	
Tool dia. *Dc*(mm)	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min	Revolution *n* min⁻¹	Feed rate *Vf* mm/min
φ6	5,300	1,140	4,500	780	4,500	230	3,700	510	2,900	320
φ8	4,000	1,220	3,400	830	3,400	250	2,800	540	2,200	340
φ10	3,200	1,220	2,700	820	2,700	250	2,200	540	1,800	350
φ12	2,700	1,170	2,300	790	2,300	240	1,900	530	1,500	330

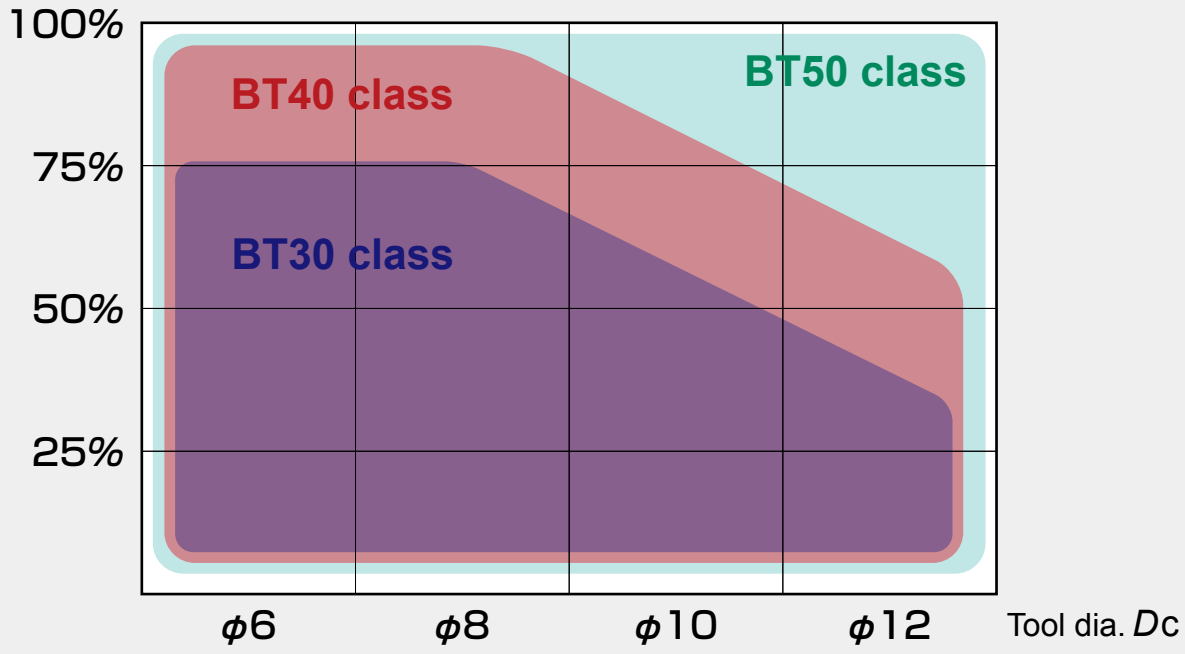
※Type R is not recommendable for milling stainless steel or Ti alloy.

Features MIRUS has the capability of two-way profiling a work from geometry as figure 1 shown. Please refer to side milling cutting conditions for previous process.

Note Please refer to the precautions in page 14.

Cutting condition adjustment based on spindle type

Ratio to depth of cut



Standard cutting condition is for BT50 class spindle situation. Please adjust the step according to above chart.

MOLDINO

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The diagrams and table data are examples of test results, and are not guaranteed values.

Attentions on Safety

1. Cautions regarding handling

(1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
(2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting

(1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
(2) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use

(1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
(2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
(3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
(4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. **Please caution of fire while using oil base coolant, fire prevention is necessary.**
(5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding

(1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
(2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
(3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with thelocal laws and regulations regarding prevention of hazards due to specified chemical substances.

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2019-4(K)
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