

NEW

TR2F *type*

Radius Mill TR2F

*Excellent cutting performance
for long-overhang machining
and machining of high-performance materials
for die-casting molds!*



MOLDINO Tool Engineering, Ltd.

New Product News | No.2501E | 2025-2

“Have you given up on high-efficiency machining of high-performance materials for die-casting molds?”

Issues in the field

No.1

Machining high-performance materials takes too long!
I want to improve productivity.



Proposed solutions

A combination of high efficiency machining for high-performance materials and extended tool life!

100~150m/min

Cutting speed V_c

High efficiency



Point!

Tool life 2.3 times that of conventional products

Conventional



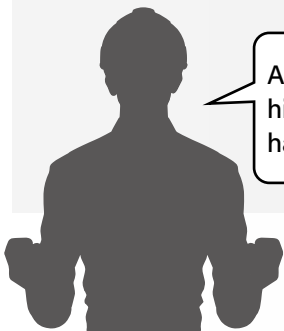
TR2F

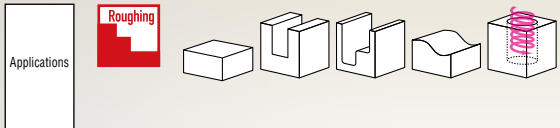
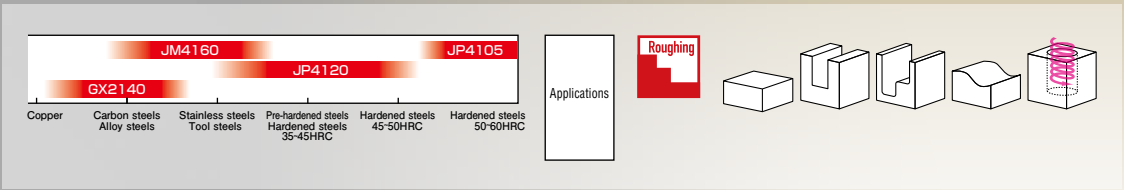


• Unique cutting edge profile ensures excellent chip formation even under high-speed conditions.

Ability to use higher cutting speeds has improved productivity!

Work material : DH31-S (45HRC)
Tool dia. : $\phi 20\text{mm}$
Cutting speed : $V_c = 120\text{m/min}$
Feed rate : $f_z = 0.8\text{mm/t}$
Depth of cut : $a_p \times a_e = 0.3 \times 13\text{mm}$
Overhang : $\text{OH} = 120\text{mm}$ ($L/D = 6$)





Issues in the field

No.2

Our current deep machining methods don't provide the consistency we need, so we've always used electrical discharge machining.

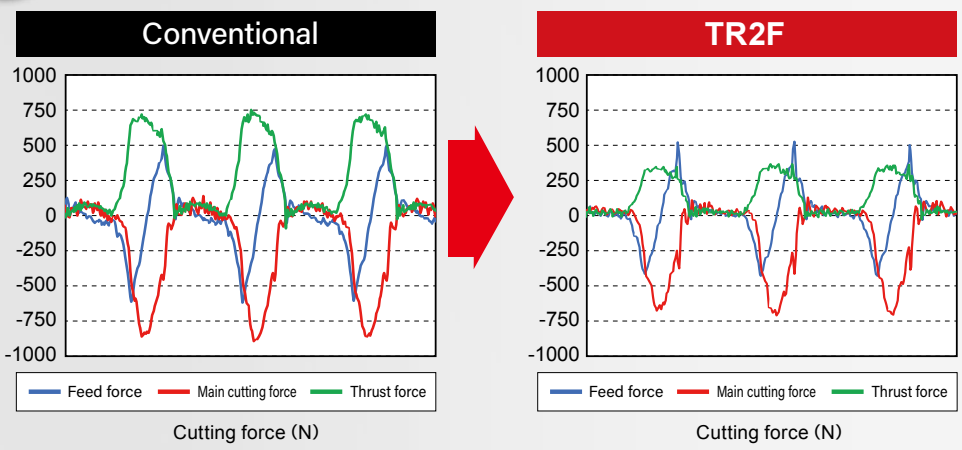
Proposed solutions

Resists chattering even with long overhangs!

»»

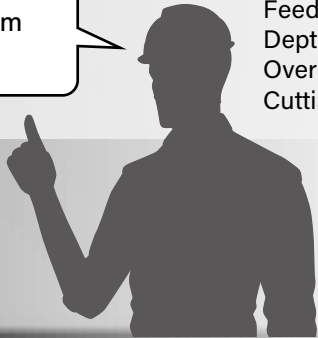
Point!

34% lower cutting resistance compared to conventional products



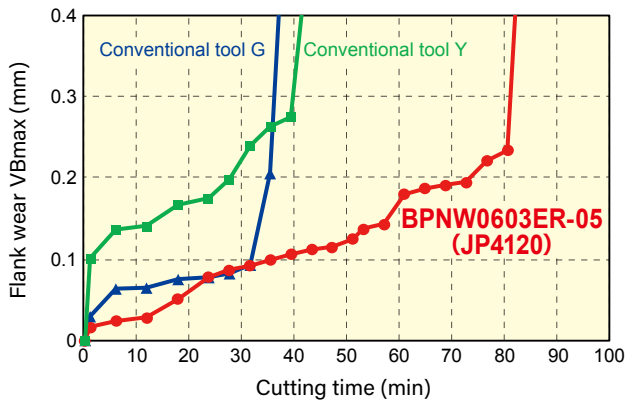
Reliable machining is possible even with an overhang of 120 mm (L/D = 6)!

Work material : DH31-S (45HRC)
 Tool dia. : $\phi 20\text{mm}$
 Cutting speed : $V_c = 150\text{m/min}$
 Feed rate : $f_z = 0.8\text{mm/t}$
 Depth of cut : $a_p \times a_e = 0.3 \times 13\text{mm}$
 Overhang : OH=120mm (L/D=6)
 Cutting conditions : Dry, Single-edge cutting

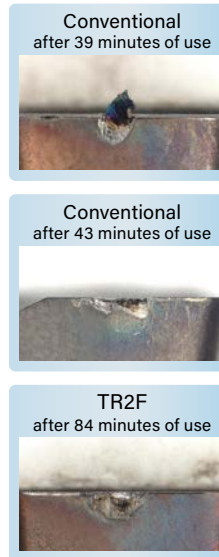


Cutting performance

Tool life curve for high-performance material (45 HRC) with L/D = 6 at Vc 120



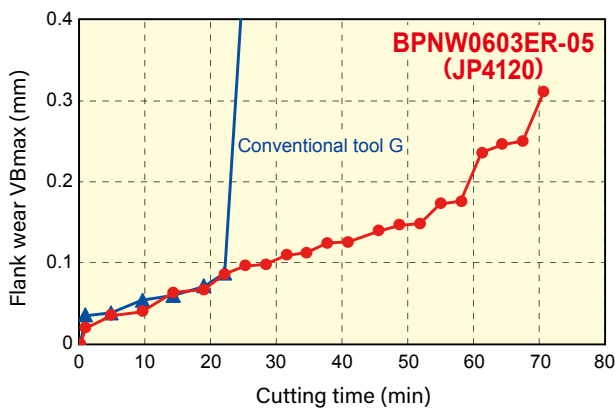
Extended tool life even with long overhangs



Cutting conditions

Work material	DH31-S (45HRC)
Tool	TR2F2020M
Insert model	BPNW0603ER-05
Cutting speed	$v_c = 120\text{m/min}$
Feed per tooth	$f_z = 0.8\text{mm/t}$
Cutting depth	$a_p \times a_e = 0.3 \times 13\text{mm}$
Overhang	120mm
Air-blow, Single flute cutting	

Tool life curve for high-performance material (45 HRC) with L/D = 6 at Vc 150



Long tool life and consistent damage pattern even at increased cutting speeds



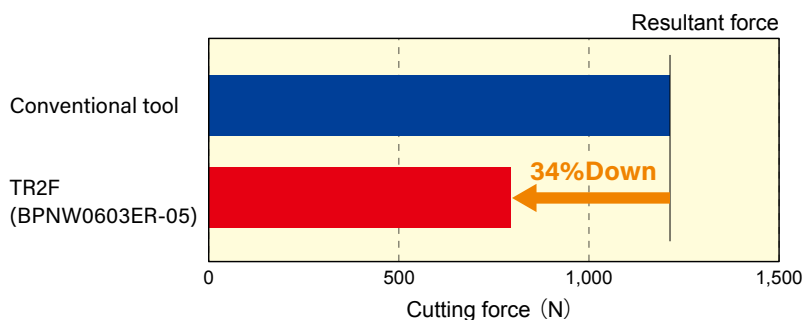
Cutting conditions

Work material	DH31-S (45HRC)
Tool	TR2F2020M
Insert model	BPNW0603ER-05
Cutting speed	$v_c = 150\text{m/min}$
Feed per tooth	$f_z = 0.8\text{mm/t}$
Cutting depth	$a_p \times a_e = 0.3 \times 13\text{mm}$
Overhang	120mm
Air-blow, Single flute cutting	

Cutting edge features

BPNW0603ER-05

Reduced cutting resistance thanks to smooth cutting edge specially designed for machining high-performance materials



Cutting conditions

Work material	DH31-S (45HRC)
Tool diameter	$\phi 20\text{mm}$
Cutting speed	$v_c = 150\text{m/min}$
Feed per tooth	$f_z = 0.8\text{mm/t}$
Cutting depth	$a_p \times a_e = 0.3 \times 13\text{mm}$
Overhang	OH=120mm (L/D=6)

Line Up

Shank type

TR2F20 \square 00 \square -00(R-0)

Numeric figure in a circle \square and Alphabetical character comes in a square \square .



Fig.1
(Standard type)

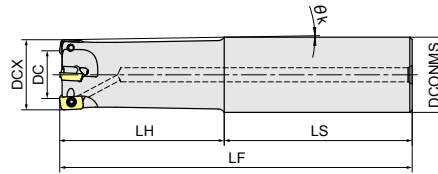
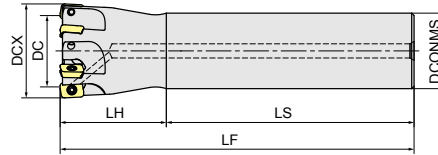





Fig.2
(Undercut type)



With air hole

Type	Item code	Stock	No. of flutes	Size (mm)						Shape	Recommended insert
				DCX	DC	LF	LH	LS	DCONMS		
Regular	TR2F2016S-2	●	2	16	7	100	30	70	16	Fig.1	BP \square 0603 \square R-05
	TR2F2017S-2	●	2	17	8	100	25	75	16	Fig.2	
	TR2F2018S-2	●	2	18	9	100	25	75	16		
	TR2F2020S-3	●	3	20	11	130	50	80	20	Fig.1	
	TR2F2022S-3	●	3	22	13	130	30	100	20	Fig.2	
	TR2F2025S-4	●	4	25	16	140	60	80	25	Fig.1	
	TR2F2030S-4	●	4	30	21	150	70	80	32		
	TR2F2032S-5	●	5	32	23	150	70	80	32		
	TR2F2035S-5	●	5	35	26	150	45	105	32	Fig.2	
	TR2F2040S-6	●	6	40	31	150	45	105	32		
Long	TR2F2016L-2	●	2	16	7	150	50	100	16	Fig.1	
	TR2F2016L15R-2	●	2	16	7	150	25	125	15	Fig.2	
	TR2F2018L16R-2	●	2	18	9	150	25	125	16		
	TR2F2020L-3	●	3	20	11	160	80	80	20	Fig.1	
	TR2F2020L18R-3	●	3	20	11	160	30	130	18	Fig.2	
	TR2F2022L20R-3	●	3	22	13	160	30	130	20		
	TR2F2025L-4	●	4	25	16	180	100	80	25	Fig.1	
	TR2F2025L23R-4	●	4	25	16	180	35	145	23	Fig.2	
	TR2F2028L25R-4	●	4	28	19	180	35	145	25		
	TR2F2032L-5	●	5	32	23	200	120	80	32	Fig.1	
	TR2F2032L30R-5	●	5	32	23	200	40	160	30	Fig.2	
	TR2F2035L32R-5	●	5	35	26	200	45	155	32		
	TR2F2040L-6	●	6	40	31	220	45	175	32		

Parts

Parts	Clamp screw	Screw driver	Screw anti-seizure agent
Shape			
Cutter body	Fastening torque (N · m)		
TR2F20 \square S/L/M/B	T08-2506A	1.1	104-T8
			P-37

[Note] The clamp screw is a consumable part. Since replacement life depends on the use environment, it is recommended that it be replaced at an early stage.

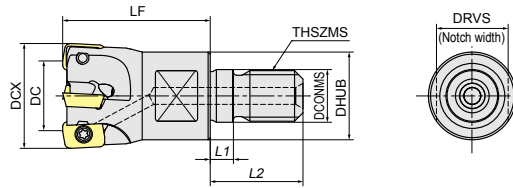
● : Stocked items.

Line Up

Modular type

TR2F20 $\bigcirc\bigcirc\bigcirc$ M- \bigcirc

Numeric figure in a circle \bigcirc and Alphabetical character comes in a square \square .



With air hole

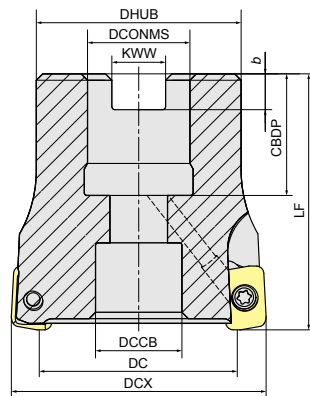
Item code	Stock	No. of flutes	Size (mm)									Recommended Insert
			DCX	DC	LF	L1	L2	DCONMS	DHUB	THSZMS	DRVS	
TR2F2016M-2	●	2	16	7	25	5.5	17	8.5	12.8	M8	10	BP \square 0603 \square R-05
TR2F2017M-2	●	2	17	8	25	5.5	17	8.5	12.8	M8	10	
TR2F2018M-2	●	2	18	9	25	5.5	17	8.5	12.8	M8	10	
TR2F2020M-3	●	3	20	11	30	5.5	19	10.5	17.8	M10	15	
TR2F2021M-3	●	3	21	12	30	5.5	19	10.5	17.8	M10	15	
TR2F2022M-3	●	3	22	13	30	5.5	19	10.5	17.8	M10	15	
TR2F2025M-4	●	4	25	16	35	5.5	22	12.5	20.8	M12	17	
TR2F2026M-4	●	4	26	17	35	5.5	22	12.5	20.8	M12	17	
TR2F2028M-4	●	4	28	19	35	5.5	22	12.5	20.8	M12	17	
TR2F2030M-4	●	4	30	21	40	6	23	17	28.8	M16	22	
TR2F2032M-5	●	5	32	23	40	6	23	17	28.8	M16	22	
TR2F2033M-5	●	5	33	24	40	6	23	17	28.8	M16	22	
TR2F2035M-5	●	5	35	26	40	6	23	17	28.8	M16	22	
TR2F2040M-6	●	6	40	31	40	6	23	17	28.8	M16	22	
TR2F2042M-6	●	6	42	33	40	6	23	17	28.8	M16	22	

[Note] Do not apply lubricants such as grease, etc. to the "contact faces" and "modular screws" of the "modular mill", "dedicated shanks" and "dedicated arbor".

Bore type

TR2F20 $\bigcirc\bigcirc$ B \square - \bigcirc

Numeric figure in a circle \bigcirc and Alphabetical character comes in a square \square .



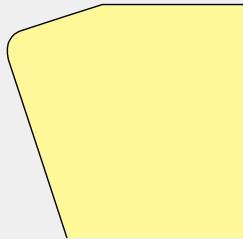
With air hole

Type	Item code	Stock	No. of flutes	Size (mm)									Recommended insert
				DCX	DC	DHUB	LF	CBBDP	KWW	b	DCONMS	DCCB	
Internal diameter inch size	TR2F2050B-7	●	7	50	41	47	50	19	8.4	5	22.225	17	BP \square 0603 \square R-05
Internal diameter mm size	TR2F2040BM-6	●	6	40	31	32	40	19	8.4	5.6	16	13.5	
	TR2F2042BM-6	●	6	42	33	32	40	19	8.4	5.6	16	13.5	
	TR2F2050BM-7	●	7	50	41	47	50	20	10.4	6.3	22	17	
	TR2F2052BM-7	●	7	52	43	47	50	20	10.4	6.3	22	17	

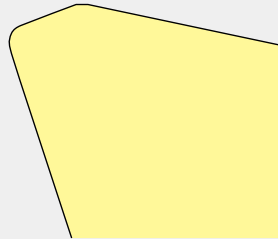
[Note] Arbor screw is not included.

● : Stocked items.

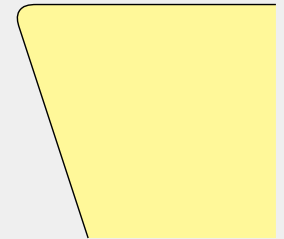
Insert



Standard machining cutting edge profile



Cutting edge with breaker



Cutting edge for high-performance materials

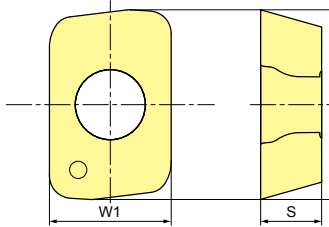


Fig.1

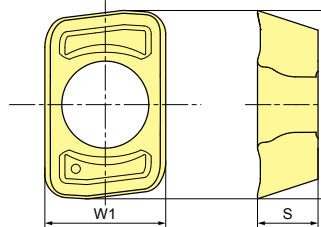


Fig.2

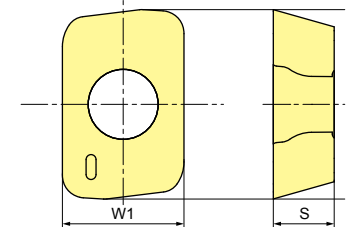


Fig.3

P	Carbon steels			■		■		
M	SUS, etc.				■			
K	Cast irons FC・FCD			■			□	
H	Hardened steels		■	□				

■ : General cutting, First recommendation
□ : General cutting, Second recommendation

Item code	Tolerance class	AJ Coating			GX Coating	Size (mm)		Shape
		JP4105	JP4120	JM4160	GX2140	W1	S	
BPNW0603TR-05	N	●	●	●	●	6.35	3.18	Fig.1
BPMT0603TR-05	M		●	●	●			Fig.2
BPNW0603ER-05	N		●	●			3.05	Fig.3

[Note] Please note that the GX Coating do not cause a reaction in conductive touch sensors.

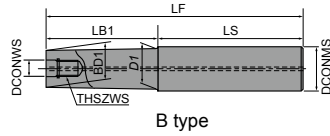
Grade map for work materials

	Work Hardness					Work Hardness		Work Hardness		Work Hardness	
	Low	High				Low	High	Low	High	Low	High
Unstable machining	<div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block;">JM4160</div> <div style="border: 1px solid green; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;">GX2140</div> <div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;">JP4120</div> <div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;">JP4105</div>					<div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block;">JM4160</div> <div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;">JP4120</div>		<div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block;">JM4160</div> <div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;">JP4120</div>		<div style="border: 1px solid green; border-radius: 15px; padding: 5px; display: inline-block;">GX2140</div> <div style="border: 1px solid red; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 20px;">JP4120</div>	
Stable machining											
	Mild steels (200HB or less)	Carbon steels Alloy steels (30HRC or less)	Carbon steels Alloy steels (30~45HRC)	Hardened steels Pre-Harden steels (45~50HRC)	Hardened steels (50~60HRC)	High-performance materials for die-casting molds		Stainless steel materials SUS		Cast irons FC,FCD	

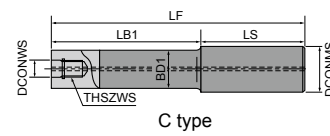
Line Up

Special Shanks for Modular Mills

Carbide Shank



B type



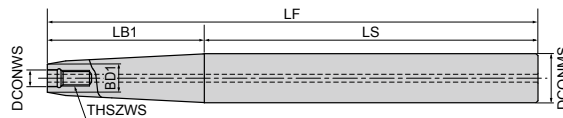
C type

Item code	Stock	Size (mm)								Type	Cutter body	With/without air hole								
		DCONWS	THSZWS	LF	LB1	LS	BD1	DCONMS	D1											
ASC16-8.5-95-30Z	●	8.5	M8	95	30	65	14.5	16	15.5	B	φ16* φ17 φ18	○								
ASC16-8.5-120-55Z	●			120	55	65														
ASC16-8.5-140-75Z	●			140	75	65														
ASC16-8.5-160-95Z	●			160	95	65														
ASC16-8.5-160-30Z	●	10.5	M10	160	30	130	18.5	20	19.5	B	φ20* φ21 φ22	○								
ASC20-10.5-120-50Z	●			120	50	70														
ASC20-10.5-170-90Z	●			170	90	80														
ASC20-10.5-220-120Z	●			220	120	100														
ASC20-10.5-270-150Z	●	10.5	M10	270	150	120	18.5	20	19.5	B	φ20* φ21 φ22	○								
ASC20-10.5-220-50Z	●			220	50	170														
ASC20-10.5-270-50Z	●			270	50	220														
ASC25-12.5-145-65	●			12.5	M12	145							65	80	23	25	—	C	φ25* φ26 φ28	○
ASC25-12.5-215-115	●	215	115			100														
ASC25-12.5-265-145	●	265	145			120														
ASC25-12.5-315-195	●	315	195			120														
ASC25-12.5-265-65	●	12.5	M12	265	65	200	23	25	—	C	φ25* φ26 φ28	○								
ASC25-12.5-315-65	●			315	65	250														
ASC32-17-160-80	●			17	M16	160							80	80	28	32	—	C	φ30* φ32* φ33 φ35 (φ40) (φ42)	○
ASC32-17-210-110	●					210							110	100						
ASC32-17-260-140	●	260	140			120														
ASC32-17-310-190	●	310	190			120														
ASC32-17-360-240	●	17	M16	360	240	120	28	32	—	C	φ30*、φ32* φ33、φ35 (φ40)、(φ42)	○								
ASC32-17-260-80	●			260	80	180														
ASC32-17-310-80	●			310	80	230														
ASC32-17-360-80	●			360	80	280														

Free-neck carbide shank

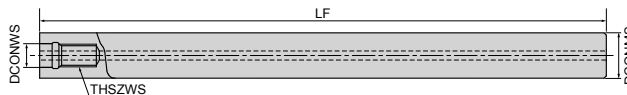
— Adjustable overhang length eliminates interference concerns.

Tapered type



Item code	Stock	Size (mm)								Supported wall angle	Cutter body	With/without air hole
		DCONWS	THSZWS	LF	LB1	LS	BD1	DCONMS				
ASC20T-8.5-250-120Z-09	★	φ8.5	M8	250	120	130	14.5	φ20	0.9° or more	φ16 φ17 φ18	○	
ASC20T-8.5-250-75Z-14	★	φ8.5	M8	250	75	175	14.5	φ20	1.4° or more			
ASC25T-8.5-250-80Z-29	★	φ8.5	M8	250	80	170	14.5	φ25	2.9° or more			
ASC25T-10.5-300-150Z-09	★	φ10.5	M10	300	150	150	18.5	φ25	0.9° or more	φ20 φ21 φ22	○	
ASC25T-10.5-300-95Z-14	★	φ10.5	M10	300	95	205	18.5	φ25	1.4° or more			
ASC32T-10.5-300-105Z-29	★	φ10.5	M10	300	105	195	18.5	φ32	2.9° or more			

Straight type



Item code	Stock	Size (mm)				Cutter body	With/without air hole
		DCONWS	THSZWS	LF	DCONMS		
ASC15-8.5-210-0Z	★	φ8.5	M8	210	φ15	φ16、φ17、φ18	○
ASC16-8.5-130-0Z	★	φ8.5	M8	130	φ16		
ASC16-8.5-210-0Z	★	φ8.5	M8	210		φ18	φ20、φ21、φ22
ASC18-10.5-240-0Z	★	φ10.5	M10	240			
ASC20-10.5-150-0Z	★	φ10.5	M10	150	φ20	φ20*、φ21、φ22	○
ASC20-10.5-250-0Z	★	φ10.5	M10	250			
ASC23-12.5-300-0Z	★	φ12.5	M12	300	φ23	φ25、φ26、φ28	○
ASC25-12.5-175-0Z	★	φ12.5	M12	175			
ASC25-12.5-300-0Z	★	φ12.5	M12	300	φ25	φ25*、φ26、φ28	○

- [Note] ① Commercial milling chucks or shrink-fit holders can be used.
 ② Under normal conditions, the φ40 and φ42 dimensions should be used with overhang lengths up to 200 mm.
 ③ Dedicated arbor (HSK-A63) and steel shank types are also standard stock items.
 ④ For ※, since the cutter diameter is smaller than the shank diameter, interference occurs at the shank.

Recommended Cutting Conditions (High-performance materials)

Work material	Recommended inserts grade	DCX Tool dia.	φ16 (2 Flutes)				φ20 (3 Flutes)				φ25 (4 Flutes)			
			Overhang	<3DCX	3~5DCX	5~7DCX	>7DCX	<3DCX	3~5DCX	5~7DCX	>7DCX	<3DCX	3~5DCX	5~7DCX
Annealed material	GX2140 JM4160	<i>n</i> (min ⁻¹)	3580	3580	2790	1990	2860	2860	2230	1590	2290	2290	1780	1270
		<i>Vc</i> (m/min)	180	180	140	100	180	180	140	100	180	180	140	100
		<i>Vf</i> (mm/min)	7160	5730	4460	2390	8590	6880	5350	2860	9170	7330	5700	3060
		<i>fz</i> (mm/t)	1.0	0.8	0.8	0.6	1.0	0.8	0.8	0.6	1.0	0.8	0.8	0.6
		<i>ap</i> (mm)	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	36	29	18	7	60	48	30	12	87	70	43	17
Hardened steels ① (42 ~ 48HRC) DAC-i, DAC-MAGIC, DHA-WORLD, etc.	JP4120 JM4160	<i>n</i> (min ⁻¹)	2390	2390	1990	1590	1910	1910	1750	1590	1530	1530	1400	1270
		<i>Vc</i> (m/min)	120	120	100	80	120	120	110	100	120	120	110	100
		<i>Vf</i> (mm/min)	3820	2860	2390	950	4580	3440	3150	1430	4890	3670	3360	1530
		<i>fz</i> (mm/t)	0.8	0.6	0.6	0.3	0.8	0.6	0.6	0.3	0.8	0.6	0.6	0.3
		<i>ap</i> (mm)	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	11	9	7	2	19	14	13	4	28	21	19	6
Hardened steels ② (42 ~ 48HRC) DH31-S, DH31-EX, DIEVAR, etc.	JP4120 JM4160	<i>n</i> (min ⁻¹)	2390	2390	1990	1590	1910	1910	1750	1590	1530	1530	1400	1270
		<i>Vc</i> (m/min)	120	120	100	80	120	120	110	100	120	120	110	100
		<i>Vf</i> (mm/min)	2860	2390	1990	950	3440	2860	2630	1430	3670	3060	2800	1530
		<i>fz</i> (mm/t)	0.6	0.5	0.5	0.3	0.6	0.5	0.5	0.3	0.6	0.5	0.5	0.3
		<i>ap</i> (mm)	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	9	7	6	2	14	12	11	4	21	17	16	6
Hardened steels ③ (42 ~ 48HRC) DH31, etc.	JM4160 JP4120	<i>n</i> (min ⁻¹)	1190	1190	990	990	950	950	800	800	760	760	640	640
		<i>Vc</i> (m/min)	60	60	50	50	60	60	50	50	60	60	50	50
		<i>Vf</i> (mm/min)	1190	950	800	600	1430	1150	950	720	1530	1220	1020	760
		<i>fz</i> (mm/t)	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3
		<i>ap</i> (mm)	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	4	3	2	1	6	5	4	2	9	7	6	3

Work material	Recommended inserts grade	DCX Tool dia.	φ32 (5 Flutes)				φ40 (6 Flutes)				φ50 (7 Flutes)			
			Overhang	<3DCX	3~5DCX	5~7DCX	>7DCX	<3DCX	3~5DCX	5~7DCX	>7DCX	<3DCX	3~5DCX	5~7DCX
Annealed material	GX2140	<i>n</i> (min ⁻¹)	1790	1790	1390	990	1430	1430	1110	800	1150	1150	890	640
		<i>Vc</i> (m/min)	180	180	140	100	180	180	140	100	180	180	140	100
		<i>Vf</i> (mm/min)	8950	7160	5570	2980	8590	6880	5350	2860	8020	6420	4990	2670
		<i>fz</i> (mm/t)	1.0	0.8	0.8	0.6	1.0	0.8	0.8	0.6	1.0	0.8	0.8	0.6
		<i>ap</i> (mm)	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3
		<i>ae</i> (mm)	22	22	22	22	28	28	28	28	30	30	30	30
		<i>Q</i> (cm ³ /min)	98	79	49	20	120	96	60	24	120	96	60	24
Hardened steels ① (42 ~ 48HRC) DAC-i, DAC-MAGIC, DHA-WORLD, etc.	JP4120 JM4160	<i>n</i> (min ⁻¹)	1190	1190	1090	990	950	950	880	800	760	760	700	640
		<i>Vc</i> (m/min)	120	120	110	100	120	120	110	100	120	120	110	100
		<i>Vf</i> (mm/min)	4770	3580	3280	1490	4580	3440	3150	1430	4280	3210	2940	1340
		<i>fz</i> (mm/t)	0.8	0.6	0.6	0.3	0.8	0.6	0.6	0.3	0.8	0.6	0.6	0.3
		<i>ap</i> (mm)	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
		<i>ae</i> (mm)	22	22	22	22	28	28	28	28	30	30	30	30
		<i>Q</i> (cm ³ /min)	31	24	22	7	38	29	26	8	39	29	26	8
Hardened steels ② (42 ~ 48HRC) DH31-S, DH31-EX, DIEVAR, etc.	JP4120 JM4160	<i>n</i> (min ⁻¹)	1190	1190	1090	990	950	950	880	800	760	760	700	640
		<i>Vc</i> (m/min)	120	120	110	100	120	120	110	100	120	120	110	100
		<i>Vf</i> (mm/min)	3580	2980	2740	1490	3440	2860	2630	1430	3210	2670	2450	1340
		<i>fz</i> (mm/t)	0.6	0.5	0.5	0.3	0.6	0.5	0.5	0.3	0.6	0.5	0.5	0.3
		<i>ap</i> (mm)	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
		<i>ae</i> (mm)	22	22	22	22	28	28	28	28	30	30	30	30
		<i>Q</i> (cm ³ /min)	24	20	18	7	29	24	22	8	29	24	22	8
Hardened steels ③ (42 ~ 48HRC) DH31, etc.	JM4160 JP4120	<i>n</i> (min ⁻¹)	600	600	500	500	480	480	400	400	380	380	320	320
		<i>Vc</i> (m/min)	60	60	50	50	60	60	50	50	60	60	50	50
		<i>Vf</i> (mm/min)	1490	1190	990	750	1430	1150	950	720	1340	1070	890	670
		<i>fz</i> (mm/t)	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3
		<i>ap</i> (mm)	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2
		<i>ae</i> (mm)	22	22	22	22	28	28	28	28	30	30	30	30
		<i>Q</i> (cm ³ /min)	10	8	7	3	12	10	8	4	12	10	8	4

※ For conditions involving overhangs of 3D or greater, refer to page 13.

※ For usage precautions, refer to **[Note]** on page 11.

Recommended Cutting Conditions

Work material	Recommended inserts grade	DCX Tool dia.	φ16 (2 Flutes)				φ20 (3 Flutes)				φ25 (4 Flutes)			
		Overhang	<3DCX	3 ~ 5DCX	5 ~ 7DCX	>7DCX	<3DCX	3 ~ 5DCX	5 ~ 7DCX	>7DCX	<3DCX	3 ~ 5DCX	5 ~ 7DCX	>7DCX
Carbon steels Alloy steels <30HRC	GX2140 JM4160	<i>n</i> (min ⁻¹)	3580	3580	2790	1990	3370	3370	2620	1870	2290	2290	1780	1270
		<i>Vc</i> (m/min)	180	180	140	100	180	180	140	100	180	180	140	100
		<i>Vf</i> (mm/min)	7160	5730	4460	2390	10110	8090	6290	3370	9170	7330	5700	3060
		<i>fz</i> (mm/t)	1	0.8	0.8	0.6	1	0.8	0.8	0.6	1	0.8	0.8	0.6
		<i>ap</i> (mm)	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	36	29	18	7	71	57	35	14	87	70	43	17
Alloy steels Tool steels 30 ~ 40HRC	JP4120	<i>n</i> (min ⁻¹)	2980	2980	2390	1790	2810	2810	2250	1690	1910	1910	1530	1150
		<i>Vc</i> (m/min)	150	150	120	90	150	150	120	90	150	150	120	90
		<i>Vf</i> (mm/min)	3580	3580	2010	1070	5060	5060	2830	1520	4580	4580	2570	1380
		<i>fz</i> (mm/t)	0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3
		<i>ap</i> (mm)	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	18	18	8	3	35	35	16	6	44	44	20	8
Pre-hardened steels Alloy steels 40 ~ 50HRC	JP4120	<i>n</i> (min ⁻¹)	1990	1990	1590	1190	1870	1870	1500	1120	1270	1270	1020	760
		<i>Vc</i> (m/min)	100	100	80	60	100	100	80	60	100	100	80	60
		<i>Vf</i> (mm/min)	1990	1590	1270	720	2810	2250	1800	1010	2550	2040	1630	920
		<i>fz</i> (mm/t)	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3
		<i>ap</i> (mm)	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	8	6	4	2	16	13	8	4	19	16	9	5
Stainless steels SUS	JM4160	<i>n</i> (min ⁻¹)	1990	1990	1590	1190	1870	1870	1500	1120	1270	1270	1020	760
		<i>Vc</i> (m/min)	100	100	80	60	100	100	80	60	100	100	80	60
		<i>Vf</i> (mm/min)	2390	2390	1270	720	3370	3370	1800	1010	3060	3060	1630	920
		<i>fz</i> (mm/t)	0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3
		<i>ap</i> (mm)	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	10	10	4	2	19	19	8	4	23	23	9	5
Cast irons FC FCD	JP4120	<i>n</i> (min ⁻¹)	3580	3580	2790	1990	3370	3370	2620	1870	2290	2290	1780	1270
		<i>Vc</i> (m/min)	180	180	140	100	180	180	140	100	180	180	140	100
		<i>Vf</i> (mm/min)	8590	6880	5350	2860	12130	9710	7550	4040	11000	8800	6840	3670
		<i>fz</i> (mm/t)	1.2	1	1	0.7	1.2	1	1	0.7	1.2	1	1	0.7
		<i>ap</i> (mm)	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	43	34	21	9	85	68	42	17	105	84	52	21
Hardened steels 50 ~ 55HRC	JP4105 JP4120	<i>n</i> (min ⁻¹)	1590	1590	1390	1190	1500	1500	1310	1120	1020	1020	890	760
		<i>Vc</i> (m/min)	80	80	70	60	80	80	70	60	80	80	70	60
		<i>Vf</i> (mm/min)	1270	1020	890	570	1800	1440	1260	810	1630	1300	1140	730
		<i>fz</i> (mm/t)	0.4	0.32	0.32	0.24	0.4	0.32	0.32	0.24	0.4	0.32	0.32	0.24
		<i>ap</i> (mm)	0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	4	3	2	1	8	6	4	2	9	7	5	2
Hardened steels 55 ~ 62HRC	JP4105 JP4120	<i>n</i> (min ⁻¹)	1190	1190	1190	1190	1120	1120	1120	1120	760	760	760	760
		<i>Vc</i> (m/min)	60	60	60	60	60	60	60	60	60	60	60	60
		<i>Vf</i> (mm/min)	720	570	570	430	1010	810	810	610	920	730	730	550
		<i>fz</i> (mm/t)	0.3	0.24	0.24	0.18	0.3	0.24	0.24	0.18	0.3	0.24	0.24	0.18
		<i>ap</i> (mm)	0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15
		<i>ae</i> (mm)	10	10	10	10	14	14	14	14	19	19	19	19
		<i>Q</i> (cm ³ /min)	2	2	1	1	4	3	2	1	5	4	3	2

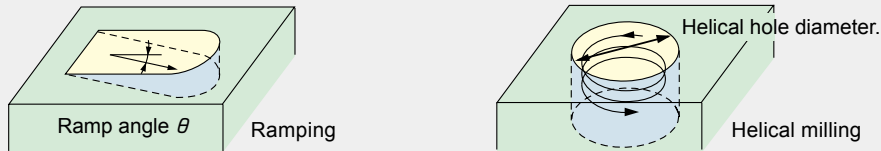
- [Note]** ① This table provides general guidelines for cutting conditions; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions. In particular, when performing shoulder milling in combination with slotting or machining of cutting widths close to slots, etc., chattering vibrations may occur, which can lead to trouble. Therefore, please consider the following when adjusting the conditions:
- Reduce rotation speed and table feed rate by 50 to 70%
 - Reduce cutting depth *ap* by 50 to 70%
 - Reduce cutting width *ae* by 50 to 70%
- ② Please note that the GX Coating do not cause a reaction in conductive touch sensors.
- ③ JP4105 is for the high-hardness steels. It is not suitable for Non-heat-treated steel material.
- ④ The machinability of hardened steels (50 ~ 60HRC) can vary significantly depending on the particular steel type and tool overhang. Adjust the table feed rate and cutting depth *ap* to suit machining conditions.
- ⑤ For strongly interrupted cutting, when unsupported length is long, or for wet cutting, JM4160 is recommended.
- ⑥ To prevent tool damage due to chip clogging, always use a chip removal method such as an air blower, etc.
- ⑦ Since there is a danger of the removed chips flying out and causing injury to workers, fire, or damage to eyes, during use be sure to cover the work area with a safety cover and have workers wear protective equipment such as glasses, etc. to make the work area safe.
- ⑧ Perform insert replacement at an early stage to prevent chipping due to excessive use.
- ⑨ The following equation can be used to determine the metal removal rate per unit time *Q*; $Q(\text{cm}^3/\text{min}) = ap(\text{mm}) \times ae(\text{mm}) \times Vf(\text{mm}/\text{min}) / 1000$

φ32 (5 Flutes)				φ40 (6 Flutes)				φ50 (7 Flutes)				Work material
<3DCX	3~5DCX	5~7DCX	>7DCX	<3DCX	3~5DCX	5~7DCX	>7DCX	<3DCX	3~5DCX	5~7DCX	>7DCX	
1790	1790	1390	990	1430	1430	1110	800	1150	1150	890	640	Carbon steels Alloy steels <30HRC
180	180	140	100	180	180	140	100	180	180	140	100	
8950	7160	5570	2980	8590	6880	5350	2860	8020	6420	4990	2670	
1	0.8	0.8	0.6	1	0.8	0.8	0.6	1	0.8	0.8	0.6	
0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	
22	22	22	22	28	28	28	28	30	30	30	30	
98	79	49	20	120	96	60	24	120	96	60	24	Alloy steels Tool steels 30 ~ 40HRC
1490	1490	1190	900	1190	1190	950	720	950	950	760	570	
150	150	120	90	150	150	120	90	150	150	120	90	
4480	4480	2510	1340	4300	4300	2410	1290	4010	4010	2250	1200	
0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3	
0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	
22	22	22	22	28	28	28	28	30	30	30	30	Pre-hardened steels Alloy steels 40 ~ 50HRC
49	49	22	9	60	60	27	11	60	60	27	11	
990	990	800	600	800	800	640	480	640	640	510	380	
100	100	80	60	100	100	80	60	100	100	80	60	
2490	1990	1590	900	2390	1910	1530	860	2230	1780	1430	800	
0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3	0.5	0.4	0.4	0.3	
0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	Stainless steels SUS
22	22	22	22	28	28	28	28	30	30	30	30	
22	18	10	6	27	21	13	7	27	21	13	7	
990	990	800	600	800	800	640	480	640	640	510	380	
100	100	80	60	100	100	80	60	100	100	80	60	
2980	2980	1590	900	2860	2860	1530	860	2670	2670	1430	800	
0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3	0.6	0.6	0.4	0.3	Cast irons FC FCD
0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	
22	22	22	22	28	28	28	28	30	30	30	30	
26	26	10	6	32	32	13	7	32	32	13	7	
1790	1790	1390	990	1430	1430	1110	800	1150	1150	890	640	
180	180	140	100	180	180	140	100	180	180	140	100	
10740	8590	6680	3580	10310	8250	6420	3440	9630	7700	5990	3210	Hardened steels 50 ~ 55HRC
1.2	1	1	0.7	1.2	1	1	0.7	1.2	1	1	0.7	
0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	0.5	0.5	0.4	0.3	
22	22	22	22	28	28	28	28	30	30	30	30	
118	94	59	24	144	116	72	29	144	116	72	29	
800	800	700	600	640	640	560	480	510	510	450	380	
80	80	70	60	80	80	70	60	80	80	70	60	Hardened steels 55 ~ 62HRC
1590	1270	1110	720	1530	1220	1070	690	1430	1140	1000	640	
0.4	0.32	0.32	0.24	0.4	0.32	0.32	0.24	0.4	0.32	0.32	0.24	
0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15	
22	22	22	22	28	28	28	28	30	30	30	30	
10	8	5	2	13	10	6	3	13	10	6	3	
600	600	600	600	480	480	480	480	380	380	380	380	Hardened steels 55 ~ 62HRC
60	60	60	60	60	60	60	60	60	60	60	60	
900	720	720	540	860	690	690	520	800	640	640	480	
0.3	0.24	0.24	0.18	0.3	0.24	0.24	0.18	0.3	0.24	0.24	0.18	
0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15	0.3	0.3	0.21	0.15	
22	22	22	22	28	28	28	28	30	30	30	30	
6	5	3	2	7	6	4	2	7	6	4	2	

Precautions for use

Maximum ramp angle and helical hole diameter

- Since the cutting flute do not extend to the center, there are limitations on the ramp angle and hole diameter, but as shown below, cutting by direct milling without a pilot hole is possible for ramping and helical milling.



- For ramping and helical cutting, please set the "Vf" to around 50% of recommended cutting condition.

(DCX) Tool dia.(mm)		φ16	φ17	φ18	φ20	φ21	φ22	φ25	φ26
Ramping	Maximum ramp angle θ	4°	3.5°	3.5°	3°	2.5°	2.5°	2°	2°
	Recommendation	2°				1°			
Helical milling	Helical hole diameter	22~30	24~32	26~34	30~38	32~40	34~42	40~48	42~50

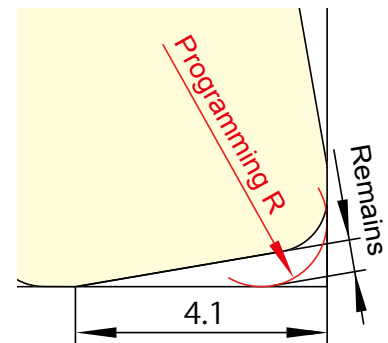
(DCX) Tool dia.(mm)		φ28	φ32	φ33	φ35	φ40	φ42	φ50	φ52
Ramping	Maximum ramp angle θ	2°	2°	2°	2°	1.5°	1.5°	1°	1°
	Recommendation	1°						0.5°	
Helical milling	Helical hole diameter	46~54	54~62	56~64	60~68	70~78	74~82	90~98	94~102

- [Note] ① The ramp angle θ should be set within the ranges listed above. Do not exceed the recommended value.
 ② For hole diameters outside the ranges listed above, a pilot hole should be drilled before milling.
 ③ It is recommended that the tool be used while performing sufficient chip removal and checking that there are no abnormal vibrations.

Programming R and maximum cutting depth

- Please define the tool shape in the CAM as indicated in the following table:

Programming R (mm)	Remains (mm)	Depth of cut (mm)
R3.0	0.219	0.365
R2.5	0.298	0.152
R2.0	0.377	0
R1.5	0.457	0
R1.0	0.536	0



Field data

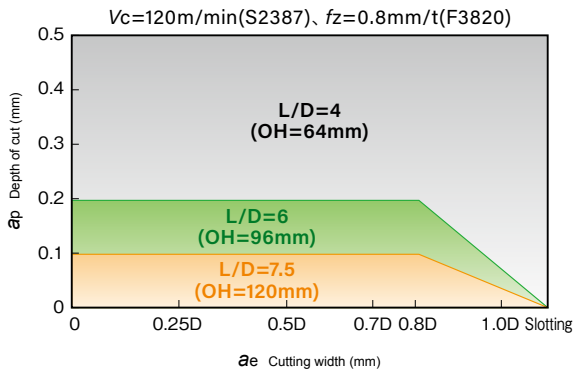
Cutting conditions

Machine : BT50
 Work material : DH31-S (45HRC)
 $V_c=120\text{m/min}$ $f_z=0.8\text{mm/t}$

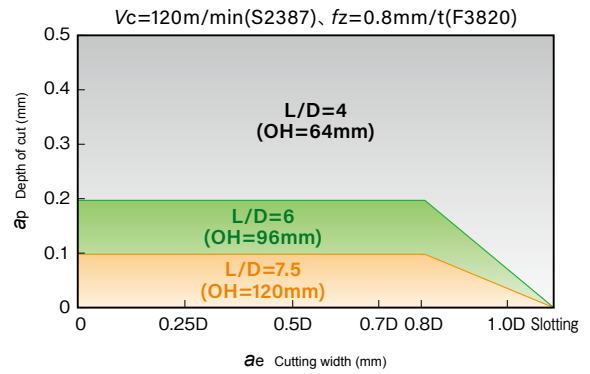
Uses carbide shank

Tool overhang (OH) and cutting depth limit

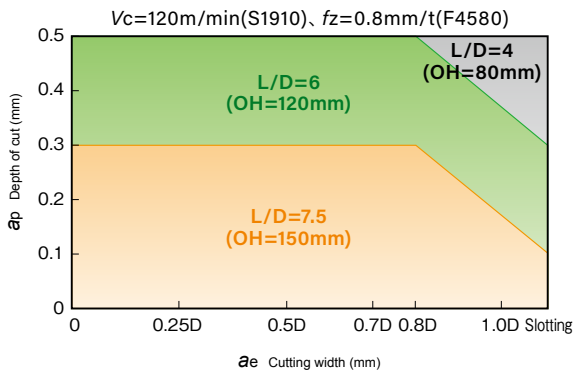
BPNW0603ER-05 ($\phi 16\text{-}2\text{NT}$)



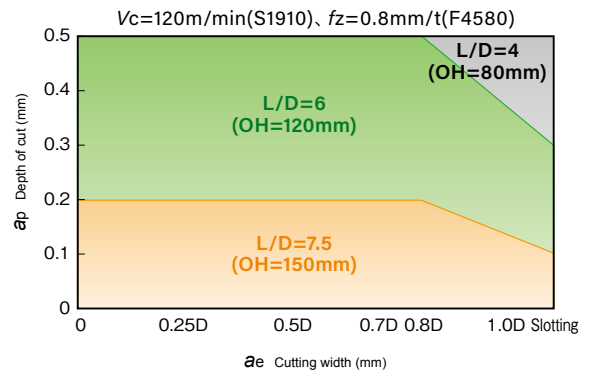
BPNW0603TR-05 ($\phi 16\text{-}2\text{NT}$)



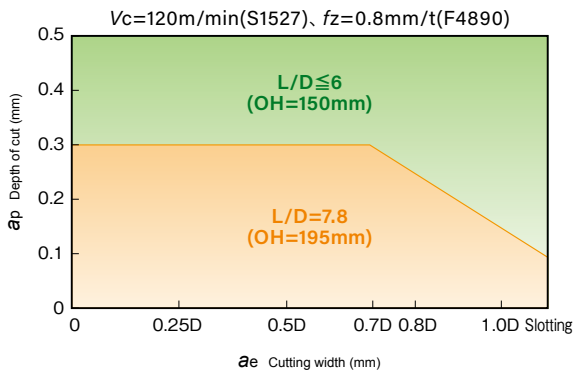
BPNW0603ER-05 ($\phi 20\text{-}3\text{NT}$)



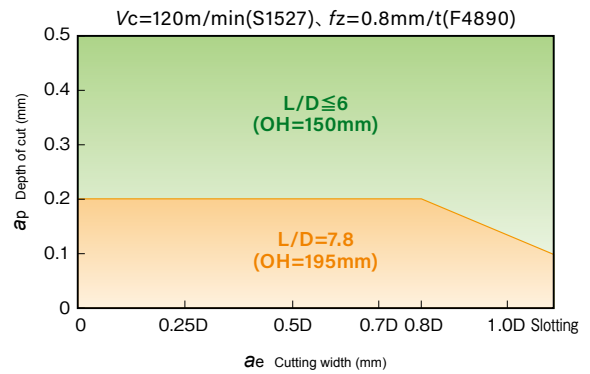
BPNW0603TR-05 ($\phi 20\text{-}3\text{NT}$)



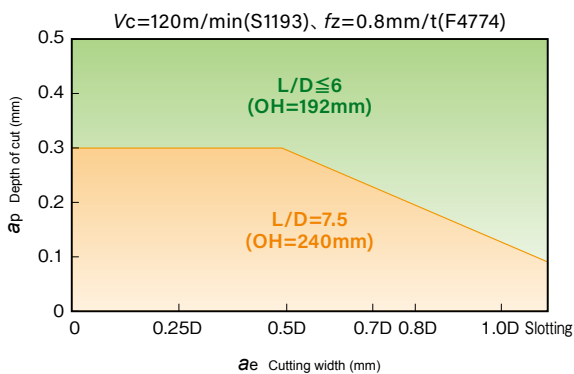
BPNW0603ER-05 ($\phi 25\text{-}4\text{NT}$)



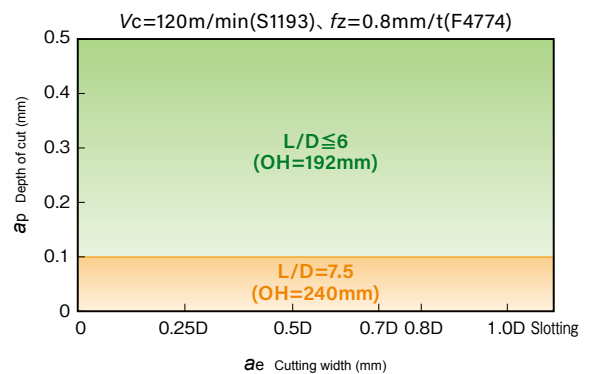
BPNW0603TR-05 ($\phi 25\text{-}4\text{NT}$)



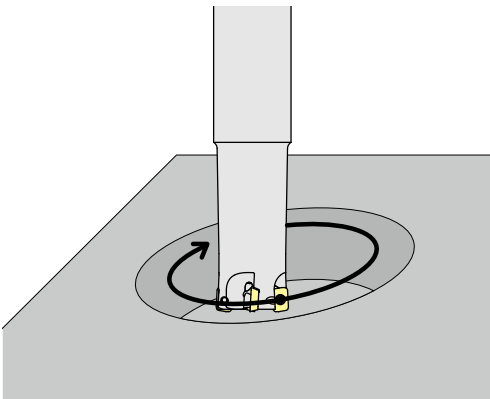
BPNW0603ER-05 ($\phi 32\text{-}5\text{NT}$)



BPNW0603TR-05 ($\phi 32\text{-}5\text{NT}$)



01 Diecast mold inlay helical machining



After 30 minutes of use



VBmax=0.756mm

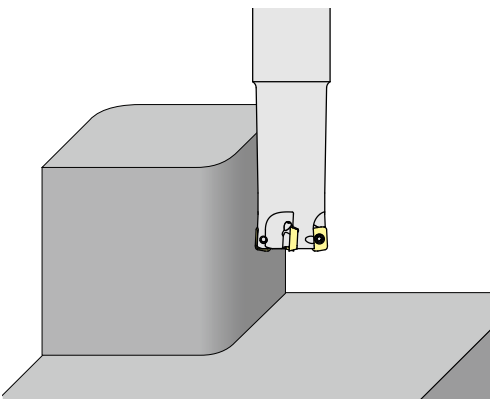
【Work material】
DH31 (45HRC)

【Tool】
TR2F2020M-3 (φ20 3 flutes)
BPNW0603TR-05 (JM4160)

【Cutting conditions】
Vc=100m/min
Vf=1,400mm/min (fz=0.3mm/t)
ap×ae=0.3×10mm
OH=180mm (L/D=9)
Air-blow

- Improved machining efficiency with 40% increase in metal removal rate

02 Rough machining of diecast mold structural components



After 30 minutes of use



VBmax=0.282mm

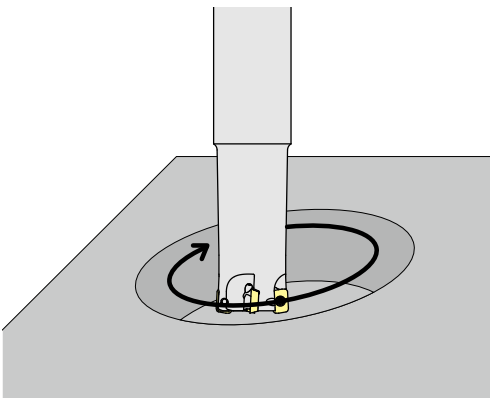
【Work material】
DIEVAR (48HRC)

【Tool】
TR2F2020M-3 (φ20 3 flutes)
BPNW0603ER-05 (JP4120)

【Cutting conditions】
Vc=125m/min
Vf=3,000mm/min (fz=0.5mm/t)
ap×ae=0.35×1.5mm
OH=120mm (L/D=6)
Air-blow

- Similar tool life to conventional products with 50% increase in machining efficiency

03 Diecast mold nested helical machining



After 50 minutes of use



VBmax=0.055mm

【Work material】
DAC-i (43HRC)

【Tool】
TR2F2032M-5 (φ32 5 flutes)
BPNW0603ER-05 (JP4120)

【Cutting conditions】
Vc=130m/min
Vf=6,500mm/min (fz=1.0mm/t)
ap×ae=0.3×23mm
OH=105mm (L/D≒3.3)
Air-blow

- Small wear even after 50 minutes of use; allows continued machining.

High-feed tools lineup

High-feed tools lineup

Type	Feature				Holder	Insert			Programming R (mm)	APMX (mm)
	Economical (No. of corners)	High accuracy (Less uncut remnants)	Supports for high-hardened steel	Efficiency (No. of Flutes)	Tool dia. (mm)	No. of corners	Shape	Inscribed circle code		
TR2F 		○	○ ~62HRC	◎ High Efficiency multiflutes	φ16~52	2		06	2.0	0.5
TD4N 	◎	◎	○ ~62HRC	◎ High Efficiency multiflutes	φ16~40	4		06	2.0	1.0
ASR Multi-Flutes 		○	○ ~62HRC	◎ High Efficiency multiflutes	φ16~66	2		06	2.0	1.5
								12	3.0	2.0
ASRF-mini 	◎		○ ~62HRC	○ General	φ20~63	4		07	2.0	1.2
ASR 		○	○ ~60HRC	○ General	φ20~100	2		08~15	3.0	2.0
ASRT 	○	○	○ ~62HRC	○ General	φ25~100	3				
ASRF 	◎		○ ~60HRC	○ General	φ32~100	4		12	4.5	
TD6N 	◎	○	~50HRC	○ General	φ50~125	6		14	3.0	1.5
										14
TR4F 	◎		○ ~60HRC	○ General	φ32~125	4		12	3.0	1.2
								15		2.0

※ Various other tools for roughing are also available.

※ For more information on tool specifications, please refer to our general catalog or visit our website. (<http://www.moldino.com>)



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

1. Attentions regarding handling

- (1) When removing the tool from the case (package), be careful not to drop it on your foot or drop it onto the tips of your bare fingers.
- (2) When actually setting the inserts, be careful not to touch the cutting flute directly with your bare hands.

2. Attentions regarding mounting

- (1) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
- (2) If abnormal chattering occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Attentions 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) The inserts 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 installed and safety equipment such as safety glasses should be worn to create a safe environment for work.
 - Do not use where there is a risk of fire or explosion.
 - Do not use non-water-soluble cutting oils. Such oils may result in fire.
- (4) Do not use the tool for any purpose other than that for which it is intended, and do not modify it.

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