

MITSUBISHI

MITSUBISHI CARBIDE

TOOLS NEWS

2005.11. Update B055G

Multi-functional Indexable Cutter

Insert
Expansion

APX3000

**A new generation of
high performance cutters
with *MIRACLE*[®] coated inserts.**

MIRACLE[®] Coated **VP20RT** ideal for
stainless steel machining.



***MIRACLE*[®] Coated VP15TF & VP20RT**

&

A wide selection of corner radii

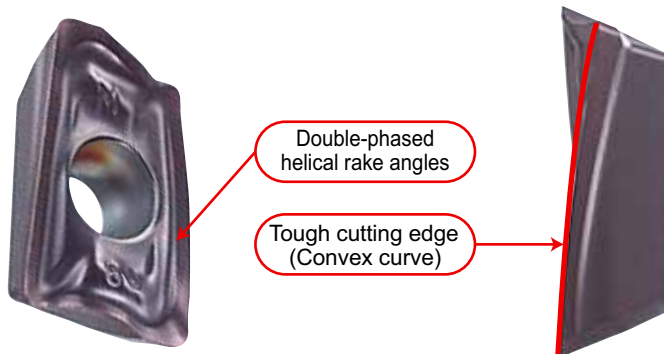
Multi-functional Indexable Cutter

APX3000

Features

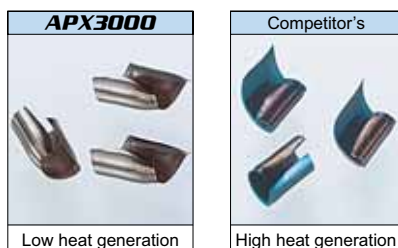
Low cutting resistance inserts

- Advanced simulation technology has been utilised to develop the inserts.
- Efficient machining on low rigidity machines and workpieces is now possible and is ideal for thin wall or extended reach applications.



Ideal heat disposal and chip control

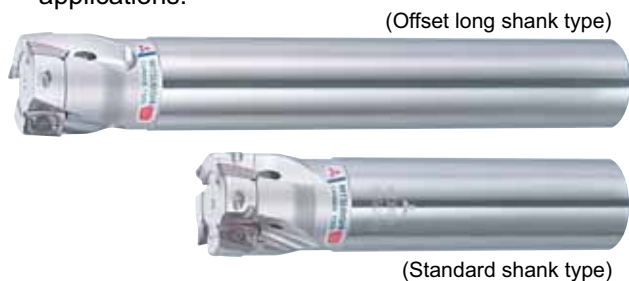
- Heat generated during cutting has been reduced due to the APX's special geometry.
- Ideal chip shape formed by the insert for easy disposal.



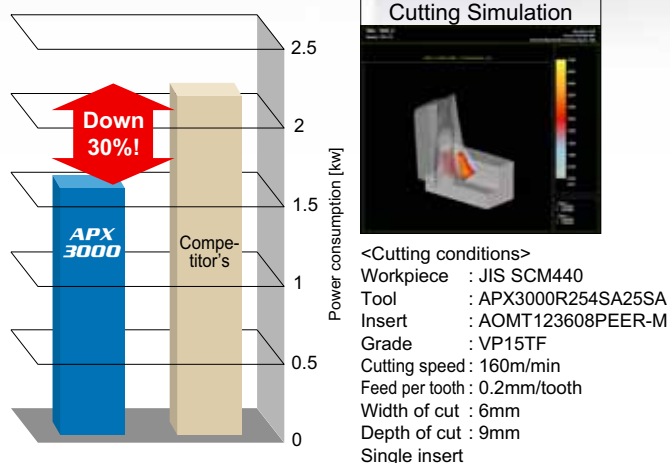
<Cutting conditions>
 Workpiece : JIS SCM440
 Tool : APX3000R254SA25SA
 Insert : AOMT123608PEER-M
 Grade : VP15TF
 Cutting speed : 150m/min
 Feed per tooth : 0.15mm/tooth
 Width of cut : 6mm
 Depth of cut : 6mm

Effective deep hole machining

- An offset, long shank type to prevent workpiece interference is available for difficult to reach deep applications.

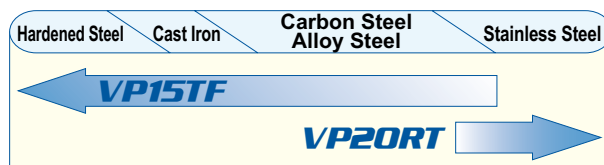


Power consumption comparison



Long life insert grade

MIRACLE coated **VP15TF** has a good balance of wear and fracture resistance. MIRACLE coated **VP20RT** exhibits excellent performance for stainless steel machining. Both grades are suitable for a variety of workpiece materials.



A wide selection of corner radii

9 sizes from R0.2 to R3.2 available. Suitable for a wide range of machining applications.



High rigidity cutter bodies

- Rigidity has been increased by using a larger amount of backing metal behind the insert.
- Resistance to corrosion and abrasion on the cutter bodies made possible by using a superior high heat resistant alloy and a special surface treatment.



Cutting Performance

Wall Surface Accuracy

The unique insert geometry allows a consistent and accurate vertical wall to be produced.

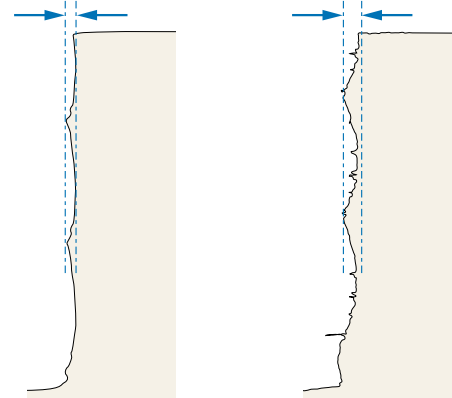
<Cutting conditions>

Workpiece : JIS SCM440
 Tool : APX3000R253SA25SA
 Insert : AOMT123608PEER-M
 Grade : VP15TF
 Cutting speed : 160m/min
 Feed per tooth : 0.15mm/tooth
 Width of cut : 2mm
 Depth of cut : 6mm

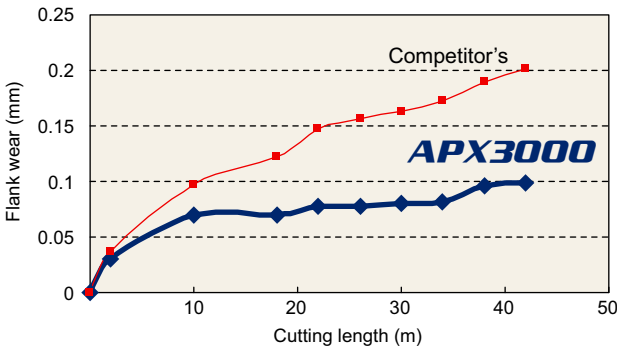


APX3000
0.021mm

Competitor's
0.032mm



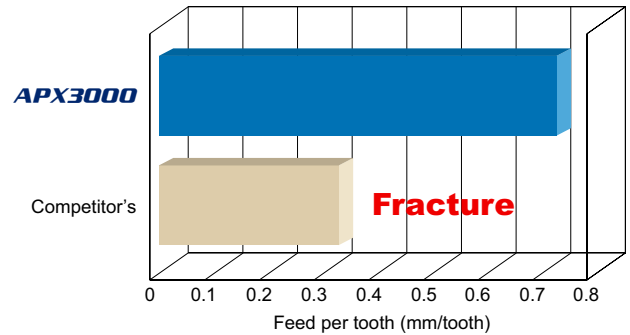
Wear Resistance



<Cutting conditions>

Workpiece : JIS SCM440
 Tool : APX3000R253SA25SA
 Insert : AOMT123608PEER-M
 Grade : VP15TF
 Cutting speed : 200m/min
 Feed per tooth : 0.2mm/tooth
 Width of cut : 3mm
 Depth of cut : 5mm
 Air blow

Fracture Resistance

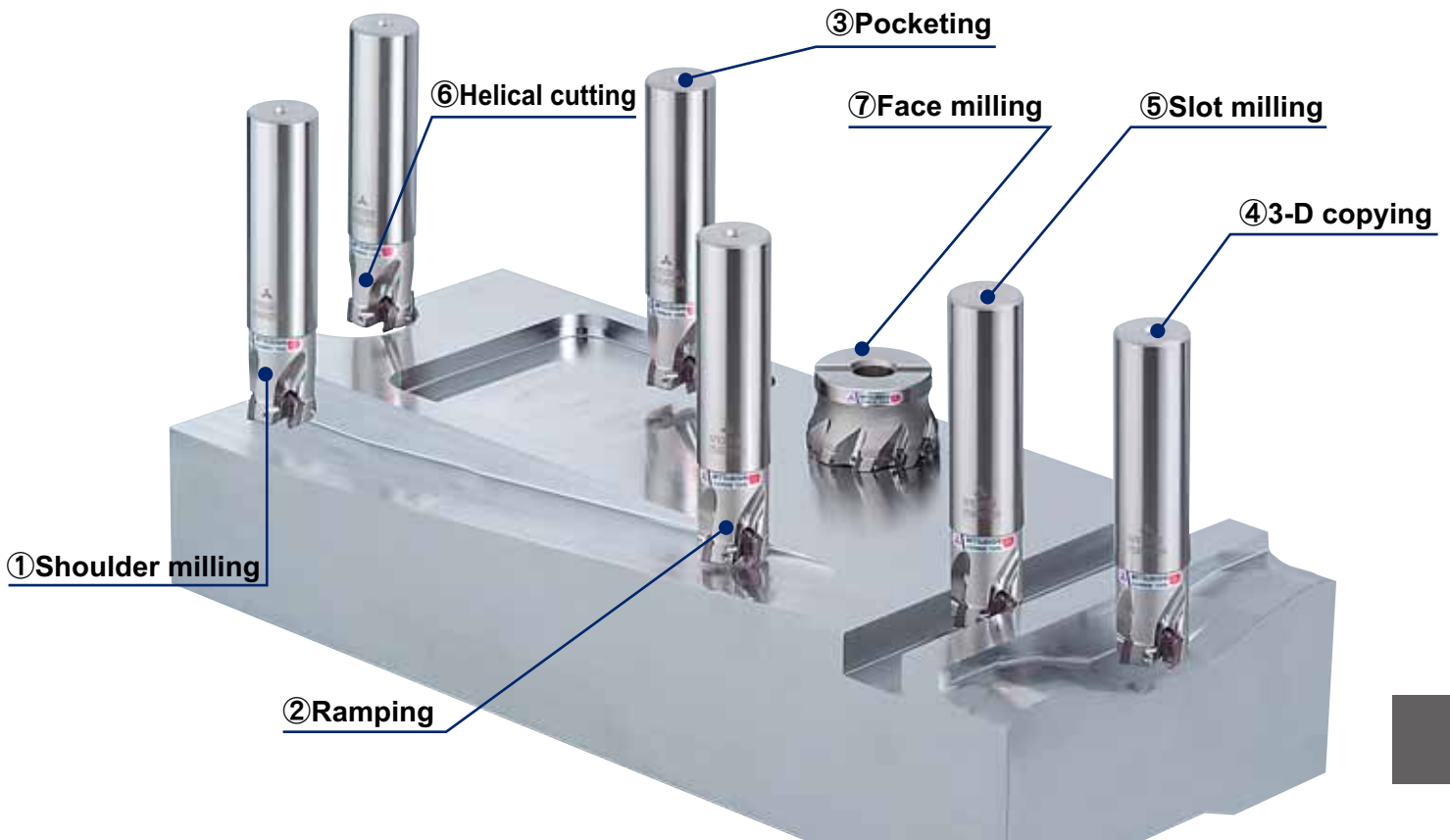


<Cutting conditions>

Workpiece : JIS S55C
 Tool : APX3000R253SA25SA
 Insert : AOMT123608PEER-M
 Grade : VP15TF
 Cutting speed : 160m/min
 Width of cut : 5mm
 Depth of cut : 5mm
 Air blow

Effective Multi-functional Machining

● The APX3000 is highly effective in various 3-D machining operations, including steep ramping angle capabilities.



APX3000

Shank Type



Fig.1

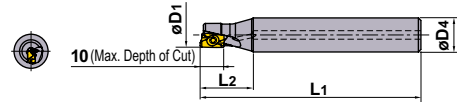


Fig.2

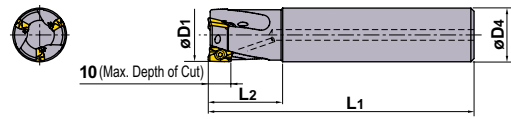
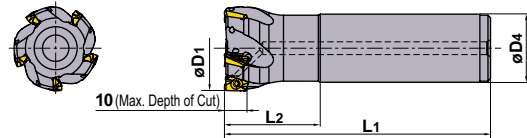





Fig.3



Right hand tool holder only.

Light Alloy	Cast Iron	General Steel	Stainless Steel	Hardened Steel
➔				

Type	Order Number	Stock	Number of Teeth	Dimensions (mm)				Max. Ramping Angle α°	 Clamp Screw	 Wrench	 Anti-seize Lubricant	Type (Fig.)
				D1	D4	L1	L2					
Standard	APX3000 R121SA16SA	●	1	12	16	85	25	6	TPS25	TIP07F	MK1KS	1
	141SA16SA	●	1	14	16	85	25	6	TPS25	TIP07F	MK1KS	1
	162SA16SA	●	2	16	16	85	25	15	TPS25	TIP07F	MK1KS	2
	182SA16SA	●	2	18	16	85	25	11	TPS25	TIP07F	MK1KS	3
	202SA20SA	●	2	20	20	100	30	9	TPS25	TIP07F	MK1KS	2
	203SA20SA	●	3	20	20	100	30	9	TPS25	TIP07F	MK1KS	2
	223SA20SA	●	3	22	20	115	30	7	TPS25-1	TIP07F	MK1KS	3
	252SA25SA	●	2	25	25	115	35	6	TPS25-1	TIP07F	MK1KS	2
	253SA25SA	●	3	25	25	115	35	6	TPS25-1	TIP07F	MK1KS	2
	254SA25SA	●	4	25	25	115	35	6	TPS25-1	TIP07F	MK1KS	2
	284SA25SA	●	4	28	25	115	35	4	TPS25-1	TIP07F	MK1KS	3
	304SA32SA	●	4	30	32	125	45	4	TPS25-1	TIP07F	MK1KS	2
	323SA32SA	●	3	32	32	125	45	3	TPS25-1	TIP07F	MK1KS	2
	324SA32SA	●	4	32	32	125	45	3	TPS25-1	TIP07F	MK1KS	2
	325SA32SA	●	5	32	32	125	45	3	TPS25-1	TIP07F	MK1KS	2
	403SA32SA	●	3	40	32	125	45	2	TPS25-1	TIP07F	MK1KS	3
	405SA32SA	●	5	40	32	125	45	2	TPS25-1	TIP07F	MK1KS	3
	406SA32SA	●	6	40	32	125	45	2	TPS25-1	TIP07F	MK1KS	3
507SA32SA	●	7	50	32	125	45	1	TPS25-1	TIP07F	MK1KS	3	
638SA32SA	●	8	63	32	125	45	1	TPS25-1	TIP07F	MK1KS	3	
Long	APX3000 R182SA16LA	●	2	18	16	120	25	11	TPS25	TIP07F	MK1KS	3
	222SA20LA	●	2	22	20	150	30	7	TPS25-1	TIP07F	MK1KS	3
	282SA25LA	●	2	28	25	170	35	4	TPS25-1	TIP07F	MK1KS	3
	283SA25LA	●	3	28	25	170	35	4	TPS25-1	TIP07F	MK1KS	3
	352SA32LA	●	2	35	32	190	45	3	TPS25-1	TIP07F	MK1KS	3
	353SA32LA	●	3	35	32	190	45	3	TPS25-1	TIP07F	MK1KS	3

Note) When using inserts with corner radius $Re \geq 2.0$, machining of the holder is required as shown on page 4.

Arbor Type



Fig.1

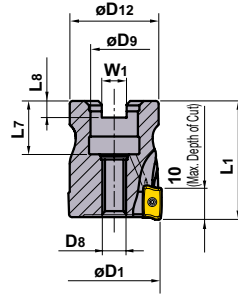
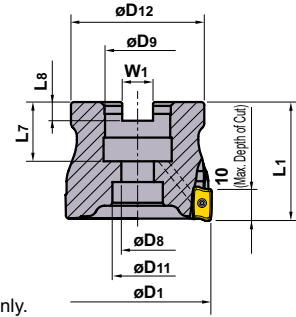


Fig.2



Right hand tool holder only.

Light alloy	Cast iron	General steel	Stainless steel	Hardened steel
➔				

Order Number	Stock	Number of Teeth	Dimensions (mm)											Weight (kg)	Max. Ramping Angle α°	Clamp Screw	Wrench	Clamping Bolt	Anti-seize Lubricant	Type (Fig.)
			D1	L1	L7	L8	D8	W1	D9	D11	D12									
APX3000-032A05RA	●	5	32	40	18	5.6	M8	8.4	16	—	30	0.2	3	TPS25-1	TIP07F	①LS24H	MK1KS	1		
-040A06RA	●	6	40	40	18	5.6	9	8.4	16	14	34	0.3	2	TPS25-1	TIP07F	②HSC08030H	MK1KS	2		
-050A07RA	●	7	50	40	20	6.3	11	10.4	22	17	45	0.4	2	TPS25-1	TIP07F	②HSC10030H	MK1KS	2		
-063A08RA	●	8	63	40	20	6.3	11	10.4	22	17	55	0.7	1	TPS25-1	TIP07F	②HSC10030H	MK1KS	2		
R08009CA	●	9	80	50	26	6	13	9.5	25.4	20	70	1.3	1	TPS25-1	TIP07F	②HSC12035H	MK1KS	2		
R10011DA	●	11	100	63	32	8	17	12.7	31.75	26	80	2.2	0.5	TPS25-1	TIP07F	②HSC16040H	MK1KS	2		

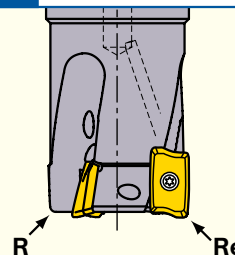
Note) When using inserts $Re \geq 2.0$, machining of the holder is needed as shown below.

Insert

Shape	Order Number	Coated		Dimensions (mm)					Geometry
		VP15TF	VP20RT	L1	L2	S1	F1	Re	
	AOMT 123602PEER-M	●	●	12	6.6	3.6	1.8	0.2	
	123604PEER-M	●	●	12	6.6	3.6	1.6	0.4	
	123608PEER-M	●	●	12	6.6	3.6	1.2	0.8	
	123610PEER-M	●	●	12	6.6	3.6	1.0	1.0	
	123612PEER-M	●	●	12	6.6	3.6	0.8	1.2	
	123616PEER-M	●	●	12	6.6	3.6	0.4	1.6	
	123620PEER-M	●	●	12	6.6	3.6	0.4	2.0	
	123630PEER-M	●	●	12	6.6	3.6	0.4	3.0	
	123632PEER-M	●	●	12	6.6	3.6	0.4	3.2	

Note on use of inserts with large corner radii

When using inserts with corner radius $Re \geq 2.0$, please machine the holder with a radius form as shown on the right.



$$R = Re - 0.5mm$$

R : Holder end radius
Re : Insert corner radius

APX3000

Recommended Cutting Conditions

Cutting Conditions for Shoulder Milling

Workpiece	Hardness	Insert Grade	Width of Cut ae (mm)	Cutting Speed vc (m/min)	φ12-16		φ18-25		φ28-100	
					Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)
P Mild Steel	≤180HB	VP15TF	-0.25D1	230 (180-270)	- 4	0.15	- 5	0.25	- 5	0.20
					4 - 7	0.10	5 - 7	0.20	5 - 7	0.15
					/		7 - 8.5	0.15	7 - 8.5	0.10
			/		8.5 - 10	0.10	8.5 - 10	0.07		
			-0.5D1	220 (170-260)	- 2	0.15	- 3	0.25	- 3	0.20
					2 - 5	0.10	3 - 5.5	0.20	3 - 5.5	0.15
	/				5.5 - 8	0.15	5.5 - 8	0.10		
	/		8 - 10	0.10	8 - 10	0.07				
	-0.75D1	180 (140-210)	- 4	0.10	- 4	0.15	- 3	0.10		
/			4 - 10	0.10	3 - 7	0.07				
/			/		/					
Carbon Steel Alloy Steel	180-350HB	VP15TF	-0.25D1	180 (140-210)	- 4	0.15	- 5	0.25	- 5	0.20
					4 - 7	0.10	5 - 7	0.20	5 - 7	0.15
					/		7 - 8.5	0.15	7 - 8.5	0.10
			/		8.5 - 10	0.10	8.5 - 10	0.07		
			-0.5D1	170 (130-200)	- 2	0.15	- 3	0.25	- 3	0.20
					2 - 5	0.10	3 - 5.5	0.20	3 - 5.5	0.15
	/				5.5 - 8	0.15	5.5 - 8	0.10		
	/		8 - 10	0.10	8 - 10	0.07				
	-0.75D1	140 (110-160)	- 4	0.10	- 4	0.15	- 3	0.10		
/			4 - 10	0.10	3 - 7	0.07				
/			/		/					
M Stainless Steel	≤270HB	VP20RT	-0.25D1	180 (140-210)	- 4	0.15	- 5	0.20	- 5	0.20
					4 - 7	0.10	5 - 7	0.15	5 - 7	0.15
					/		7 - 8.5	0.10	7 - 8.5	0.10
			/		8.5 - 10	0.07	8.5 - 10	0.07		
			-0.5D1	170 (130-200)	- 2	0.15	- 3	0.20	- 3	0.20
					2 - 5	0.10	3 - 5.5	0.15	3 - 5.5	0.15
	/				5.5 - 8	0.10	5.5 - 8	0.10		
	/		8 - 10	0.07	8 - 10	0.07				
	-0.75D1	140 (110-160)	- 4	0.10	- 4	0.10	- 3	0.10		
/			4 - 10	0.07	3 - 7	0.07				
/			/		/					
K Cast Iron	Tensile Strength ≤350MPa	VP15TF	-0.25D1	180 (140-210)	- 4	0.15	- 5	0.25	- 5	0.20
					4 - 7	0.10	5 - 7	0.20	5 - 7	0.15
					/		7 - 8.5	0.15	7 - 8.5	0.10
			/		8.5 - 10	0.10	8.5 - 10	0.07		
			-0.5D1	170 (130-200)	- 2	0.15	- 3	0.25	- 3	0.20
					2 - 5	0.10	3 - 5.5	0.20	3 - 5.5	0.15
	/				5.5 - 8	0.15	5.5 - 8	0.10		
	/		8 - 10	0.10	8 - 10	0.07				
	-0.75D1	140 (110-160)	- 4	0.10	- 4	0.15	- 3	0.10		
/			4 - 10	0.10	3 - 7	0.07				
/			/		/					
Ductile Cast Iron	Tensile Strength ≤800MPa	VP15TF	-0.25D1	130 (100-150)	- 4	0.10	- 5	0.20	- 5	0.20
					4 - 7	0.07	5 - 7	0.15	5 - 7	0.15
					/		7 - 8.5	0.10	7 - 8.5	0.10
			/		8.5 - 10	0.07	8.5 - 10	0.07		
			-0.5D1	120 (90-140)	- 2	0.10	- 3	0.20	- 3	0.20
					2 - 5	0.07	3 - 5.5	0.15	3 - 5.5	0.15
	/				5.5 - 8	0.10	5.5 - 8	0.10		
	/		8 - 10	0.07	8 - 10	0.07				
	-0.75D1	100 (80-120)	- 4	0.07	- 4	0.10	- 3	0.10		
/			4 - 10	0.07	3 - 7	0.07				
/			/		/					
H Hardened Steel	40-55HRC	VP15TF	-0.25D1	90 (70-100)	- 4	0.10	- 5	0.15	- 5	0.15
					4 - 7	0.07	5 - 7	0.10	5 - 7	0.10
					/		7 - 8.5	0.07	/	
			-0.5D1	85 (60-100)	- 2	0.10	- 3	0.15	- 3	0.15
					2 - 5	0.07	3 - 5.5	0.10	/	
					/		/		/	
-0.75D1	70 (50- 80)	- 4	0.07	- 4	0.07	- 3	0.07			
		/		/		/				
		/		/		/				

(Note 1) These cutting conditions are a guide to the standard shank type and the arbor type.

Please make adjustments according to the machining conditions.

(Note 2) Vibration is liable to occur in certain cases. Please reduce the depth of cut and / or reduce cutting conditions in the following cases.

- When using the long shank type
- When using long tool overhang with the standard or arbor type
- When the application has poor clamping rigidity or when using a low rigidity machine.

(Note 3) In case of coarse and fine pitch cutters, the coarse pitch type is recommended to prevent vibration.

Cutting Conditions for Slot Milling

Workpiece	Hardness	Insert Grade	Width of Cut ae (mm)	Cutting Speed vc (m/min)	φ 12-16		φ 18-25		φ 28-100	
					Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)	Depth of Cut ap (mm)	Feed per Tooth fz (mm/tooth)
P Mild Steel	≤180HB	VP15TF	D1	180 (140-210)	-3	0.10	- 4	0.10	- 3	0.10
							4 - 7	0.07	3 - 5	0.07
Carbon Steel Alloy Steel	180-350HB	VP15TF	D1	140 (110-160)	-3	0.10	- 4	0.10	- 3	0.10
							4 - 7	0.07	3 - 5	0.07
M Stainless Steel	≤270HB	VP20RT	D1	140 (110-160)	-3	0.10	- 4	0.10	- 3	0.10
K Cast Iron	Tensile Strength ≤350MPa	VP15TF	D1	140 (110-160)	-3	0.10	- 4	0.10	- 3	0.10
							4 - 7	0.07	3 - 5	0.07
Ductile Cast Iron	Tensile Strength ≤800MPa	VP15TF	D1	100 (80-120)	-3	0.07	- 4	0.10	- 3	0.10
							4 - 7	0.07	3 - 5	0.07
H Hardened Steel	40-55HRC	VP15TF	D1	70 (50- 80)	-3	0.07	- 4	0.07	- 3	0.07

(Note 1) These cutting conditions are a guide to the standard shank type and the arbor type.

Please make adjustments according to the machining conditions.

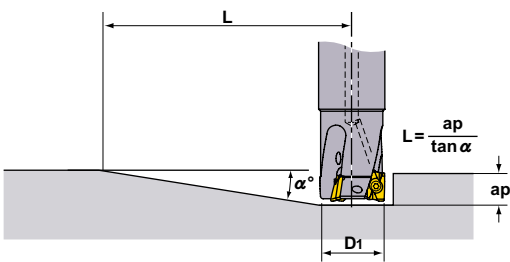
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- When using the long shank type
- When using long tool overhang with the standard or arbor type
- When the application has poor clamping rigidity or when using a low rigidity machine.

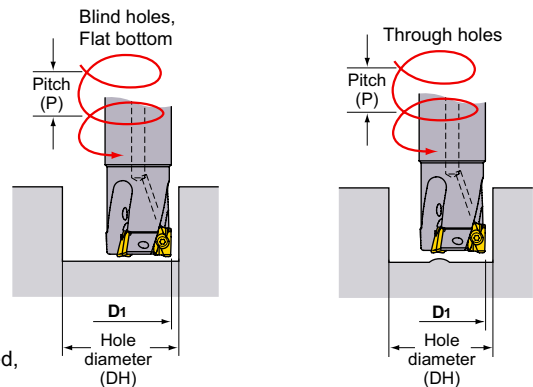
(Note 3) In case of coarse and fine pitch cutters, the coarse pitch type is recommended to prevent vibration.

Ramping/Helical Cutting

Ramping



Helical Cutting



Refer to the table below for cutting conditions. For feed per tooth and cutting speed, follow the cutting conditions for slot milling.

Cutting Edge Diameter D1 (mm)	Ramping		Helical Cutting (Blind Hole, Flat Bottom)				Helical Cutting (Through Hole)	
	Maximum Ramping Angle α (°)	Minimum Distance ¹⁾ L (mm)	Maximum Hole Diameter ²⁾ DH max. (mm)	Maximum Pitch P max. (mm)	Minimum Hole Diameter DH min. (mm)	Maximum Pitch P max. (mm)	Minimum Hole Diameter DH min. (mm)	Maximum Pitch P max. (mm)
12	6	95	22	2.5	20.5	2	14	0.5
14	6	95	26	2.5	24.5	2	18	1
16	15	37	30	9	28	7	21	2
18	11	51	34	5	32	4.5	25	2
20	9	63	38	5	36	4.5	29	2
22	7	81	42	5	40	4.5	33	2
25	6	95	48	6	46	5	39	3
28	4	143	54	4.5	52	4	45	2
30	4	143	58	4.5	56	4	49	2
32	3	190	62	4.5	60	4	53	2
35	3	190	68	4	66	3.5	59	2
40	2	286	78	4	76	3.5	69	2
50	1	572	98	2	96	2	89	2
63	1	572	124	2	122	2	115	2
80	1	572	158	2	156	2	149	2
100	0.5	1145	198	1	196	1	189	1

Note) (1) $L (=10/\tan \alpha)$. Cutters' moving distance until depth of cut reaches 10mm at a maximum ramping angle.

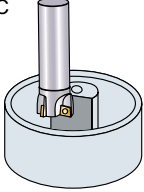
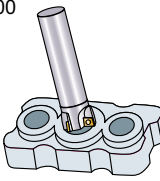
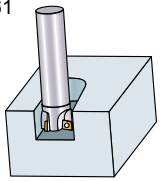
(2) In case nose radius of 0.8mm. Other nose that, find with the below formula.

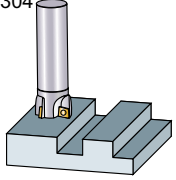
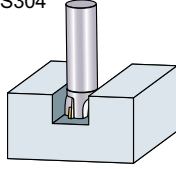
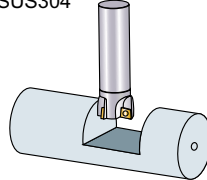
$$\{(\text{cutting edge diameter } D1) - (\text{nose radius}) - 0.2\} \times 2$$

(3) When machining highly ductile materials with ramping angles above, chips could be continuous. In this case, decrease the ramping angle or feed per tooth.

APX3000

Application Examples

Tool		APX3000R162SA16SA	APX3000R405SA32SA	APX3000R254SA25SA
Insert (Grade)		AOMT123616PEER-M(VP15TF)	AOMT123608PEER-M(VP15TF)	AOMT123608PEER-M(VP15TF)
Workpiece		JIS S45C 	JIS FC200 	JIS SKD61 (HRC45) 
Cutting Conditions	Cutting Speed (m/min)	150	150	150
	Feed per Tooth (mm/tooth)	0.05	0.15	0.12
	Depth of Cut (mm)	1.5	5	3
	Width of Cut (mm)	1.5	30	10-25
Coolant		Wet	Dry	Dry
Machine Shank Type		M/C-BT30	M/C-BT50	M/C-BT50
Result		Lower cutting noise and double tool life compared to a competitor's products.	Reduced cutting noise, better surface finish and double the tool life compared to the competitor's product.	Better cutting performance and lower cutting resistance compared to the competitor's product.

Tool		APX3000R203SA20SA	APX3000R325SA32SA	APX3000R162SA16SA
Insert (Grade)		AOMT123608PEER-M(VP20RT)	AOMT123608PEER-M(VP20RT)	AOMT123608PEER-M(VP20RT)
Workpiece		JIS SUS304 	JIS SUS304 	JIS SUS304 
Cutting Conditions	Cutting Speed (m/min)	160	130	160
	Feed per Tooth (mm/tooth)	0.1	0.2	0.11
	Depth of Cut (mm)	3.2	0.25	2.6
	Width of Cut (mm)	5.1	28	14
Coolant		Wet	Wet	Dry
Machine Shank Type		M/C-BT40	M/C-BT50	M/C-BT40
Result		Better chip discharge and lower cutting noise compared to competitor's products.	Lower cutting resistance enabled stable machining even at 6 times higher cutting conditions. 12 times longer tool life.	Lower cutting resistance prevented burr formation and reduced work piece stress.

Please note that the machining performed in the application examples is dependent on the rigidity of the machine used and the rigidity of the workpiece and clamping.

Operational Guidance

- Use only specified inserts and parts.
- Clamp the inserts at a specified torque of (1.0N/m) only.

For Your Safety

● Don't touch inserts and chips without gloves. ● Please machine within the recommended application range, and exchange expired tools with new ones in advance of breakage. ● Please use safety cover and wear safety glasses. ● When using compounded cutting oils, please take fire preventions. ● When attaching inserts or spare parts, please use the attached wrench or spanner. ● When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

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(Tools specifications subject to change without notice.)