

MITSUBISHI

MITSUBISHI CARBIDE

TOOLS NEWS

2006.7.Update B055G

**APX
4000**
now
available!

Multi-functional Indexable Cutter

APX3000/4000

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

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

APX4000 now available.
Up to 15mm depth of cut!



APX3000

APX4000

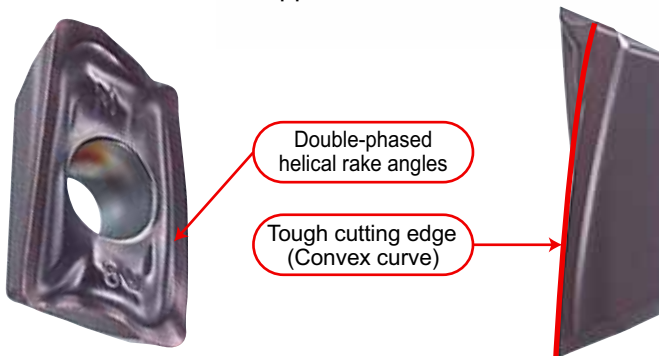
NEW

Multi-functional Indexable Cutter **APX3000/4000**

Features

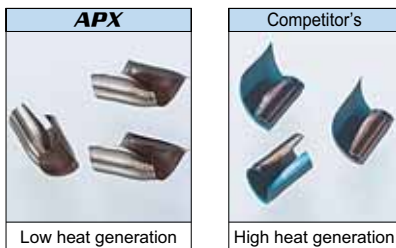
Low Cutting Resistance Inserts

- 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

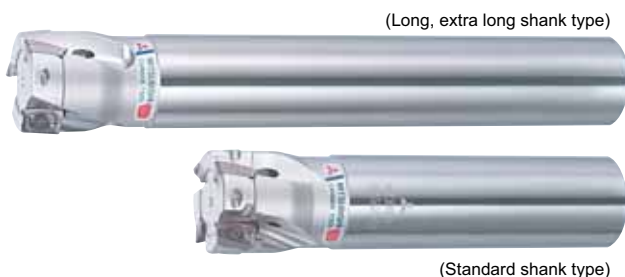
Feed per tooth : 0.15mm/tooth

Width of cut : 6mm

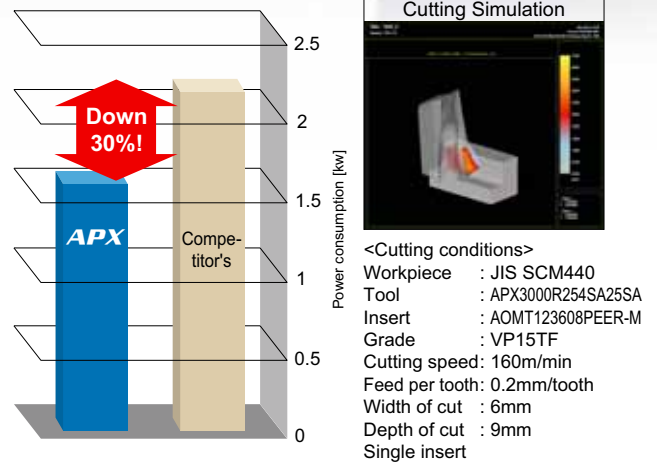
Depth of cut : 6mm

Effective Deep Hole Machining

- A long shank type is available for difficult to reach applications. An extra long shank type is also included in the **APX4000** range.

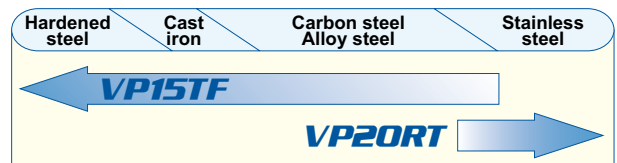


Power consumption comparison



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.



Insert Size

APX4000 with a new 15 mm insert is suitable for larger depths of cut. The new insert is also thicker and therefore ideal for high load machining.

NEW APX4000	APX3000
Max. Depth of Cut 15mm	Max. Depth of Cut 10mm
	

Cutting Performance

Wall Surface Accuracy

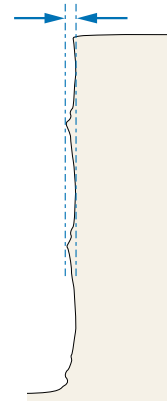
The unique insert geometry allows a consistent and accurate vertical wall to be produced.

<Cutting conditions>

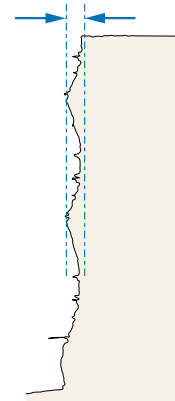
Workpiece : JIS SCM440
 Tool : APX3000R253SA25SA
 Insert : AOMT123608PEER-M
 Grade : VP15TF
 Cutting speed : 160m/min
 Feed per tooth : 0.15mm/tooth
 Width of cut : 2mm
 Depth of cut : 6mm



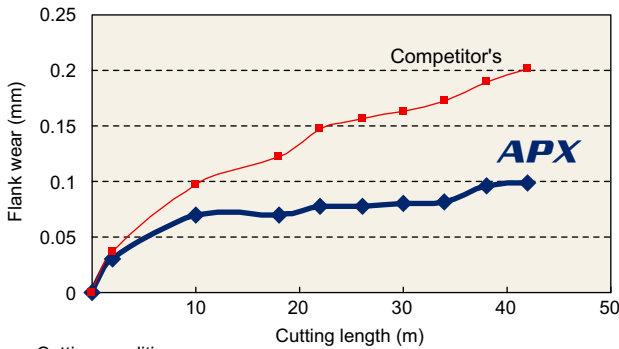
APX
0.021mm



Competitor's
0.032mm



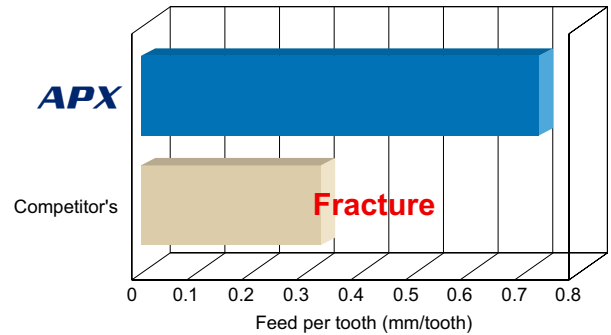
Wear Resistance



<Cutting conditions>

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

Fracture Resistance

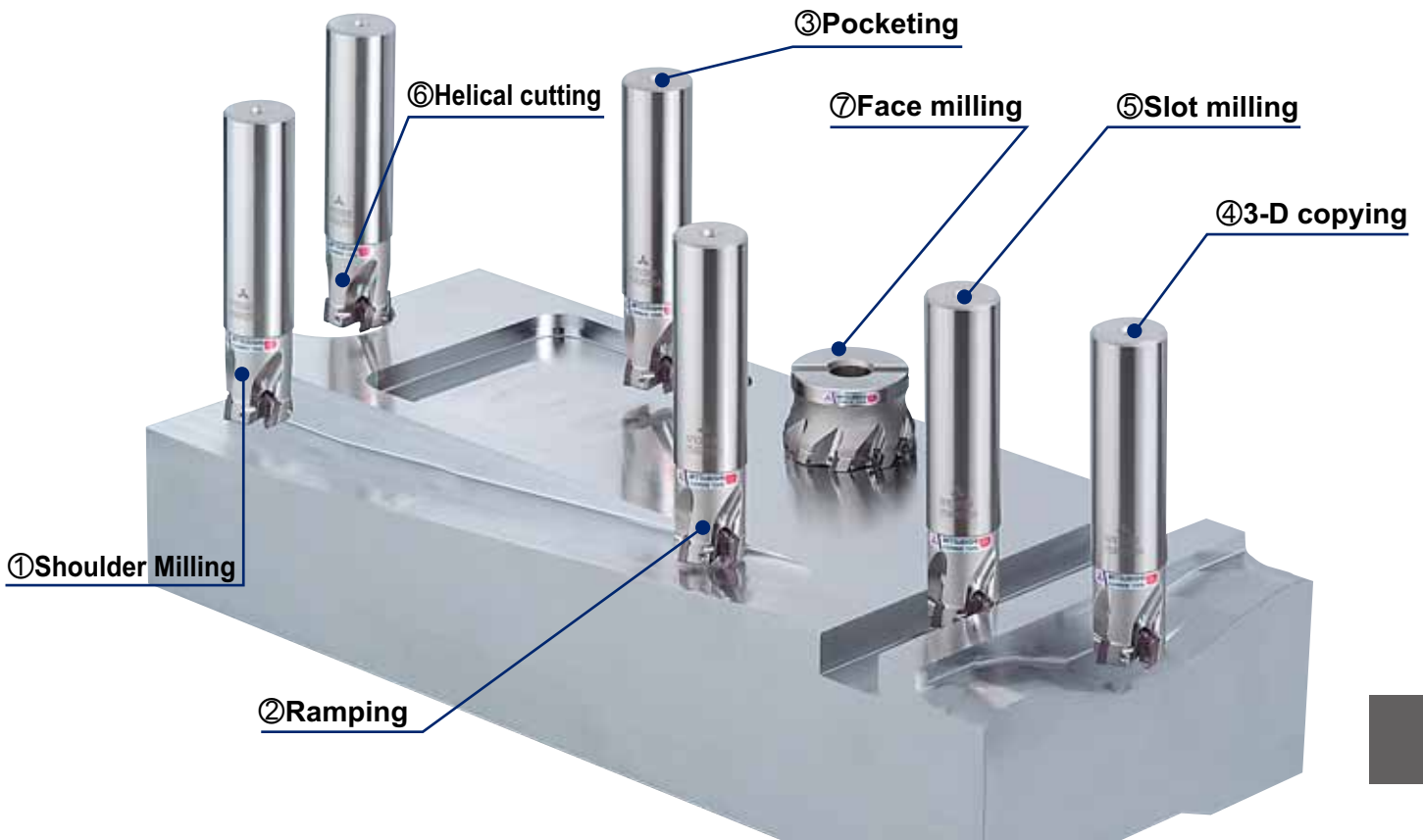


<Cutting conditions>

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 **APX** is highly effective in various 3-D machining operations, including steep ramping angle capabilities.



APX3000

Shank Type



Fig. 1

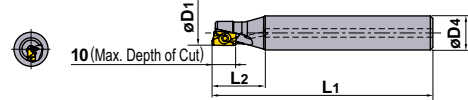


Fig. 2

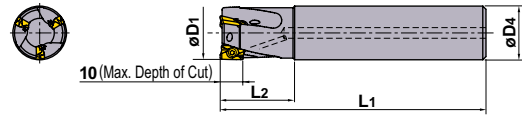
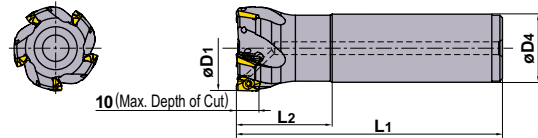


Fig. 3



Right hand tool holder only.

Light Alloy	Cast Iron	General Steel	Stainless Steel	Hardened Steel
	➔			

Type	Order Number	Stock R	Number of Teeth	Dimensions (mm)				Max. Ramping Angle α°	Type (Fig.)				
				D1	D4	L1	L2						
Standard	APX3000 R121SA16SA	●	1	12	16	85	25	6	1	TPS25	TIP07F	MK1KS	AOMT1236 PEER-M
	141SA16SA	●	1	14	16	85	25	6	1	TPS25	TIP07F	MK1KS	
	162SA16SA	●	2	16	16	85	25	15	2	TPS25	TIP07F	MK1KS	
	182SA16SA	●	2	18	16	85	25	11	3	TPS25	TIP07F	MK1KS	
	202SA20SA	●	2	20	20	100	30	9	2	TPS25	TIP07F	MK1KS	
	203SA20SA	●	3	20	20	100	30	9	2	TPS25	TIP07F	MK1KS	
	223SA20SA	●	3	22	20	115	30	7	3	TPS25-1	TIP07F	MK1KS	
	252SA25SA	●	2	25	25	115	35	6	2	TPS25-1	TIP07F	MK1KS	
	253SA25SA	●	3	25	25	115	35	6	2	TPS25-1	TIP07F	MK1KS	
	254SA25SA	●	4	25	25	115	35	6	2	TPS25-1	TIP07F	MK1KS	
	284SA25SA	●	4	28	25	115	35	4	3	TPS25-1	TIP07F	MK1KS	
	304SA32SA	●	4	30	32	125	45	4	2	TPS25-1	TIP07F	MK1KS	
	323SA32SA	●	3	32	32	125	45	3	2	TPS25-1	TIP07F	MK1KS	
	324SA32SA	●	4	32	32	125	45	3	2	TPS25-1	TIP07F	MK1KS	
	325SA32SA	●	5	32	32	125	45	3	2	TPS25-1	TIP07F	MK1KS	
	403SA32SA	●	3	40	32	125	45	2	3	TPS25-1	TIP07F	MK1KS	
	405SA32SA	●	5	40	32	125	45	2	3	TPS25-1	TIP07F	MK1KS	
406SA32SA	●	6	40	32	125	45	2	3	TPS25-1	TIP07F	MK1KS		
507SA32SA	●	7	50	32	125	45	1	3	TPS25-1	TIP07F	MK1KS		
638SA32SA	●	8	63	32	125	45	1	3	TPS25-1	TIP07F	MK1KS		
Long Shank	APX3000 R182SA16LA	●	2	18	16	120	25	11	3	TPS25	TIP07F	MK1KS	
	222SA20LA	●	2	22	20	150	30	7	3	TPS25-1	TIP07F	MK1KS	
	282SA25LA	●	2	28	25	170	35	4	3	TPS25-1	TIP07F	MK1KS	
	283SA25LA	●	3	28	25	170	35	4	3	TPS25-1	TIP07F	MK1KS	
	352SA32LA	●	2	35	32	190	45	3	3	TPS25-1	TIP07F	MK1KS	
	353SA32LA	●	3	35	32	190	45	3	3	TPS25-1	TIP07F	MK1KS	

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

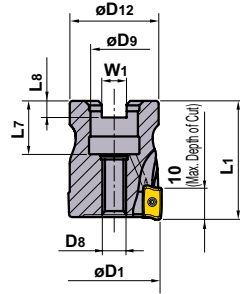
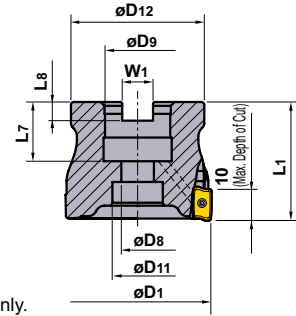


Fig. 2



Right hand tool holder only.

Light Alloy	Cast Iron	General Steel	Stainless Steel	Hardened Steel
➔				

D1	Clamping Bolt Order Number	Geometry	
$\phi 32$	LS24H	①	①
$\phi 40$	HSC08030H	②	
$\phi 50, \phi 63$	10030H		
$\phi 80$	12035H		
$\phi 100$	16040H		

Order Number	Stock	Number of Teeth	Dimensions (mm)										Weight (kg)	α Max. Ramping Angle	Type (Fig.)	Tools/Accessories			
			D1	L1	L7	L8	D8	W1	D9	D11	D12	Clamp Screw				Wrench	Anti-seizure Lubricant	Insert	
APX3000-032A05RA	●	5	32	40	18	5.6	M8	8.4	16	—	30	0.2	3	1	TPS25-1	TIP07F	MK1KS	AOMT1236 PEER-M	
-040A06RA	●	6	40	40	18	5.6	9	8.4	16	14	34	0.3	2	2	TPS25-1	TIP07F	MK1KS		
-050A07RA	●	7	50	40	20	6.3	11	10.4	22	17	45	0.4	2	2	TPS25-1	TIP07F	MK1KS		
-063A08RA	●	8	63	40	20	6.3	11	10.4	22	17	55	0.7	1	2	TPS25-1	TIP07F	MK1KS		
R08009CA	●	9	80	50	26	6	13	9.5	25.4	20	70	1.3	1	2	TPS25-1	TIP07F	MK1KS		
R10011DA	●	11	100	63	32	8	17	12.7	31.75	26	80	2.2	0.5	2	TPS25-1	TIP07F	MK1KS		

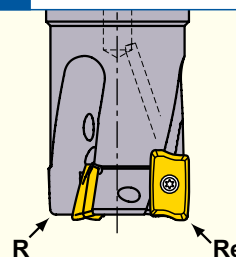
Note) When using inserts $Re \geq 2.0$, machining of the holder is needed as shown below.

Insert

Shape	Order Number	Stock		Dimensions (mm)					Geometry
		Coated		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	

APX3000: 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

APX4000

Shank Type

NEW



Fig. 1

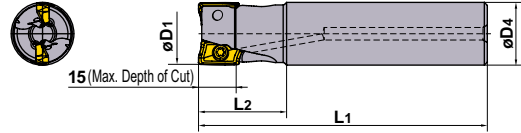
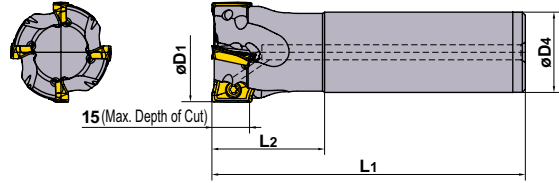


Fig. 2



Light Alloy	Cast Iron	General Steel	Stainless Steel	Hardened Steel

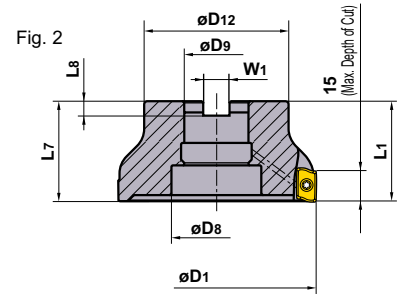
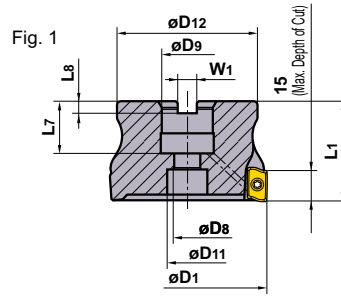
Right hand tool holder only.

Type	Order Number	Stock	Number of Teeth	Dimensions (mm)				Max. Ramping Angle α°	Type (Fig.)	Clamp Screw	Wrench	Anti-seizure Lubricant	Insert
				D1	D4	L1	L2						
Standard	NEW APX4000 R252SA25SA	●	2	25	25	115	35	11	1	TPS4	TIP15W	MK1KS	AOMT1848 PEER-M
	322SA32SA	●	2	32	32	125	45	7	1	TPS4	TIP15W	MK1KS	
	323SA32SA	●	3	32	32	125	45	7	1	TPS4	TIP15W	MK1KS	
	403SA32SA	●	3	40	32	125	45	6	2	TPS43	TIP15W	MK1KS	
	404SA32SA	●	4	40	32	125	45	6	2	TPS43	TIP15W	MK1KS	
	504SA32SA	●	4	50	32	125	45	4	2	TPS43	TIP15W	MK1KS	
	505SA32SA	●	5	50	32	125	45	4	2	TPS43	TIP15W	MK1KS	
	634SA32SA	●	4	63	32	125	45	3	2	TPS43	TIP15W	MK1KS	
636SA32SA	●	6	63	32	125	45	3	2	TPS43	TIP15W	MK1KS		
Long Shank	NEW APX4000 R252SA25LA	○*1	2	25	25	170	35	11	1	TPS4	TIP15W	MK1KS	
	282SA25LA	○*1	2	28	25	170	35	9	2	TPS4	TIP15W	MK1KS	
	322SA32LA	○*1	2	32	32	190	45	7	1	TPS4	TIP15W	MK1KS	
	323SA32LA	○*1	3	32	32	190	45	7	1	TPS4	TIP15W	MK1KS	
	352SA32LA	○*1	2	35	32	190	45	6	2	TPS4	TIP15W	MK1KS	
	353SA32LA	○*1	3	35	32	190	45	6	2	TPS4	TIP15W	MK1KS	
	402SA32LA	○*1	2	40	32	190	45	6	2	TPS43	TIP15W	MK1KS	
	403SA32LA	○*1	3	40	32	190	45	6	2	TPS43	TIP15W	MK1KS	
404SA32LA	○*1	4	40	32	190	45	6	2	TPS43	TIP15W	MK1KS		
Extra Long Shank Type	NEW APX4000 R252SA25ELA	○*2	2	25	25	220	80	11	1	TPS4	TIP15W	MK1KS	
	282SA25ELA	○*2	2	28	25	220	35	9	2	TPS4	TIP15W	MK1KS	
	322SA32ELA	○*2	2	32	32	260	100	7	1	TPS4	TIP15W	MK1KS	
	323SA32ELA	○*2	3	32	32	260	100	7	1	TPS4	TIP15W	MK1KS	
	352SA32ELA	○*2	2	35	32	260	45	6	2	TPS4	TIP15W	MK1KS	
	353SA32ELA	○*2	3	35	32	260	45	6	2	TPS4	TIP15W	MK1KS	
	402SA32ELA	○*2	2	40	32	260	45	6	2	TPS43	TIP15W	MK1KS	
	403SA32ELA	○*2	3	40	32	260	45	6	2	TPS43	TIP15W	MK1KS	
404SA32ELA	○*2	4	40	32	260	45	6	2	TPS43	TIP15W	MK1KS		

● : Inventory maintained. ○ : Available from: (*1: End of July 2006, *2: August 2006, *3: September 2006)

Arbor Type

NEW



Right hand tool holder only.

Light Alloy	Cast Iron	General Steel	Stainless Steel	Hardened Steel
➔				

D1	Clamping Bolt Order Number	Geometry	
φ40	HSC08030H	①	
φ50, φ63	10030H		
φ80	12035H		
φ100	16040H		
φ125	MBA20030H	②	
φ160	24045H		

Order Number	Stock	Number of Teeth	Dimensions (mm)										Weight (kg)	Max. Ramping Angle α°	Type (Fig.)				
	R		D1	L1	L7	L8	D8	W1	D9	D11	D12								
NEW APX4000-040A04RA	○*2	4	40	40	18	5.6	9	8.4	16	14	34	0.2	6	1	TPS43	TIP15W	MK1KS	AOMT1848 PEER-M	
-050A05RA	○*2	5	50	40	20	6.3	11	10.4	22	17	45	0.3	4	1	TPS43	TIP15W	MK1KS		
-063A06RA	○*2	6	63	40	20	6.3	11	10.4	22	17	50	0.5	3	1	TPS43	TIP15W	MK1KS		
R08007CA	○*2	7	80	50	26	6	13	9.5	25.4	20	70	1.2	2	1	TPS43	TIP15W	MK1KS		
R10008DA	○*2	8	100	63	32	8	17	12.7	31.75	26	80	2.1	1.5	1	TPS43	TIP15W	MK1KS		
R12509EA	○*2	9	125	63	40	10	56	15.9	38.1	—	100	3.3	1	2	TPS43	TIP15W	MK1KS		
R16010FA	○*2	10	160	63	40	11	72	19	50.8	—	100	4.8	1	2	TPS43	TIP15W	MK1KS		

Insert

Shape	Order Number	Stock		Dimensions (mm)					Geometry
		Coated		L1	L2	S1	F1	Re	
		VP15TF	VP20RT						
	NEW AOMT184804PEER-M	○*3	○*3	18	9	4.8	1.8	0.4	
	184808PEER-M	●	○*3	18	9	4.8	1.4	0.8	

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
			-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
	-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
			-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
	-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
			-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
	-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
			-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
	-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
			-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
	-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)	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	≤180H	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.

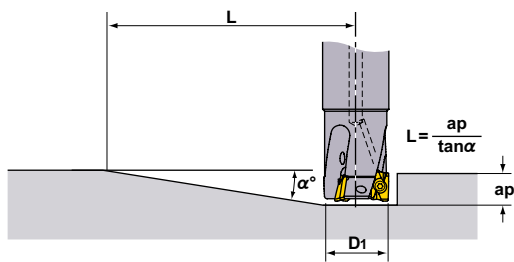
(Note 2) Vibration is liable to occur in certain cases. Please reduce the depth of cut and / or reduce cutting conditions in the following cases.

- 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.

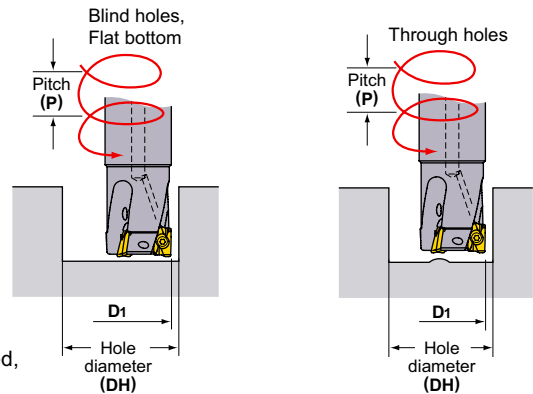
(Note 3) In case of coarse and fine pitch cutters, the coarse pitch type is recommended to prevent vibration.

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.

Recommended Cutting Conditions

Cutting Conditions for Shoulder Milling

Workpiece	Hardness	Insert Grade	Width of Cut ae (mm)	Cutting Speed vc (m/min)	φ25—40		φ50—80		φ100—160	
					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	-0.25D ₁	230 (180—270)	-5	0.3	-5	0.3	-5	0.25
					5—7.5	0.25	5—7.5	0.25	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.2	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.15	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
			-0.5D ₁	220 (170—260)	-5	0.3	-5	0.3	-5	0.25
					5—7.5	0.25	5—7.5	0.25	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.2	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.15	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
			-0.75D ₁	180 (140—210)	-5	0.2	-5	0.2	-5	0.15
					5—10	0.15	5—10	0.15	5—10	0.1
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
Carbon Steel Alloy Steel	180—350HB	VP15TF	-0.25D ₁	180 (140—210)	-5	0.3	-5	0.3	-5	0.25
					5—7.5	0.25	5—7.5	0.25	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.2	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.15	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
			-0.5D ₁	170 (130—200)	-5	0.3	-5	0.3	-5	0.25
					5—7.5	0.25	5—7.5	0.25	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.2	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.15	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
			-0.75D ₁	140 (110—160)	-5	0.2	-5	0.2	-5	0.15
					5—10	0.15	5—10	0.15	5—10	0.1
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
M Stainless Steel	≤270HB	VP20RT	-0.25D ₁	180 (140—210)	-5	0.3	-5	0.25	-5	0.25
					5—7.5	0.25	5—7.5	0.2	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.15	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.1	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.07	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.07	12.5—15	0.07
			-0.5D ₁	170 (130—200)	-5	0.3	-5	0.25	-5	0.25
					5—7.5	0.25	5—7.5	0.2	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.15	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.1	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.07	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.07	12.5—15	0.07
			-0.75D ₁	140 (110—160)	-5	0.2	-5	0.15	-5	0.15
					5—10	0.15	5—10	0.1	5—10	0.1
					10—15	0.1	10—15	0.07	10—15	0.07
					10—15	0.1	10—15	0.07	10—15	0.07
					10—15	0.1	10—15	0.07	10—15	0.07
					10—15	0.1	10—15	0.07	10—15	0.07
K Cast Iron	Tensile Strength ≤350MPa	VP15TF	-0.25D ₁	180 (140—210)	-5	0.3	-5	0.3	-5	0.25
					5—7.5	0.25	5—7.5	0.25	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.2	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.15	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
			-0.5D ₁	170 (130—200)	-5	0.3	-5	0.3	-5	0.25
					5—7.5	0.25	5—7.5	0.25	5—7.5	0.2
					7.5—10	0.2	7.5—10	0.2	7.5—10	0.15
					10—12.5	0.15	10—12.5	0.15	10—12.5	0.1
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
					12.5—15	0.1	12.5—15	0.1	12.5—15	0.07
			-0.75D ₁	140 (110—160)	-5	0.2	-5	0.2	-5	0.15
					5—10	0.15	5—10	0.15	5—10	0.1
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
Ductile Cast Iron	Tensile Strength ≤800MPa	VP15TF	-0.25D ₁	130 (100—150)	-5	0.25	-5	0.25	-5	0.25
					5—7.5	0.2	5—7.5	0.2	5—7.5	0.2
					7.5—10	0.15	7.5—10	0.15	7.5—10	0.15
					10—12.5	0.1	10—12.5	0.1	10—12.5	0.1
					12.5—15	0.07	12.5—15	0.07	12.5—15	0.07
					12.5—15	0.07	12.5—15	0.07	12.5—15	0.07
			-0.5D ₁	120 (90—140)	-5	0.25	-5	0.25	-5	0.25
					5—7.5	0.2	5—7.5	0.2	5—7.5	0.2
					7.5—10	0.15	7.5—10	0.15	7.5—10	0.15
					10—12.5	0.1	10—12.5	0.1	10—12.5	0.1
					12.5—15	0.07	12.5—15	0.07	12.5—15	0.07
					12.5—15	0.07	12.5—15	0.07	12.5—15	0.07
			-0.75D ₁	100 (80—120)	-5	0.2	-5	0.2	-5	0.15
					5—10	0.15	5—10	0.15	5—10	0.1
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
					10—15	0.1	10—15	0.1	10—15	0.07
H Hardened Steel	40—55HRC	VP15TF	-0.25D ₁	90 (70—100)	-5	0.15	-5	0.15	-5	0.15
					5—7.5	0.1	5—7.5	0.1	5—7.5	0.1
					7.5—10	0.07	7.5—10	0.07	7.5—10	0.07
			-0.5D ₁	85 (60—100)	-5	0.1	-5	0.1	-5	0.1
					5—7.5	0.07	5—7.5	0.07	5—7.5	0.07
					5—7.5	0.07	5—7.5	0.07	5—7.5	0.07
			-0.75D ₁	70	-5	0.07	-5	0.07	-5	0.07
					-5	0.07	-5	0.07	-5	0.07
					-5	0.07	-5	0.07	-5	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 and extra 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)	φ25—40		φ50—80		φ100—160	
					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	≤180H	VP15TF	D1	180 (140—210)	—5	0.15	—5	0.15	—5	0.15
					5—7.5	0.1	5—7.5	0.1	5—7.5	0.1
					7.5—10	0.07	7.5—10	0.07	7.5—10	0.07
Carbon Steel Alloy Steel	180—350HB	VP15TF	D1	140 (110—160)	—5	0.15	—5	0.15	—5	0.15
					5—7.5	0.1	5—7.5	0.1	5—7.5	0.1
					7.5—10	0.07	7.5—10	0.07	7.5—10	0.07
M Stainless Steel	≤270HB	VP20RT	D1	140 (110—160)	—5	0.15	—5	0.15	—5	0.15
					5—7.5	0.1	5—7.5	0.1	5—7.5	0.1
					7.5—10	0.07	7.5—10	0.07	7.5—10	0.07
K Cast Iron	Tensile Strength ≤350MPa	VP15TF	D1	140 (110—160)	—5	0.15	—5	0.15	—5	0.15
					5—7.5	0.1	5—7.5	0.1	5—7.5	0.1
					7.5—10	0.07	7.5—10	0.07	7.5—10	0.07
Ductile Cast Iron	Tensile Strength ≤800MPa	VP15TF	D1	100 (80—120)	—5	0.15	—5	0.15	—5	0.15
					5—7.5	0.1	5—7.5	0.1	5—7.5	0.1
					7.5—10	0.07	7.5—10	0.07	7.5—10	0.07
H Hardened Steel	40—55HRC	VP15TF	D1	70 (50—80)	—5	0.07	—5	0.07	—5	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.

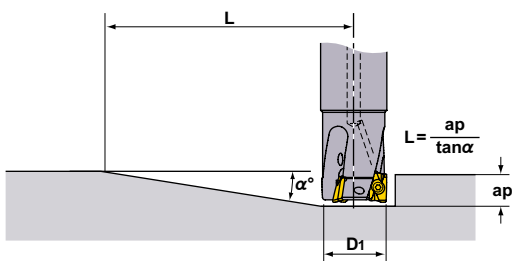
(Note 2) Vibration is liable to occur in certain cases. Please reduce the depth of cut and / or reduce cutting conditions in the following cases.

- When using the long shank type and extra 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.

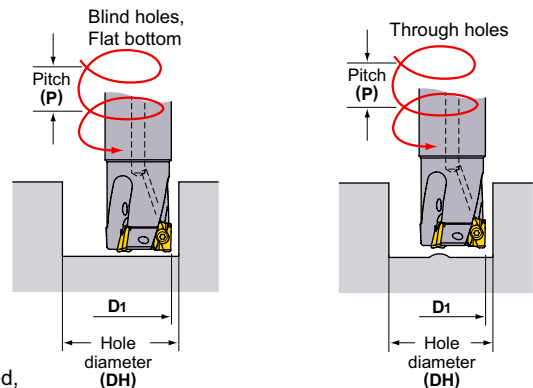
(Note 3) In case of coarse and fine pitch cutters, the coarse pitch type is recommended to prevent vibration.

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)
25	11	85	48	14	45	12	32	4
28	9	105	54	12	51	11	38	4
32	7	135	62	11	59	10	46	5
35	6	158	68	10	65	9	52	5
40	6	158	78	12	75	11	62	7
50	4	238	98	10	95	9	82	7
63	3	318	124	10	121	9	108	7
80	2	477	158	8	155	8	142	6
100	1.5	636	198	8	195	7	182	6
125	1	954	248	6	245	6	232	5
160	1	954	318	8	315	8	302	7

Note) (1) $L = 15 / \tan \alpha$. Cutters' moving distance until depth of cut reaches 15mm at a maximum ramping angle.

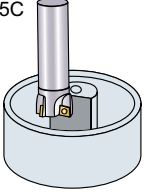
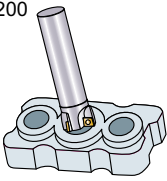
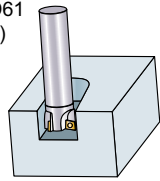
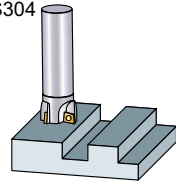
(2) In case nose radius of 0.8mm. Other nose that, find with the below formula.

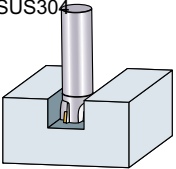
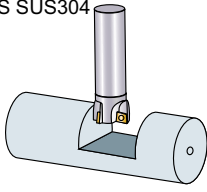
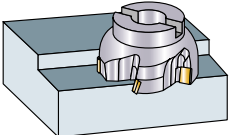
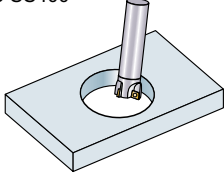
{(cutting edge diameter D1) - (nose radius) - 0.2} x 2

(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.

APX3000/4000

Application Examples

Tool		APX3000R162SA16SA	APX3000R405SA32SA	APX3000R254SA25SA	APX3000R203SA20SA
Insert (Grade)		AOMT123616PEER-M(VP15TF)	AOMT123608PEER-M(VP15TF)	AOMT123608PEER-M(VP15TF)	AOMT123608PEER-M(VP20RT)
Workpiece					
Cutting Conditions	Cutting Speed (m/min)	150	150	150	160
	Feed per Tooth (mm/tooth)	0.05	0.15	0.12	0.1
	Depth of Cut (mm)	1.5	5	3	3.2
	Width of Cut (mm)	1.5	30	10–25	5.1
Coolant		Wet	Dry	Dry	Wet
Machine Shank Type		M/C-BT30	M/C-BT50	M/C-BT50	M/C-BT40
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 a competitor's product.	Improved cutting performance and lower cutting resistance.	Better chip discharge and lower cutting noise.

Tool		APX3000R325SA32SA	APX3000R162SA16SA	APX4000R08007CA	APX4000R404SA32SA
Insert (Grade)		AOMT123608PEER-M(VP20RT)	AOMT123608PEER-M(VP20RT)	AOMT184808PEER-M(VP15TF)	AOMT184808PEER-M(VP15TF)
Workpiece					
Cutting Conditions	Cutting Speed (m/min)	130	160	165	190
	Feed per Tooth (mm/tooth)	0.2	0.11	0.15	0.25
	Depth of Cut (mm)	0.25	2.6	3	10
	Width of Cut (mm)	28	14	50	5
Coolant		Wet	Dry	Wet	Wet
Machine Shank Type		M/C-BT50	M/C-BT40	M/C-BT50	M/C-BT50
Result		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.	Better cutting performance and lower cutting resistance compared to a competitor's product.	Cutting resistance is lower than the competitor's product, thus allowing a stable machining performance.

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 only.
APX3000 : 1.0 N · m APX4000 : 4.0 N · m

For Your Safety

- Don't handle 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 covers and wear safety glasses. ● When using compounded cutting oils, please take fire precautions. ● When attaching inserts or spare parts, please use only the correct wrench or spanner. ● When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

MITSUBISHI MATERIALS CORPORATION



The Scope of the Registration:
Design, Development and
Production of Cemented
Carbide Tools and Carbide
Blanks



The Scope of the Registration:
Design, Development and
Production of Cutting Tools,
Wear-resistant Tools, Rock
Drilling Tools, Cemented
Carbide Blanks and Coated
Products



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(Tools specifications subject to change without notice.)