MOLDINO
The Edge To Innovation

AME type

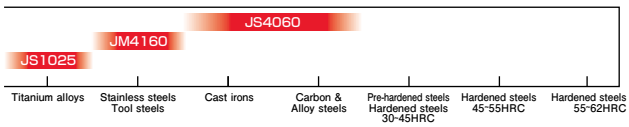
Roughing End Mill AME

MOLDINO Tool Engineering, Ltd.

New Product News | No.1212E-8 | 2022-11

New variations of coating, introducing AJ coating series.

Nicked inserts enable suppression of chattering in heavy milling!



Cutting Applications

AJ Coating series

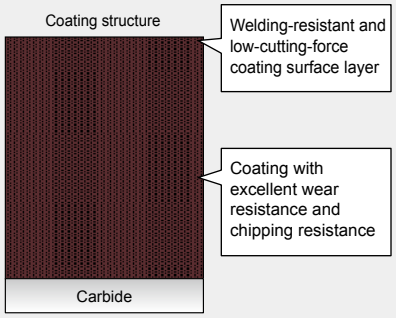
Features of AJ Coating series

- Employs an AlTiN layer with a new composition created by increasing the Al content of conventional layers.
- Excellent wear resistance, chipping resistance, and heat resistance!

New technology!!

- The new layer with high Al content employs a new composition and optimizes the structure to improve wear resistance and chipping resistance!
- Employs a low-friction-effect coating with excellent welding resistance as the top-most surface layer. This reduces welding to the work and decreases cutting force!

Layer structure **AJ Coating**



PVD Technology Grade for machining stainless-steel materials **JM4160**

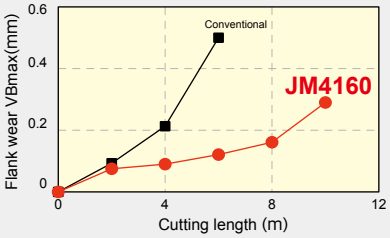
Features

- Employs a carbide substrate with high toughness and the new "AJ Coating" to improve wear resistance and chipping resistance when machining stainless-steel materials.
- Employs AJ Coating with excellent welding resistance to reduce the welding to work material that occurs when machining stainless steel materials.

Strong fields

- Provides long tool life for general processing of stainless-steel materials.

Cutting performance



Work material：SUS304
Tool：ASRS2032R-5
Insert：EPMT0603EN-8LF
Cutting conditions：
v_c=180m/min f_z=0.5mm/t $a_p \times a_e$=0.8×21mm
Wet ※Single-flute cutting

Shank type AME○○○○S○○○-○○○-○NT

Numeric figure in a circle ◌

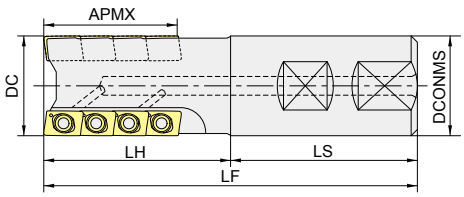


Fig-1〈Side lock shank〉

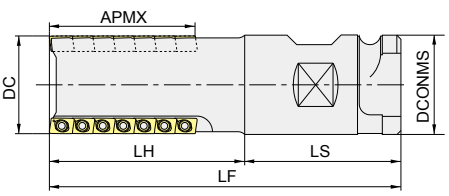


Fig-2 〈Combination shank〉

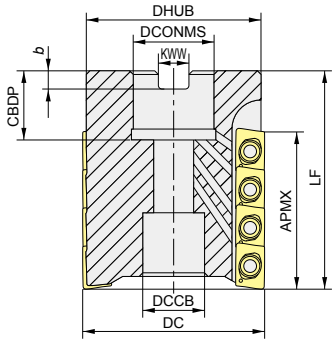
Item code		Stock	No. of flutes	No. of inserts: For wave-edge and sharp-edged inserts	No. of inserts: For Niked inserts 2Nicks	No. of inserts: For Niked inserts 3Nicks	Size (mm) DC	LF	DCONMS	APMX	LH	LS	Inserts	Shape
Side lock shank	AME1232S32-42-3NT※4	●	3	12	4	8	32	120	32	42	60	60	APMT120508R-FT	Fig.1
	AME1240S32-63-4NT	●	4	24	12	12	40	150	32	63	80	70	APMT120530R-FT※1※2	
	AME1240S42-63-4NT	●	4	24	12	12	40	150	42	63	80	70	APMT120508R-N2※3	
	AME1250S42-73-4NT	●	4	28	14	14	50	160	42	73	90	70	APMT120508R-N3※3	
Combination shank	AME1250S508-73-4NT	●	4	28	14	14	50	180	50.8	73	100	80	APMT120508R-RS	
	AME1250S508-115-4NT	●	4	44	22	22	50	220	50.8	115	140	80	APMT120520R-RS※1	Fig.2
													APMT120530R-RS※1※2	

※1 : R2.0 and R3.0 can be used only for tip inserts.
※2 : When using R3.0, it is necessary to perform additional machining of body corner areas.
※3 : When using nicked inserts, install 2 types of inserts (N2 type and N3 type) on a single holder. Installing only N2 type inserts or only N3 type inserts on the holder will cause tool damage.
※4 : When using nicked inserts on a 3-flute type shank, use 4 N2 type inserts and 8 N3 type inserts.

【Note】 Arbor screw is not included.

Bore type AMEB○○○○R(M/S)-○○-○NT

Numeric figure in a circle ◌



Item code		Stock	No. of flutes	No. of inserts: For wave-edge and sharp-edged inserts	No. of inserts: For Niked inserts 2 Nicks	No. of inserts: For Niked inserts 3 Nicks	Size (mm) DC	APMX	DHUB	LF	CBDP	KWW	b	DCONMS	DCCB	Inserts
Inside diameter inch size	AMEB1250R-42-4NT	●	4	16	8	8	50	42	48	60	19	8.4	5	22.225	17	APMT120508R-FT
	AMEB1263R-42-6NT	●	6	24	12	12	63	42	61	60	19	8.4	5	22.225	17	APMT120530R-FT※1※2
Inside diameter mm size	AMEB1250RM-42-4NT	●	4	16	8	8	50	42	48	60	20	10.4	6.3	22	17	APMT120508R-N2※3
	AMEB1263RM-42-6NT	●	6	24	12	12	63	42	61	60	20	10.4	6.3	22	17	APMT120508R-N3※3
Shell type	AMEB1250RS-32-4NT	●	4	12	6	6	50	32	48	55	22	12.4	7	27	19	APMT120508R-RS
																APMT120520R-RS※1
																APMT120530R-RS※1※2

※1 : R2.0 and R3.0 can be used only for tip inserts.
※2 : When using R3.0, it is necessary to perform additional machining of body corner areas.
※3 : When using nicked inserts, install 2 types of inserts (N2 type and N3 type) on a single holder. Installing only N2 type inserts or only N3 type inserts on the holder will cause tool damage.

【Note】 Arbor screw is not included.

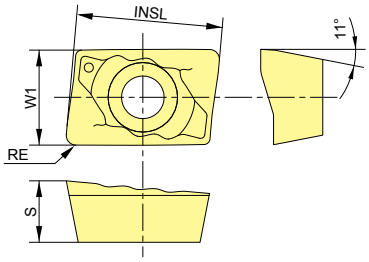
● : Stocked Items.

Line Up

Inserts

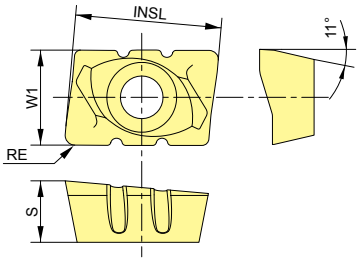
FT

Fig-3
〈Wave-edged insert〉



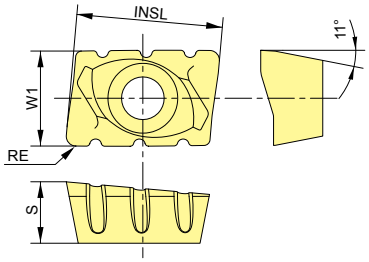
N2

Fig-4
〈2 Nicks type〉



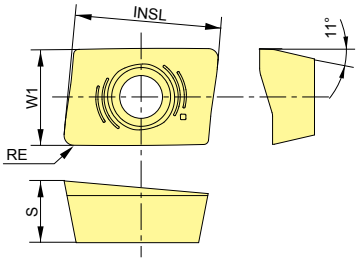
N3

Fig-5
〈3 Nicks type〉



RS

Fig-6
〈Sharp-edged inserts〉



P	Carbon steels		■	
M	SUS, etc.			■
K	FC・FCD　Cast irons		■	
S	Titanium alloys	■		

■ : General cutting, First recommended
⌐ : General cutting, Second recommended

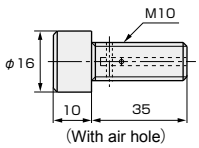
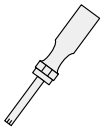
Item code		Tolerance class	JS Coating		AJ Coating	Size (mm)				Shape
			JS1025	JS4060	JM4160	INSL	W1	S	RE	
Wave-edged insert	APMT120508R-FT	M		●	●	12	7.89	5	0.8	Fig.3
	APMT120530R-FT※1			●	●	12	7.89	5	3.0	
2 Nicks	APMT120508R-N2※2			●	●	12	7.89	5	0.8	Fig.4
3 Nicks	APMT120508R-N3※2			●	●	12	7.89	5	0.8	Fig.5
Sharp-edged inserts	APMT120508R-RS		●			12	7.89	5	0.8	Fig.6
	APMT120520R-RS※1		●			12	7.89	5	2.0	
	APMT120530R-RS※1		●			12	7.89	5	3.0	

※1 : R2.0 and R3.0 can be used only for tip inserts.
※2 : When using nicked inserts, install 2 types of inserts (N2 type and N3 type) on a single holder. Installing only N2 type inserts or only N3 type inserts on the holder will cause tool damage.

【Note】 Please note that the JS Coating does not cause a reaction in conductive touch sensors.

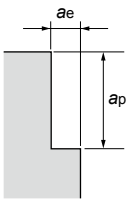
Parts

Numeric figure in a circle ◌.

Parts		Clamp screw		Arbor screw	Screw driver	Screw anti-seizure agent
Shape / Cutter body			Fastening torque (N・m)			
Shank	AME12◌◌S◌◌◌-◌◌◌-◌NT	265-141	2.0	—	104-T10	P-37
Bore	AMEB12◌◌R-◌◌-◌NT	265-141	2.0	100-182 (With Air hole)		
	AMEB12◌◌RM-◌◌-◌NT					
	AMEB12◌◌RS-◌◌-◌NT	265-141	2.0	—		

● : Stocked Items.　No Mark : Manufactured upon request only.

Recommended Cutting Conditions



<Shoulder Milling>

Work material	Recommended grade	Cutting speed Vc(m/min)	Feed tooth fz(mm/t)	Shank type									
				φ32		φ40				φ50			
				ae < 8mm		ae < 4mm		4mm < ae < 10mm		ae < 5mm		5mm < ae < 12mm	
				Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min
Mild steels (200HB or less)	JS4060	120~ **150** ~180	0.12~ **0.16** ~0.20	1,492	716	1,432	1,146	1,194	764	1,146	917	955	611
				vc=150m/min fz=0.16mm/t		vc=180m/min fz=0.2mm/t		vc=150m/min fz=0.16mm/t		vc=180m/min fz=0.2mm/t		vc=150m/min fz=0.16mm/t	
Carbon / Alloy steels (30HRC or less)	JS4060	100~ **120** ~140	0.12~ **0.16** ~0.20	1,194	573	1,114	891	955	611	891	713	764	489
				vc=120m/min fz=0.16mm/t		vc=140m/min fz=0.2mm/t		vc=120m/min fz=0.16mm/t		vc=140m/min fz=0.2mm/t		vc=120m/min fz=0.16mm/t	
Carbon / Alloy steels (30~40HRC)	JS4060	80~ **90** ~100	0.10~ **0.12** ~0.14	895	322	716	401	637	306	573	321	509	244
				vc=90m/min fz=0.12mm/t		vc=90m/min fz=0.14mm/t		vc=80m/min fz=0.12mm/t		vc=90m/min fz=0.14mm/t		vc=80m/min fz=0.12mm/t	
Stainless steels SUS ※Wet Cutting	JM4160	80~ **90** ~100	0.12~ **0.16** ~0.20	995	477	796	637	716	458	637	509	573	367
				vc=100m/min fz=0.16mm/t		vc=100m/min fz=0.2mm/t		vc=90m/min fz=0.16mm/t		vc=100m/min fz=0.2mm/t		vc=90m/min fz=0.16mm/t	
Cast irons FC,FCD	JS4060	120~ **150** ~180	0.12~ **0.16** ~0.20	1,492	716	1,432	1,146	1,194	764	1,146	917	955	611
				vc=150m/min fz=0.16mm/t		vc=180m/min fz=0.2mm/t		vc=150m/min fz=0.16mm/t		vc=180m/min fz=0.2mm/t		vc=150m/min fz=0.16mm/t	
Titanium alloys Ti ※Wet Cutting	JS1025	30~ **40** ~50	0.07~ **0.10** ~0.13	398	119	398	207	318	127	318	166	255	102
				vc=40m/min fz=0.1mm/t		vc=50m/min fz=0.13mm/t		vc=40m/min fz=0.1mm/t		vc=50m/min fz=0.13mm/t		vc=40m/min fz=0.1mm/t	

Work material	Recommended grade	Cutting speed Vc(m/min)	Feed tooth fz(mm/t)	Bore type							
				φ50				φ63			
				L/D < 3		3 < L/D < 5		L/D < 3		3 < L/D < 5	
				Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min	Revolution min-1	Feed speed mm/min
Mild steels (200HB or less)	JS4060	120~ **150** ~180	0.12~ **0.16** ~0.20	955	611	764	367	758	728	606	437
				vc=150m/min fz=0.16mm/t		vc=120m/min fz=0.12mm/t		vc=150m/min fz=0.16mm/t		vc=120m/min fz=0.12mm/t	
Carbon / Alloy steels (30HRC or less)	JS4060	100~ **120** ~140	0.12~ **0.16** ~0.20	764	489	637	306	606	582	505	364
				vc=120m/min fz=0.16mm/t		vc=100m/min fz=0.12mm/t		vc=120m/min fz=0.16mm/t		vc=100m/min fz=0.12mm/t	
Carbon / Alloy steels (30~40HRC)	JS4060	80~ **90** ~100	0.10~ **0.12** ~0.14	573	275	509	204	455	327	404	243
				vc=90m/min fz=0.12mm/t		vc=80m/min fz=0.1mm/t		vc=90m/min fz=0.12mm/t		vc=80m/min fz=0.1mm/t	
Stainless steels SUS ※Wet Cutting	JM4160	80~ **90** ~100	0.12~ **0.16** ~0.20	637	407	573	275	505	485	455	327
				vc=100m/min fz=0.16mm/t		vc=90m/min fz=0.12mm/t		vc=100m/min fz=0.16mm/t		vc=90m/min fz=0.12mm/t	
Cast irons FC,FCD	JS4060	120~ **150** ~180	0.12~ **0.16** ~0.20	955	611	764	367	758	728	606	437
				vc=150m/min fz=0.16mm/t		vc=120m/min fz=0.12mm/t		vc=150m/min fz=0.16mm/t		vc=120m/min fz=0.12mm/t	
Titanium alloys Ti ※Wet Cutting	JS1025	30~ **40** ~50	0.07~ **0.10** ~0.13	318	166	255	102	253	197	202	121
				vc=50m/min fz=0.13mm/t		vc=40m/min fz=0.1mm/t		vc=50m/min fz=0.13mm/t		vc=40m/min fz=0.1mm/t	

For adjusting cutting amount, refer to the machining region curves on the p8.

【Note】
①This table shows general conditions for shoulder cutting. Conditions should be adjusted according to machine rigidity and tooling, workpiece condition, etc.
②To prevent tool damage due to chip clogging, always use a chip removal method such as an air blower, etc.
③Since there is a danger of discharged chips flying up and causing cuts, burns, or damaging eyes, during use be sure that protective covers are in place and that workers wear protective equipment such as protective goggles to create a safe work environment.
④Please note that the JS Coating does not cause a reaction in conductive touch sensors.
⑤Replace inserts at an early stage to avoid breakage due to excessive use.
⑥The following equation can be used to determine the metal removal rate per unit time Q:
$Q(cm^3/min) = a_p(mm) \times a_e(mm) \times v_f(mm/min)/1000$
⑦This tool is not suitable for slotting.
⑧Be sure to supply a water-soluble lubricant when machining titanium alloys.
⑨FT breakers are medium-finishing inserts. Recommended for use for a_e<3mm.

Features and Applications of Insert

Selecting the appropriate breaker enables appropriate machining for various applications.

▼Low cutting force, roughing, first recommended

Nicked inserts

N2 N3

- Nicked inserts enable low-resistance machining.
- It has low resistance machining and suppresses chatter vibration even for deep cutting.

▼For semi finishing

Wave-edged inserts

FT

- Enables shallow-depth, high-feed-rate machining.
- Use of a wave-edged flute shape improves insert tip strength.

▼For titanium cutting

Sharp-edged inserts

RS

- The sharp-edged insert is suited for high-efficiency machining of titanium.
- Sharp cutting edge enables machining to be performed with low resistance.

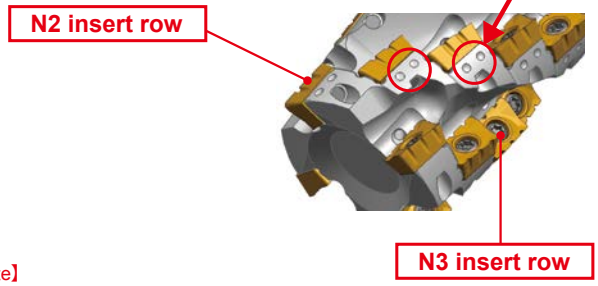
Features and Applications of Cutter Body

The effective inserts arrangement reduces chatter vibration at heavy milling.

The tip blade also has a surface to clamp insert surface in the tool axis direction to achieve secure clamping.

How to install the nicked inserts

- Install N2 type inserts on insert rows with holder mark.
- Install N3 type inserts on insert rows without holder mark.



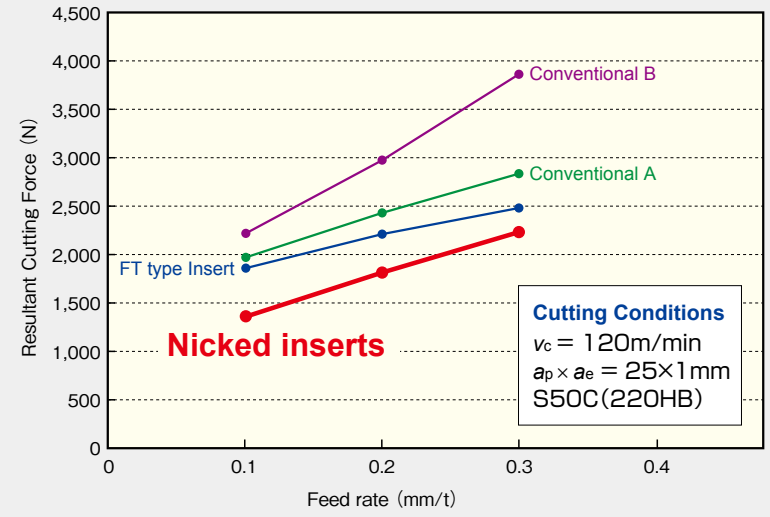
【Note】

①When using nicked inserts, install 2 types of inserts (N2 type and N3 type) on a single holder. Installing only N2 type inserts or only N3 type inserts on the holder will cause tool damage.

②Installing nicked inserts in the wrong position will cause tool damage. Be sure to exercise sufficient care.

Cutting Performance

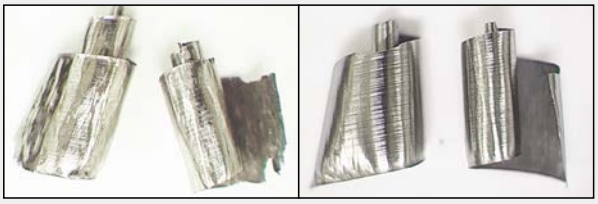
●Since AME adopted nicked insert, it is able to reduce cutting force by 30~40%.



Titanium Cutting

●By using a sharp-edged insert, free-cutting machining of titanium alloys has become possible.
●Cutting performance is also good, and good chip removal is achieved.
●Since machining is performed at low resistance, stable machining even at long extension amounts becomes possible and good tool life is achieved.

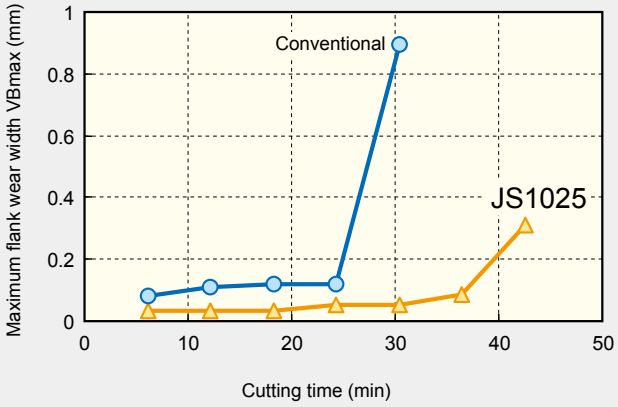
Chip shape comparison $a_p \times a_e$=30×30mm



Conventional chip shape　　AME's chip shape

Cutting scene
(L/D=3.4)

Tool life comparison $a_p \times a_e$=10×30mm (Single-flute cutting)



Work material : **Ti-6Al-4V**

Tool model : **AMEB1250RS-32-4NT**　　Cutting speed : **v_c=50m/min (n=320min^{-1})**

Insert model : **APMT120508R-RS;JS1025**　　Feed rate : **v_f=42mm/min (f_z=0.13mm/t)**

Overhang : **170mm**、Machine used : **BT50(11/15kW)**

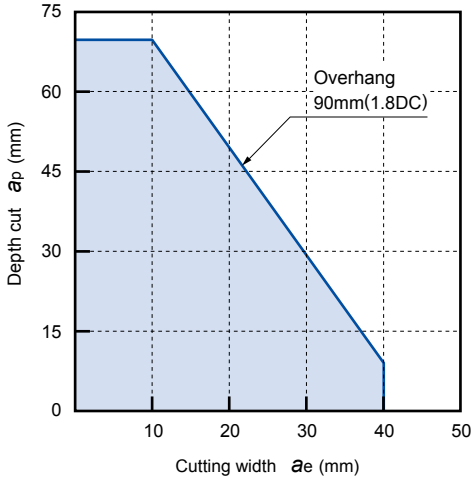
Coolant : **Emulsion oil (Dilution ratio: 5 to 8%)**

Cutting performance

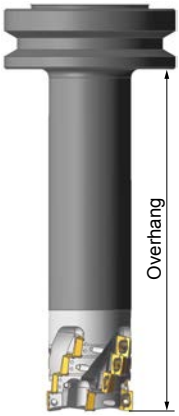
Overhang and Cutting range

❶Shank Type(φ50)

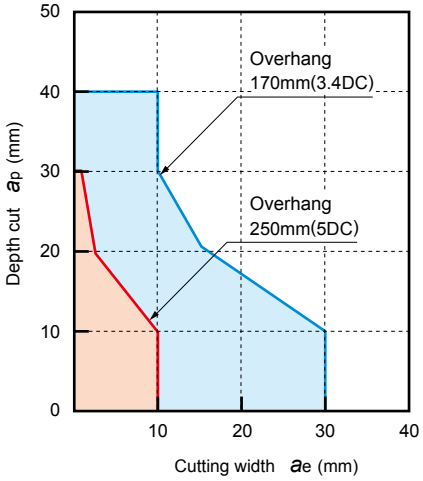
AME1250S42-73-4NT



❷Bore Type(φ50)



AMEB1250R-42-4NT



Cutting Conditions

Machine used : **BT50 (11/15kW)**

Insert : **APMT120508R-N2/N3**(With nick)

Work material : **Carbon Steels (S50C:220HB)**

Cutting speed : **v_c=120**m/min(**n=764**min-1)

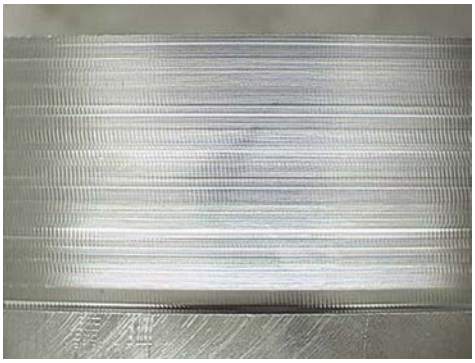
Feed rate : **v_f=367**mm/min(**f_z=0.1**mm/t)

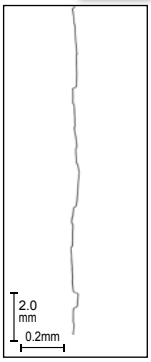
※For actual machining, adjust the cutting amount according to the cutting material and machine rigidity and tooling.

Machined Surfaces Comparison

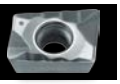
・Both nicked inserts and wave-edged inserts provide good machined surfaces.

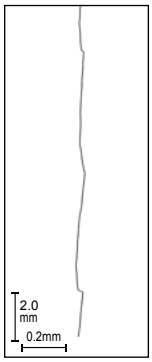
○ Nicked Insert N2/N3 Breaker





○ Wave-edged Insert FT Breaker





Cutting Conditions

Machine used : **BT50 (11/15kW)**

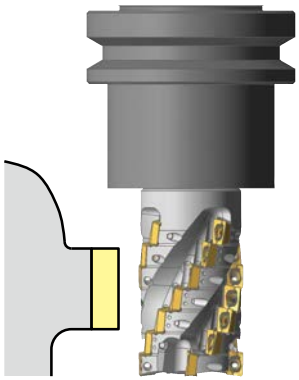
Work material : **Carbon Steels (S50C:220HB)**

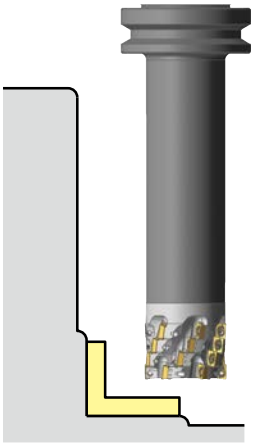
Cutting speed : **v_c=150**m/min(**n=955**min-1)

Feed rate : **v_f=573**mm/min(**f_z=0.15**mm/t)

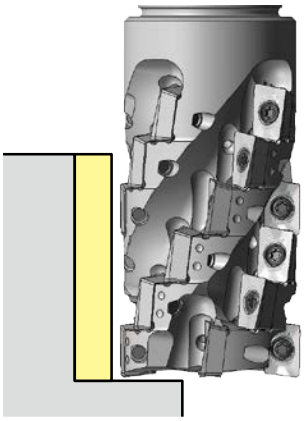
Depth of cut : **a_e×a_p=5×40**mm

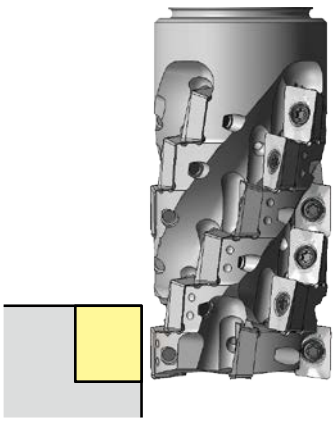
Cutting examples of press mold

Cutter body	AME1250S508-73-4NT (ϕ50-4Flutes, Shank type)
Insert	APMT120508R-N2/N3;JS4060 (Nicked inserts)
Cutting Conditions	V_c = 95m/min (n=600min^{-1}) V_f = 300mm/min (fz=0.125mm/t) a_p×a_e = 40×5mm、OH=100mm Work material : Press mold cast steel Air-blow, Trimming blade machining
Cutting scene	

Cutter body	AMEB1263R-42-6NT (ϕ63-6Flutes, Bore type)
Insert	APMT120508R-N2/N3;JS4060 (Nicked inserts)
Cutting Conditions	V_c = 180m/min (n=900min^{-1}) V_f = 1,500mm/min (fz=0.28mm/t) a_p×a_e = 2.5～10×10～63mm Work material : FC250、OH = 250mm Air-blow, Depth constant cutting
Cutting scene	

Cutting examples of Titanium

Cutter body	AME1240S42-63-4NT (ϕ40-4Flutes, Shank type)
Insert	APMT120508R-RS ; JS1025 (Sharp-edged inserts)
Cutting Conditions	V_c = 40m/min (n=320min^{-1}) V_f = 130mm/min (fz=0.1mm/t) ap×ae = 43×3mm Work material : Ti-6Al-4V Emulsion oil, Side cutting
Comment	By using an insert for titanium alloy machining, 2 × the efficiency and 2 × the tool life was achieved.
Cutting scene	

Cutter body	AME1240S42-63-4NT (ϕ40-4Flutes, Shank type)
Insert	APMT120508R-RS ; JS1025 (Sharp-edged inserts)
Cutting Conditions	V_c = 40m/min (n=320min^{-1}) V_f = 190mm/min (fz=0.15mm/t) ap×ae = 12×10mm Work material : Ti-6Al-4V Emulsion oil, Side cutting
Comment	Due to low cutting resistance, cutting noise were lower and machining conditions were stable.
Cutting scene	

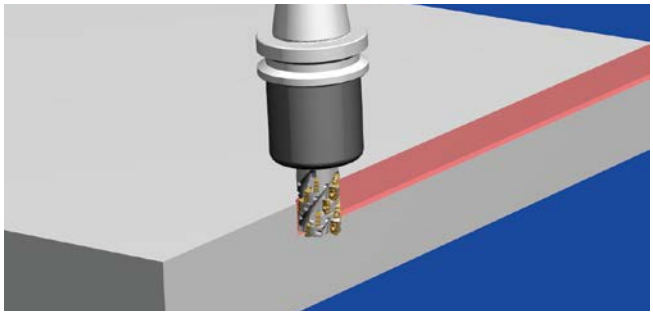
Field data

Example of 50% machining reduction (S45C) of side machining of plate

		Conventional	**Proposal**
		Indexable tool roughing	**AME1250S508-73-4NT**
Tool/insert costs	(Yen/Tool)	¥19,980	**¥28,000**
Corner count per insert	(Corner/Insert)	4	**2**
Number of flutes	(Inserts)	4(16)	**4(28)**
Tool life	(Min./Tool)	60	**60**
Tool replacement time	(Min./Tool)	5	**7**
Machine cost	(Yen/Min.)	¥100	**¥100**
Machining time per workpiece	(Min./Workpiece)	103.0	**23.0**
Machining cost per workpiece	(Yen/Workpiece)	¥19,733	**¥7,935**
Machining cost ratio	(%)	100%	**40%**

		Conventional	**Proposal**
CO_2 emissions per machining of workpiece	(kg-CO_2/Workpiece)	3.488	**2.744**
Annual CO_2 emissions	(kg-CO_2/Year)	2,543	**2,000**
Possible annual CO_2 emissions reductions	(kg-CO_2/Year)		**543**

	V_c (m/min)	V_f (mm/min)	$a_p \times a_e$ (mm)	Q (cm^3/min)
Conventional	173	700	30×3	63
AME	173	940	30×10	282



Cutting cost : 60%

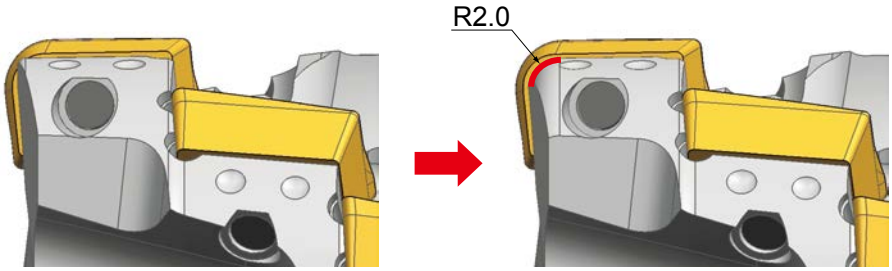
CO_2 : 21%

Reduced

	User	Work	Tools	Cutting Conditions	Result
1	Company A	Machine parts SCM	AME1250S508-73-4NT APMT120508R-FT Equivalent to JM4160	v_c=100m/min, v_f=400mm/min, a_p×a_e=70×0.5mm, Air-blow	Compared to corresponding conventional, machining noise of AME type is less and machining surface is virtually flat, providing good results.
2	Company B	Press mold Cast steel	AME1250S508-73-4NT APMT120508R-N2,N3 JS4060	v_c=94m/min, v_f=300mm/min, a_p×a_e=40×5mm	AME type was tested under the same cutting conditions as conventional products, and was found to provide lower cutting force for stable machining. Applicable to low-rigidity M/C.
3	Company C	Mold parts S45C	AME1250S508-73-4NT APMT120508R-N2,N3 JS4060	v_c=173m/min, v_f=940mm/min, a_p×a_e=30×10mm (Conventional:v_c=173, v_f=700, a_p×a_e=30×3)	Low cutting force of AME type enabled approx. 4.5× machining efficiency with stable machining status.
4	Company D	Machine parts SUS410	AME1250S42-73-4NT APMT120508R-N2,N3 Equivalent to JM4160	v_c=100m/min, v_f=300mm/min, a_p×a_e=22×5mm (Conventional:v_c=30, v_f=80, a_p×a_e=30×9)	AME type provided 1.5× the machining efficiency of conventional HSS roughing end mills.
5	Company E	Machine parts FC250	AME1250S42-73-4NT APMT120508R-N2,N3 JS4060	v_c=120m/min, v_f=304mm/min, a_p×a_e=50×4mm (Conventional:v_c=500, v_f=1,200, a_p=7, a_e=3)	Machining time of 15 minutes with conventional shoulder mill was reduced to 8 minutes with AME type.
6	Company F	Machine parts SS400	AMEB1250RM-42-4NT APMT120508R-N2,N3 JS4060	v_c=180m/min, v_f=480mm/min, a_p×a_e=26×15mm	Tool life was 1.3× that of corresponding conventional.

Cautions during use

※When using corner R3.0 it is necessary to perform additional machining of body corner areas as indicated below.



MOLDINO

The Edge To Innovation

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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DISTRIBUTED BY:

Printed in JAPAN
2022-11 (ME-To)
2012-2:FP