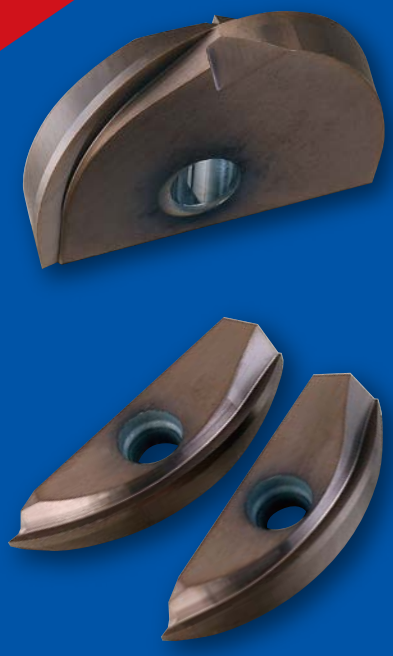
MOLDINO
The Edge To Innovation

ABP4F type

Ball Precision Multi Flutes ABP4F



MOLDINO Tool Engineering, Ltd.

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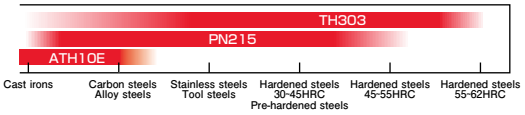
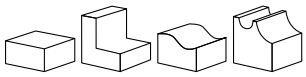


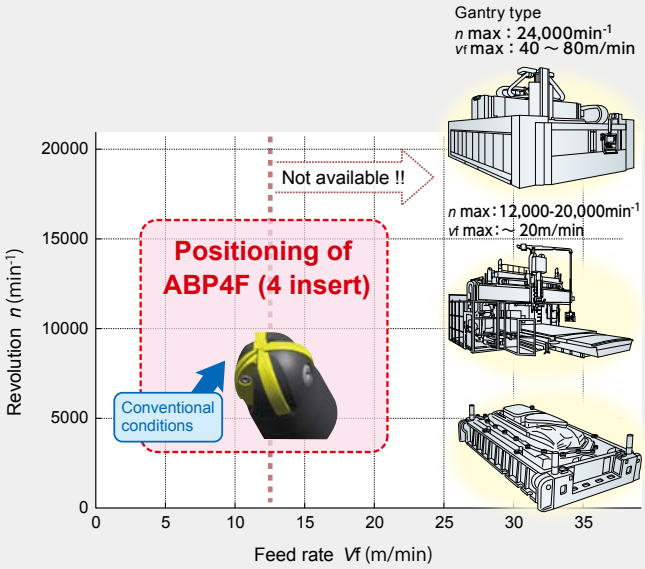
Applications



Features 01 Features of ABP4F type

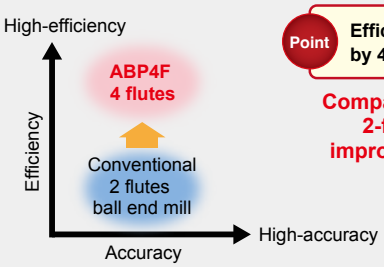
・New product: 4-flutes ball end mill (ϕ20 to ϕ30) compatible with machines ranging from general-purpose manufacturing machines to the latest high-speed machines

Example of large press die for automotive parts



Processing advantage of 4-flutes end mill

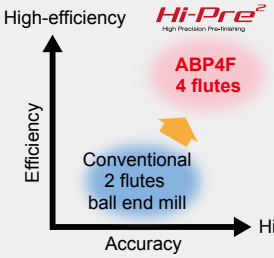
Figure Finishing



Point: Efficiency improves by 4-flutes end mill

Compared with conventional 2-flutes ball end mill, improves cutting efficiency.

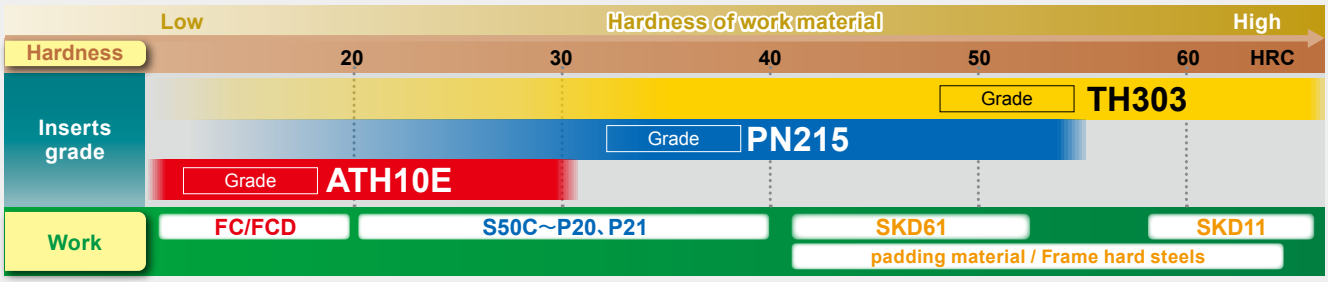
Figure Semi-Finishing



Point: Efficiency processing with small pitch → Reduce the processing load on semi-finishing → Improve finishing accuracy

Compared with conventional 2-flutes ball end mill, improves cutting efficiency and accuracy.

Recommended grades map based on work materials



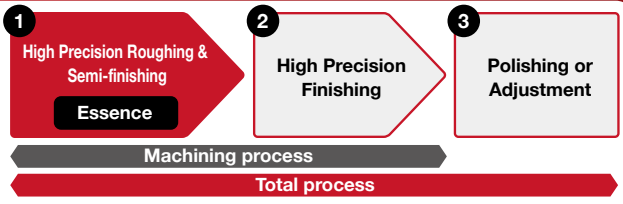
Hi-Pre² makes the whole processing method develop.

Hi-Pre² High Precision Pre-finishing

Is only the finishing process important for high precision machining?

For making high precision dies & molds, the accuracy of roughing and semi-finishing processes are very important as well as finishing. High precision from roughing enables the optimization of the total production process including polishing or adjustment! This is "Hi-Pre²", MOLDINO propose.

Hi-Pre² = High Precision Pre-Finishing



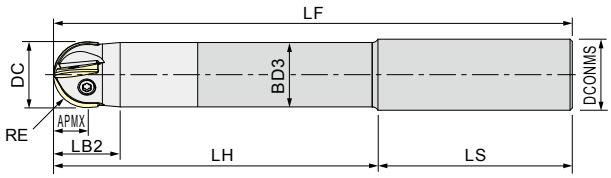
Takes advantage for total process including polishing or adjustment!

Line Up

Carbide shank

ABP4F○○S○○WL○○○

Numeric figure in a circle ○.

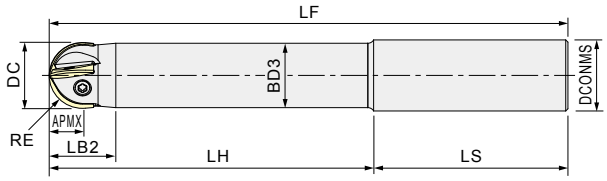


Item code	Stock	No.of inserts		Size (mm)									Inserts	
		Main insert	Sub insert	DC	RE	LF	DCONMS	APMX	LB2	LH	BD3	LS	Main insert	Sub insert
ABP4F20S20WL80	●	1	2	20	10	160	20	10	17	80	19	80	ZDFG200CE ZDFG200CT	ZDFG200SE ZDFG200SK
ABP4F20S20WL100	●					180				100				
ABP4F20S20WL120	●					200				120				
ABP4F25S25WL100	●	1	2	25	12.5	180	25	12.5	23.5	100	24	80	ZDFG250CE ZDFG250CT	ZDFG250SE ZDFG250SK
ABP4F25S25WL120	●					200				120				
ABP4F25S25WL150	●					230				150				
ABP4F30S32WL100	●	1	2	30	15	180	32	15	30	100	28	80	ZDFG300CE ZDFG300CT	ZDFG300SE ZDFG300SK
ABP4F30S32WL120	●					200				120				
ABP4F30S32WL150	●					230				150				

Steel shank

ABP4F○○S○○L○○○

Numeric figure in a circle ○.



Item code	Stock	No.of inserts		Size (mm)									Inserts	
		Main insert	Sub insert	DC	RE	LF	DCONMS	APMX	LB2	LH	BD3	LS	Main insert	Sub insert
ABP4F20S20L60	●	1	2	20	10	140	20	10	17	60	19	80	ZDFG200CE ZDFG200CT	ZDFG200SE ZDFG200SK
ABP4F20S20L80	●					160				80				
ABP4F20S20L100	●					180				100				
ABP4F25S25L100	●	1	2	25	12.5	180	25	12.5	23.5	100	24	80	ZDFG250CE ZDFG250CT	ZDFG250SE ZDFG250SK
ABP4F25S25L120	●					200				120				
ABP4F25S25L150	●					230				150				
ABP4F30S32L100	●	1	2	30	15	180	32	15	30	100	29	80	ZDFG300CE ZDFG300CT	ZDFG300SE ZDFG300SK
ABP4F30S32L120	●					200				120				
ABP4F30S32L150	●					230				150				

Parts

Numeric figure in a circle ○.

Parts	Clamp screw				Screw driver / Wrench				Screw anti-seizure agent
Shape / Cutter body					 A B				
	Main insert	Fastening torque (N・m)	Sub insert	Fastening torque (N・m)	Main insert	Shape	Sub insert	Shape	
ABP4F20S20○L○○○	155-158	2.2	250-140	0.5	104-T15	A	104-T6	A	P-37
ABP4F25S25○L○○○	155-159	2.9	250-141	1.1	104-T15	A	104-T8	A	
ABP4F30S32○L○○○	155-160	4.9	265-141	2	105-T20	B	104-T10	A	

【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.

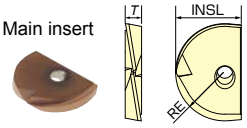
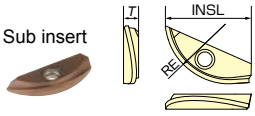
● : Stocked Items.

Recommended grades map

Inserts

		TH Coating			PN2 Coating	PN Coating
		TH303	ATH10E	ATH80D	PN215	PN15M
P	Carbon steels	▭		▭	■	■
K	FC・FCD Cast irons	■	■	■	▭	▭
H	Hardened steels	■		■	▭	▭

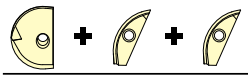
■ : General cutting, First recommended
▭ : General cutting, Second recommended

Shape	Item code	Tolerance class	TH303	ATH10E	ATH80D	PN215	PN15M	RE	INSL	T
Main insert 	ZDFG200CE	F		●				10	13.8	3.2
	ZDFG200CT		●		●	●	●			
	ZDFG250CE			●				12.5	16.8	4
	ZDFG250CT		●		●	●	●			
	ZDFG300CE			●				15	20	5
	ZDFG300CT		●		●	●	●			
Sub insert 	ZDFG200SE			●	●		●	10	14.31	2.4
	ZDFG200SK		●			●			14.24	
	ZDFG250SE			●	●		●	12.5	17.43	3
	ZDFG250SK		●			●			17.34	
	ZDFG300SE			●	●		●	15	20.74	3.6
	ZDFG300SK		●			●			20.64	

※Main inserts are packaged 1 per case. Sub inserts are packaged 2 per case.

		TH303	ATH10E	ATH80D	PN215	PN15M
P	Carbon steels	▭		▭	■	■
K	FC・FCD Cast irons	■	■	■	▭	▭
H	Hardened steels	■		■	▭	▭

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

Shape	Item code	Tolerance class	TH303	ATH10E	ATH80D	PN215	PN15M	set items
Main insert Sub insert Sub insert 	ZDFG200SET	F	●	●	●	●	●	Main inserts are packaged 1 + Sub inserts are packaged 2
	ZDFG250SET		●	●	●	●	●	
	ZDFG300SET		●	●	●	●	●	

Insert regrinding/recoating orders accepted. Please contact our sales department.

※Regrinding and recoating can be performed only once.

Set-up procedures of Inserts

To meet the specification for radius tolerance ±0.01mm, attach inserts according to the procedure below.

Inserts must be set up in the order of ① main insert then ② sub insert.
Clean the insert seat by air-blow etc.Apply the Screw anti-seizure agent to the whole clamp screw.Excessive tightening torque or the screw to which chip adhered cause screw damage or the problem from which a screw does not separate.Please tighten the screw NOT to exceed the torque of the following table.

Set-up procedures of main insert

1. Place a top mark on the insert as shown toward a screw tightening side.
2. Tighten the insert screw without pressing down the insert too much strongly.

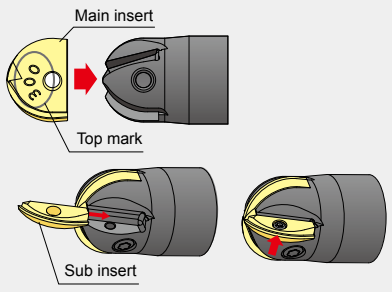
Set-up procedures of sub inserts

3. Install a sub insert along the restraining wall.
4. Pressing the insert firmly against the wall while tighten the insert screw.

Inserts must be removed in the order of ① sub insert then ② main insert.

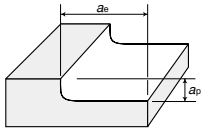
Tightening torque

Tool dia. DC (mm)	Main insert (N・m)	Sub insert (N・m)
φ20	2.2	0.5
φ25	2.9	1.1
φ30	4.9	2.0



● : Stocked Items.

Recommended cutting conditions



※ Red indicates primary recommended insert grades.

Work materials	Insert grade		Cutting conditions	φ 20			φ 25			φ 30		
	Semi finishing	Finishing		Semi finishing	Finishing		Semi finishing	Finishing		Semi finishing	Finishing	
					General	High-speed processing		General	High-speed processing		General	High-speed processing
Carbon steels Alloy steels (30HRC or less)	PN215 PN15M	PN215 PN15M	*n* (min-1)	4,780	9,240	10,350	4,460	8,790	10,190	3,820	7,640	10,080
			Vc(m/min)	300	580	650	350	690	800	360	720	950
			Vf(mm/min)	3,440	6,650	9,110	3,570	7,030	8,970	3,060	6,110	8,870
			fz(mm/t)	0.18	0.18	0.22	0.2	0.2	0.22	0.2	0.2	0.22
			ap(mm)	0.3	0.1	0.1	0.4	0.1	0.1	0.5	0.1	0.1
			ae(mm)	1.2	0.4	0.4	1.4	0.45	0.45	1.5	0.5	0.5
Carbon steels Alloy steels (30～45HRC)	PN215 TH303 PN15M ATH80D	PN215 TH303 PN15M ATH80D	*n* (min-1)	3,670	6,850	7,960	3,060	6,880	8,280	2,650	6,050	8,490
			Vc(m/min)	230	430	500	240	540	650	250	570	800
			Vf(mm/min)	2,640	4,930	6,370	2,450	5,510	6,630	2,120	4,840	6,790
			fz(mm/t)	0.18	0.18	0.2	0.2	0.2	0.2	0.2	0.2	0.2
			ap(mm)	0.3	0.1	0.1	0.4	0.1	0.1	0.5	0.1	0.1
			ae(mm)	1	0.4	0.4	1.4	0.45	0.45	1.5	0.5	0.5
Cast irons	TH303 PN215 ATH80D PN15M	ATH10E TH303 PN215 ATH80D	*n* (min-1)	6,690	10,190	11,150	5,930	10,570	11,460	5,940	9,550	11,670
			Vc(m/min)	420	640	700	465	830	900	560	900	1,100
			Vf(mm/min)	4,820	8,150	11,150	4,740	8,460	11,460	4,750	7,640	11,670
			fz(mm/t)	0.18	0.2	0.25	0.2	0.2	0.25	0.2	0.2	0.25
			ap(mm)	0.3	0.1	0.1	0.4	0.1	0.1	0.5	0.1	0.1
			ae(mm)	1.2	0.4	0.4	1.4	0.45	0.45	1.5	0.5	0.5
Hardened steels 45～55HRC Flame hardening steels	TH303 PN215 ATH80D PN15M	TH303 PN215 ATH80D PN15M	*n* (min-1)	1,910	4,780	6,690	1,790	4,460	6,120	1,700	4,240	5,840
			Vc(m/min)	120	300	420	140	350	480	160	400	550
			Vf(mm/min)	1,380	3,440	5,350	1,290	3,570	4,890	1,220	3,400	4,670
			fz(mm/t)	0.18	0.18	0.2	0.18	0.2	0.2	0.18	0.2	0.2
			ap(mm)	0.2	0.1	0.1	0.3	0.1	0.1	0.4	0.1	0.1
			ae(mm)	0.8	0.3	0.3	0.9	0.4	0.4	1	0.5	0.5
Hardened steels 55～62HRC	TH303 ATH80D	TH303 ATH80D	*n* (min-1)	1,600	3,190	5,420	1,410	3,570	5,230	1,270	3,820	5,200
			Vc(m/min)	100	200	340	110	280	410	120	360	490
			Vf(mm/min)	1,150	2,300	4,330	1,010	2,860	4,180	920	3,060	4,160
			fz(mm/t)	0.18	0.18	0.2	0.18	0.2	0.2	0.18	0.2	0.2
			ap(mm)	0.2	0.1	0.1	0.3	0.1	0.1	0.4	0.1	0.1
			ae(mm)	0.5	0.3	0.3	0.6	0.4	0.4	0.8	0.5	0.5
Maximum *fz*(mm/t)				< 0.5			< 0.6			< 0.7		
Maximum *ap*(mm)				< 10.0			< 12.5			< 15.0		

Overhang	*Vc* (m/min)	*Vf* (mm/min)
4DC	100%	100%
4DC ～ 6DC	85%	85%

【Note】 ① These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
② The above table is for an overhang of <4DC using a carbide shank as the standard. When using a steel shank, reduce the cutting conditions by approximately 20%.
③ When overhang is 4DC or more, values in the above table should be adjusted by referring to the table.

Attention

Never tighten the clamp screw without putting the insert. The tool body may be deformed, resulting in improper insert mounting or deterioration of mounting accuracy.

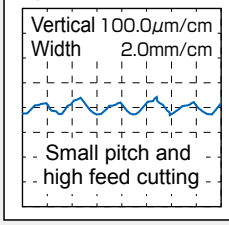
Do not tighten the screw without putting insert

Cutting performance

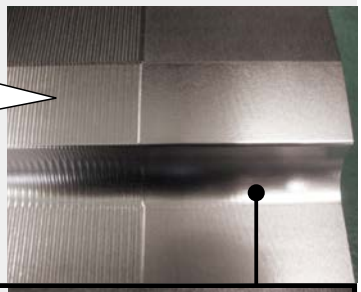
01 Compared with cutting surface after semi-finishing (FCD600)

ABP4F type (4 flutes)

Tool：ABP4Fϕ30 ATH80D
$a_p \times p_f = 0.4 \times 1.5$mm
n=12,000min^{-1}
v_f =12,000mm/min
Q=7.2cm^3/min



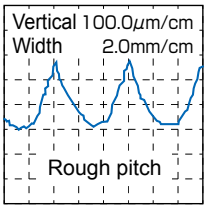
Semi-Finishing Finishing



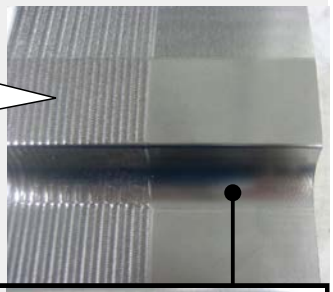
Tool：
For finishing ϕ30 2 flutes Ball
$a_p \times p_f = 0.1 \times 0.3$mm
n=12,000min^{-1}
v_f =8,000mm/min
Q=0.24cm^3/min

Conventional (2 flutes)

Tool：For roughing ϕ30 2 flutes Ball
$a_p \times p_f = 0.4 \times 3.0$mm
n=3,000min^{-1}
v_f =3,000mm/min
Q=3.6cm^3/min



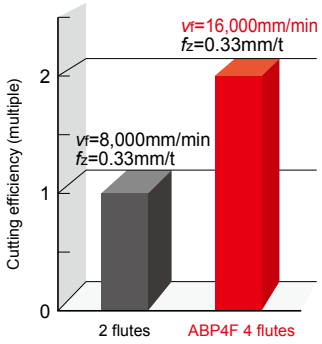
Semi-Finishing Finishing

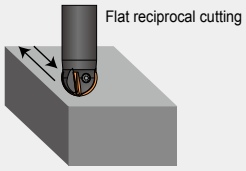


Tool：
For finishing ϕ30 2 flutes Ball
$a_p \times p_f = 0.1 \times 0.3$mm
n=12,000min^{-1}
v_f =8,000mm/min
Q=0.24cm^3/min

It's influence to finishing surface roughness when before process is rough.

02 Performance comparison when cutting flat surfaces



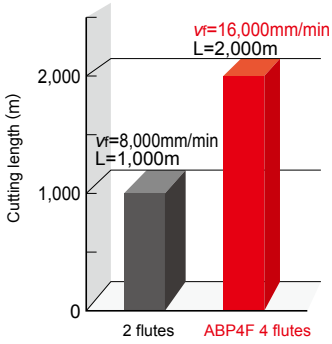


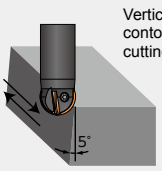
Cutting conditions
Work material：FCD600
Tool dia.：ϕ30 ATH10E
OH =150mm
V_c=1,130m/min
(n =12,000min^{-1})
$a_p \times p_f$ = 0.1×0.5mm
Dry
Cutting length L=10km

Conclusion Double the cutting efficiency of 2-flute tools

03 Tool life comparison when cutting vertical walls

Reach tool life standard：VBmax=0.2mm

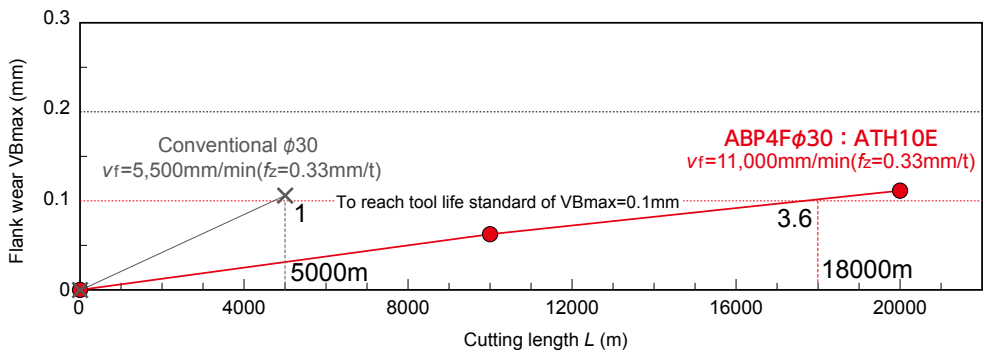


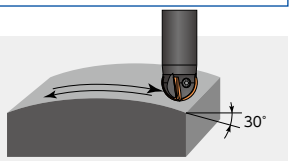


Cutting conditions
Work material：FCD600
Tool dia.：ϕ30 ATH10E
OH =150mm
V_c=1,130m/min
(n =12,000min^{-1})
$a_e \times p_f$ = 0.1×0.5mm
f_z=0.33mm/t
Dry

Conclusion Double the tool life of 2-flute tools

04 Wear comparison when profiling





Cutting conditions
Work material：FCD600
n =8,000min^{-1}
V_c=754m/min
$a_p \times p_f$ = 0.1×0.5mm
Dry

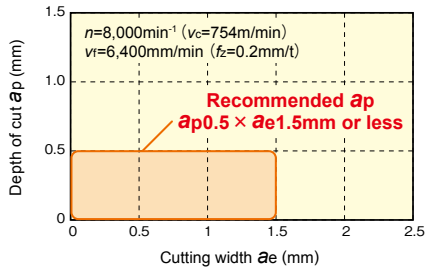
Conclusion Compared to conventional products, provides twice the cutting efficiency. 3.6 times the cutting length was achieved.

Field data

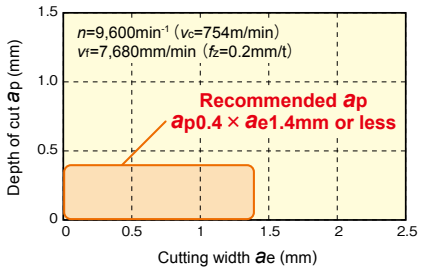
01 Cutting range

Machine：BT50 M/C　Work material：FCD600　Scanning line

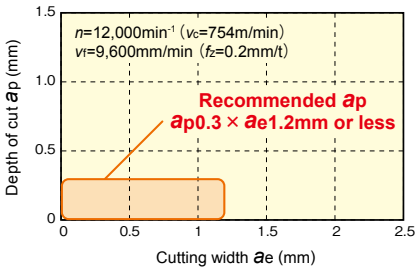
φ30



φ25



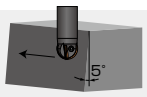
φ20



02 *Vc*-T chart

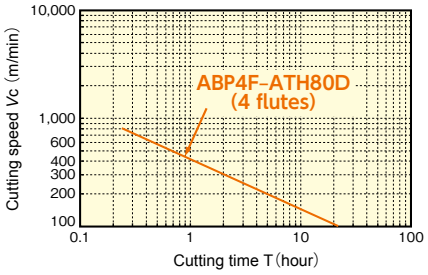
High-hardened steels

Work material：SKD11(60HRC)
Tool dia.：φ30
$a_e \times p_f = 0.1 \times 0.3$mm
f_z=0.2mm/t



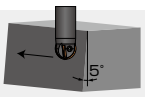
Vertical wall contour line cutting

Reach tool life standard：VBmax = 0.1mm



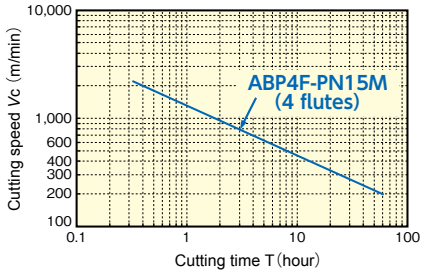
Carbon steels

Work material：S50C(220HB)
Tool dia.：φ30
$a_e \times p_f = 0.1 \times 0.5$mm
f_z=0.3mm/t



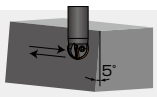
Vertical wall contour line cutting

Reach tool life standard：VBmax = 0.1mm



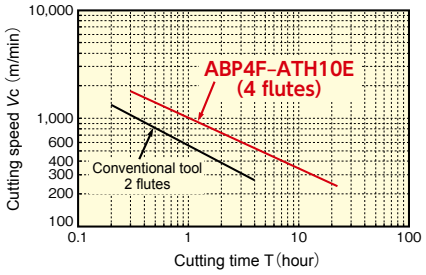
Cast irons

Work material：FCD600
Tool dia.：φ30
$a_e \times p_f = 0.1 \times 0.5$mm
f_z=0.33mm/t

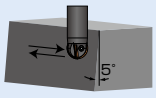
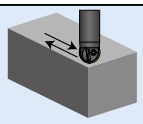
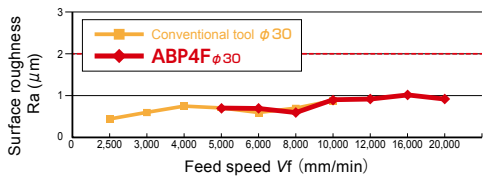
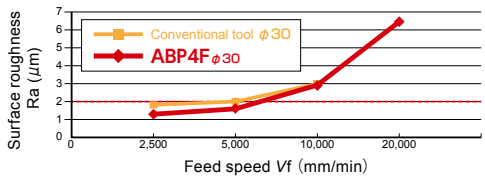
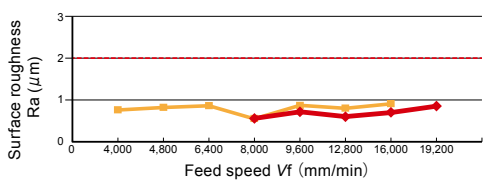
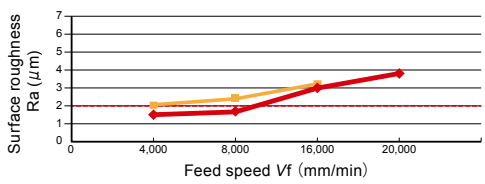
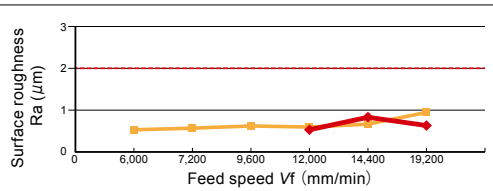
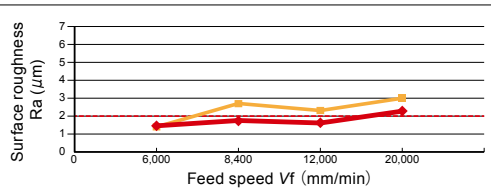


Vertical wall contour reciprocal cutting

Reach tool life standard：VBmax = 0.1mm



03 Finished surface roughness

	 Vertical wall contour reciprocal cutting Work material：FCD600 $a_e \times p_f = 0.1 \times 0.5$mm OH=120mm, Dry	 Flat reciprocal cutting Work material：FCD600 $a_p \times p_f = 0.1 \times 0.5$mm OH=120mm, Dry
v_c=471m/min (n=5,000min^{-1})		
v_c=754m/min (n=8,000min^{-1})		
v_c=1,131m/min (n=12,000min^{-1})		

【Note】 When Ra≤2μm is set as the standard, the test results shown above satisfy the standard when cutting vertical walls.
However, in order to satisfy Ra≤2μm when planing, it is necessary to set f_z≤0.25mm.
To be specific, from the above data the following should be used as general criteria: When n=5,000, V_f=5,000 or less; when n=8,000, V_f=8,000 or less, when n=12,000, V_f=12,000 or less.

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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.

4. Attention on use of Carbide brazed end mill

Carbide brazed tools are made by brazing of carbide and steel.
They may occurred breakage due to fatigue in brazing part.
Therefore,it is strongly suggest to set board or guard to shut off shattering around the machines for the safety.
Don't use in the case of remodeling carbide shank, giving strong impacts and occurring flaw and crack on the surface.

5. Attentions regarding regrinding

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

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