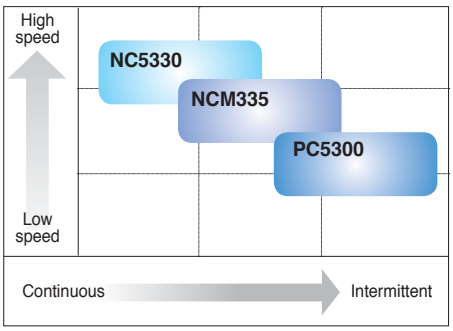
Recommended cutting condition

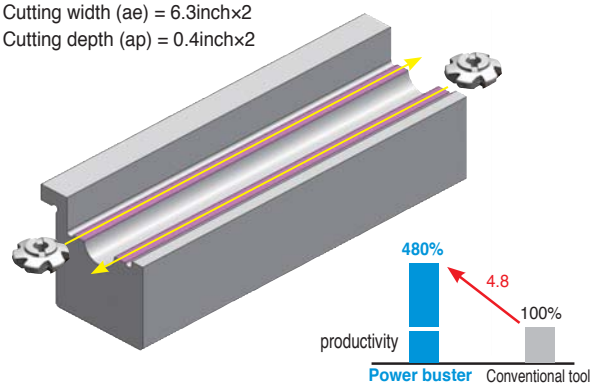
ISO	Workpiece	NC5330	NCM335	PC5300
		fz(ipt)		
		0.004-0.008-0.012	0.004-0.008-0.012	0.004-0.008-0.012
		vg(sfm)		
P	Carbon steel	984–820–656	919-755-591	820-656-525
P	Alloy steel	820–394–591	755-591-492	591-492-394
P	Die steel	591–492–427	525-427-361	459-394-328
K	Gray cast iron	919-722-591	820-656-525	722-591-492
K	Malleable cast iron	820-656-525	755-591-492	591-492-427
K	Nodular cast iron	755-591-492	689-525-427	525-394-328



Power Buster Test

• **Cylinder block for ship engine (Cast iron)**

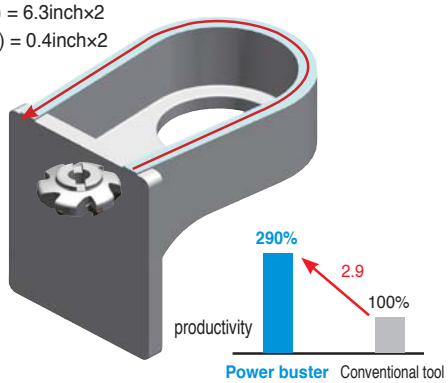
Cutting width (ae) = 6.3inch×2
Cutting depth (ap) = 0.4inch×2



Item	Power Buster	Conventional tool
Diameter(ØD)	8inch	8inch
⦾	12 tooth	12 tooth
Grade	NC9025	PVD coating for Cast iron
vc	558sfm	427sfm
fz	0.009ipt	0.006ipt
ap	0.4inch x 2 passes	0.16inch x 5 passes
min	28.2min/ea	137.5min/ea
4.8 times productivity increased		• One-sided 4 corner insert(Without nick) AA 45° cutter

• **Heavy machinery part (Alloy steel)**

Cutting width (ae) = 6.3inch×2
Cutting depth (ap) = 0.4inch×2



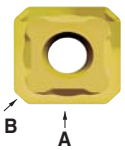
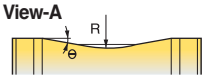
Item	Power Buster	Conventional tool
Diameter(ØD)	5inch	5inch
⦾	8 tooth	8 tooth
Grade	NCM335	PVD coating for Cast iron
vc	591sfm	492sfm
fz	0.006ipt	0.004ipt
ap	0.2inch x 2 passes	0.1inch x 4 passes
min	5min/ea	14.7min/ea
2.9 times productivity increased		• Double-sided 8 corner insert(Without nick)AA 45° cutter

Chip breaker

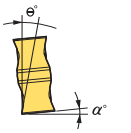
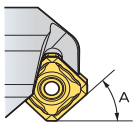
Insert	Cutting edge	Features
For aluminum MA		Due to sharp cutting edge and buffed surface, it has good chip flow and welding resistance
Light cutting MF		Due to low cutting load, it is good for light cutting and difficult-to-cut material

Insert	Cutting edge	Features
General cutting MM		It is suitable design for general milling
Wiper W		Specialized edge design can be suitable for excellent surface roughness operation

Features of insert

Insert	Cutting edge	Features
	View-A 	High rake chip breaker & positive setting angle for low cutting load
	View-B 	Designed wiper technology in minor cutting edge for improved surface roughness
	Chip breaker 	Low cutting load due to the positive setting and high rake angle chip breaker

Features of cutter

Shape	Cutting edge	Features
		High rake angle makes positive setting angle for low cutting load
		Suitable for facing and chamfering • RM8A A=45° • RM8E A=15° • RM8Q A=2°

Recommended cutting condition

ISO	Grade	SNM(E)X1206A(E)NN-MF		SNM(E)X1206A(E)NN-MM		SNEX1206A(E)NN-MA		Max-ap	SNM(E)X1507A(E)NN-MF				Max-ap
		vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)		vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	
P	NC5330	-	-	490~985	0.004~0.014	-	-	RM8A 0.236 RM8E 0.354 RM8Q 0.453	-	-	490~985	0.004~0.014	RM8A 0.295inch RM8E 0.433inch
P	NCM325	655~985	0.002~0.012	490~985	0.004~0.014	655~1150	0.001~0.010		655~985	0.002~0.012	490~985	0.004~0.014	
P	PC3500	655~985	0.002~0.012	490~985	0.004~0.014	655~1150	0.001~0.010		655~985	0.002~0.012	490~985	0.004~0.014	
K	PC6510	490~985	0.003~0.014	490~985	0.004~0.0146	-	-		490~985	0.003~0.014	490~985	0.004~0.0146	
K	PC5300	490~985	0.003~0.014	490~985	0.004~0.016	-	-		490~985	0.003~0.014	490~985	0.004~0.016	
M	PC9530	330~590	0.002~0.002	390~590	0.004~0.014	390~955	0.001~0.008		-	-	-	-	
M	PC5300	-	-	-	-	-	-		330~590	0.002~0.002	390~590	0.004~0.014	

Rich Mill RMH8

Screw on clamping system

▶ Adopting stable clamping system

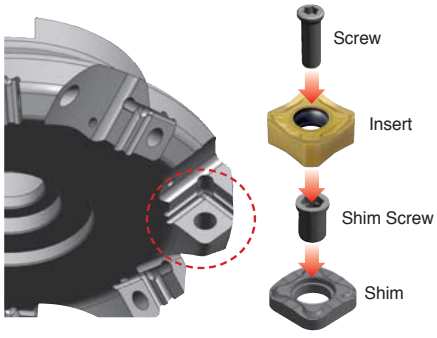
Reinforced rigidity and enhanced clamping power

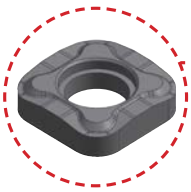
▶ Appling shim system, prevent cutter damage when insert breaks

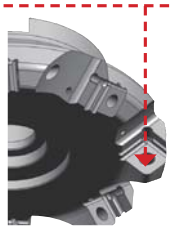
Adopting exchangeable shim

▶ Using various kinds of cutter (Approach angle 45°, 15°, 2°)

▶ Stable clamping power with insert

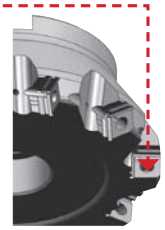






RMH8A (AA 45°)

RMH8E(AA 15°)



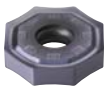
RMH8Q(AA 2°)

Rich Mill RM16

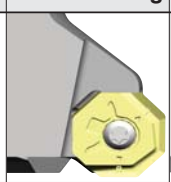
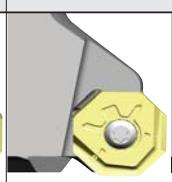
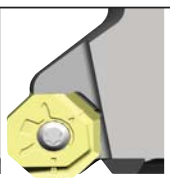
Features

- ▶ Economical 16 cutting edges
- ▶ Reduces cost in medium cutting
- ▶ Wiper insert can be used for good surface roughness
- ▶ Optimal matching of the special cutting edge geometry with variety of new grades provides consistence & long tool
- ▶ When it is used 16 corners, maximum cutting depth is 0.22inch, but it is used 8 corners, maximum cutting depth is 0.51inch
- ▶ Wiper insert is placed 0.05mm lower than facing insert in cutter
- ▶ When feed is bigger than wiper cutting edge length(0.28inch), 2 wiper inserts are placed in symmetrical position

Chip breaker

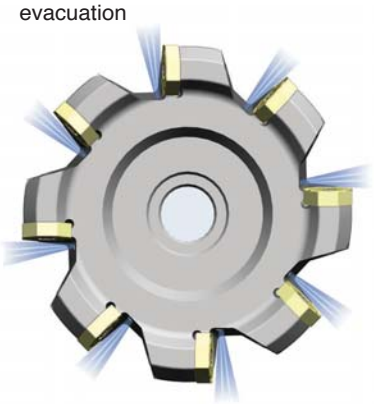
Insert		Cutting edge	Features
Aluminum Cutting Light MA			With sharp edge application the better productivity has been accomplished, especially for Aluminum cutting
Light cutting MF			Due to low cutting load, it is good for light cutting and difficult-to-cut material
General cutting MM			It is suitable design for general milling
Wiper W			It has better surface roughness than MM,MF chip breaker

Instruction for wiper insert

Hand	Correct setting	Incorrect setting			
Right hand					
Decision	○	×	×	×	×
Left hand					
Decision	○	×	×	×	×

Through coolant system

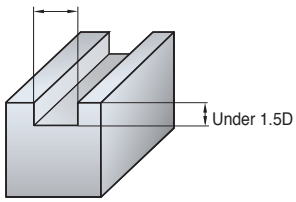
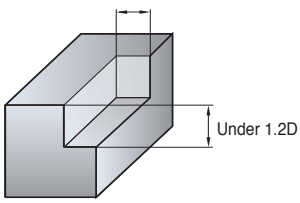
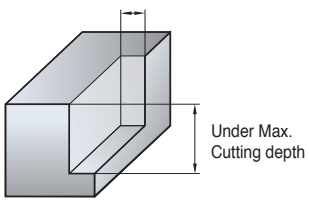
- Well designed chip pocket for better chip flow
- Through coolant system reduces cutting heat and improves chip evacuation



Recommended cutting condition

ISO	Grade	ONM(H)X060608-MM		ONM(H)X060608-MF		ONHX060608-W		ONM(H)X080608-MM		ONM(H)X080608-MF		ONHX080608-W	
		vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)
	NCM325	500 ~ 990	0.004 ~ 0.014	660 ~ 990	0.002 ~ 0.012	660 ~ 990	0.002 ~ 0.008	500 ~ 990	0.004 ~ 0.016	660 ~ 990	0.002 ~ 0.014	660 ~ 990	0.002 ~ 0.010
P	PC3500	500 ~ 990	0.004 ~ 0.014	660 ~ 990	0.002 ~ 0.012	660 ~ 990	0.002 ~ 0.008	500 ~ 990	0.004 ~ 0.016	660 ~ 990	0.002 ~ 0.014	660 ~ 990	0.002 ~ 0.010
M	PC9530	400 ~ 590	0.004 ~ 0.014	330 ~ 590	0.002 ~ 0.012	330 ~ 590	0.002 ~ 0.008	400 ~ 590	0.004 ~ 0.016	330 ~ 590	0.002 ~ 0.014	330 ~ 590	0.002 ~ 0.010
K	PC6510	500 ~ 990	0.004 ~ 0.016	500 ~ 990	0.003 ~ 0.014	500 ~ 990	0.002 ~ 0.010	500 ~ 990	0.004 ~ 0.018	500 ~ 990	0.003 ~ 0.016	500 ~ 990	0.002 ~ 0.012

Recommended depth of cut

1. Slotting	2. Shouldering	3. Shouldering
		
Under 1.5D	Under 1.2D	Under Max. Cutting depth

Recommended cutting condition(for multi edge type)

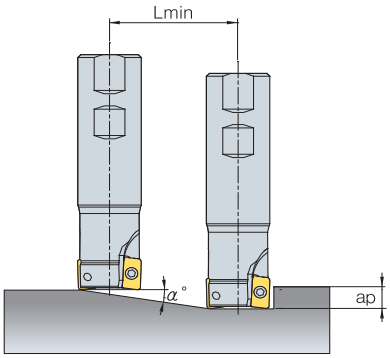
Workpiece	Grades	Fig.	Tool Dia.							
			Ø0.75, 1.0		Ø1.25, 1.5		Ø2.0, 2.5		Ø3.0, 4.0	
			vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)
Mild steel, Low carbon steel	NCM325 PC3500	①	260~330	0.002~0.003	330~390	0.002~0.003	330~390	0.002~0.003	330~390	0.002~0.003
		②	330~390	0.003~0.004	390~460	0.003~0.004	390~460	0.003~0.004	390~460	0.003~0.004
		③	330~390	0.004~0.006	390~460	0.004~0.006	390~460	0.004~0.006	430~490	0.004~0.006
High carbon steel, Alloy steel	NCM325 PC3500	①	200~260	0.002~0.002	260~330	0.002~0.002	260~330	0.002~0.002	260~330	0.002~0.002
		②	260~330	0.002~0.003	330~390	0.003~0.004	330~390	0.003~0.004	330~390	0.003~0.004
		③	260~330	0.004~0.006	360~430	0.004~0.006	330~430	0.004~0.006	360~430	0.004~0.006
Alloy tool steel	NCM325 PC3500	①	160~230	0.002~0.002	230~300	0.002~0.002	230~300	0.002~0.002	230~300	0.002~0.002
		②	200~260	0.002~0.003	300~390	0.002~0.003	330~390	0.002~0.003	330~390	0.002~0.003
		③	300~360	0.005~0.007	330~430	0.004~0.006	330~390	0.004~0.006	360~430	0.004~0.006
Stainless steel	PC5300 PC9530	①	160~230	0.002~0.002	230~300	0.002~0.002	230~300	0.002~0.002	230~300	0.002~0.002
		②	200~260	0.002~0.003	300~390	0.002~0.003	330~390	0.002~0.003	330~390	0.002~0.003
		③	300~360	0.004~0.006	330~430	0.004~0.006	360~430	0.004~0.006	360~430	0.004~0.006
Cast iron	PC6510 PC5300	①	230~300	0.004~0.005	230~300	0.004~0.005	300~390	0.004~0.005	300~390	0.004~0.005
		②	260~330	0.005~0.005	300~390	0.005~0.005	330~460	0.005~0.005	330~460	0.005~0.005
		③	260~330	0.006~0.008	330~430	0.006~0.008	390~490	0.006~0.008	390~490	0.006~0.008
Aluminum alloy	H01	①	660~2,620	0.004~0.008	980~2,950	0.004~0.008	1,310~3,280	0.004~0.008	1,310~3,280	0.004~0.008
		②	820~2,950	0.006~0.012	980~3,120	0.006~0.012	1,310~3,280	0.004~0.016	1,310~3,280	0.004~0.016
		③	820~2,950	0.006~0.012	980~3,120	0.006~0.012	1,310~3,280	0.004~0.016	1,310~3,280	0.004~0.016
Hardened steel	PC3545 PC5300	①	160~230	0.001~0.001	200~300	0.001~0.001	200~300	0.001~0.001	200~300	0.001~0.001
		②	200~260	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003
		③	260~330	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003

Recommended cutting condition(for single edge type)

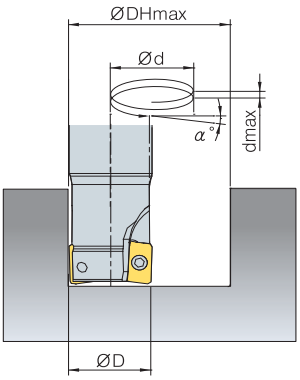
Workpiece	Grades	Fig.	Tool Dia.							
			Ø0.75, 1.0		Ø1.25, 1.5		Ø2.0, 2.5		Ø3.0, 4.0	
			vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)
Mild steel, Low carbon steel	NCM325 PC3500	①	200~260	0.002~0.003	260~390	0.002~0.003	390~660	0.002~0.003	490~660	0.002~0.003
		②	260~390	0.003~0.004	390~590	0.003~0.004	590~820	0.003~0.004	660~820	0.003~0.004
		③	260~390	0.004~0.006	390~590	0.004~0.006	590~820	0.004~0.006	660~820	0.004~0.006
High carbon steel, Alloy steel	NCM325 PC3500	①	160~260	0.002~0.002	260~360	0.002~0.002	330~490	0.002~0.002	330~490	0.002~0.002
		②	260~330	0.002~0.003	360~490	0.002~0.004	490~660	0.002~0.004	490~660	0.002~0.004
		③	260~330	0.004~0.006	390~490	0.004~0.006	590~660	0.004~0.006	590~660	0.004~0.006
Alloy tool steel	NCM325 PC3500	①	160~230	0.002~0.002	260~330	0.002~0.002	330~430	0.002~0.002	330~430	0.002~0.002
		②	230~330	0.002~0.003	330~430	0.002~0.004	430~590	0.002~0.004	430~590	0.002~0.004
		③	230~330	0.004~0.006	330~490	0.004~0.006	430~590	0.004~0.006	430~590	0.004~0.006
Stainless steel	PC5300 PC9530	①	160~230	0.002~0.002	260~330	0.002~0.002	330~430	0.002~0.002	330~430	0.002~0.002
		②	230~330	0.002~0.003	330~430	0.002~0.004	430~590	0.002~0.004	430~590	0.002~0.004
		③	230~330	0.004~0.006	330~490	0.004~0.006	430~590	0.004~0.006	430~590	0.004~0.006
Cast iron	PC6510 PC5300	①	260~330	0.003~0.005	260~330	0.006~0.006	390~490	0.006~0.006	390~490	0.006~0.006
		②	330~390	0.005~0.006	330~430	0.006~0.007	490~660	0.006~0.007	490~660	0.006~0.007
		③	330~390	0.006~0.008	330~430	0.006~0.008	490~660	0.006~0.008	490~660	0.006~0.008
Aluminum alloy	H01	①	820~2,620	0.006~0.008	980~2,950	0.006~0.008	1,310~3,280	0.004~0.008	1,310~3,280	0.004~0.008
		②	820~2,950	0.008~0.010	1,150~3,120	0.008~0.010	1,310~3,280	0.008~0.012	1,310~3,280	0.008~0.012
		③	820~2,950	0.010~0.012	1,150~3,120	0.010~0.012	1,310~3,280	0.012~0.016	1,310~3,280	0.012~0.016
Hardened steel	PC3545 PC5300	①	160~230	0.001~0.001	200~300	0.001~0.001	200~300	0.001~0.001	200~300	0.001~0.001
		②	200~260	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003
		③	260~330	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003	260~330	0.002~0.003

Cutting condition for ramping and helical operation

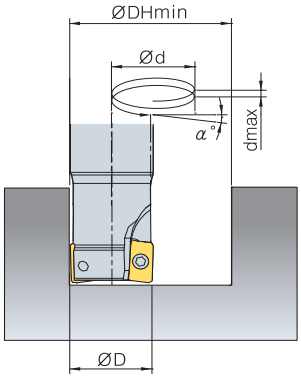
1. Ramping



2. Helical cutting for blind hole



3. Helical cutting for through hole

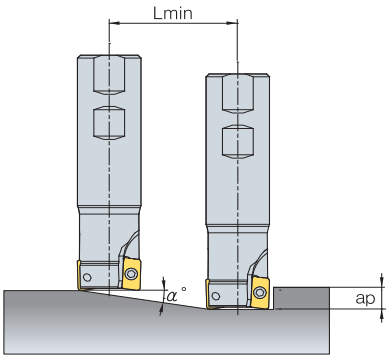


Designation		Tool Dia. ØD(min)	Ramping		Helical cutting for blind hole				Helical cutting for through hole	
			Maximum angle (α°)	Lmin(inch)	Max. desirable hole Dia. ØDHmax(inch)	Max. pitch dmax(inch)	Min. desirable hole Dia. ØDHmin(inch)	Max. pitch dmax(inch)	Min. desirable hole Dia. ØDHmin(inch)	Max. pitch dmax(inch)
AMSA	1043HS	0.438	5.50	2.045	0.828	0.080	0.781	0.075	0.599	0.058
	1050HS	0.500	4.52	2.492	0.953	0.075	0.906	0.072	0.724	0.057
	1056HS	0.563	3.83	2.938	1.078	0.072	1.031	0.069	0.849	0.057
	1062HS	0.625	3.33	3.384	1.203	0.070	1.156	0.067	0.974	0.057
	1068HS	0.688	2.94	3.831	1.328	0.068	1.281	0.066	1.099	0.056
	1075HS	0.750	2.64	4.277	1.453	0.067	1.406	0.065	1.224	0.056
	1081HS	0.813	2.39	4.724	1.578	0.066	1.531	0.064	1.349	0.056
	1087HS	0.875	2.18	5.170	1.703	0.065	1.656	0.063	1.474	0.056
	1100HS	1.000	1.86	6.063	1.953	0.063	1.906	0.062	1.724	0.056
	1106HS	1.063	1.73	6.509	2.078	0.063	2.031	0.061	1.849	0.056
	1125HS	1.250	1.44	7.849	2.453	0.062	2.406	0.060	2.224	0.056
	1131HS	1.313	1.36	8.295	2.578	0.061	2.531	0.060	2.349	0.056
AMCA	1150HS	1.500	1.17	9.634	2.953	0.060	2.906	0.059	2.724	0.056
	1200HS	2.000	0.85	13.206	3.953	0.059	3.906	0.058	3.724	0.056
	1250HS	2.500	0.67	16.777	4.953	0.058	4.906	0.058	4.724	0.055
AMSA	15050HS	0.500	5.93	3.410	0.953	0.099	0.898	0.093	0.646	0.067
	15056HS	0.563	6.05	3.342	1.078	0.114	1.023	0.108	0.771	0.082
	15062HS	0.625	5.10	3.967	1.203	0.107	1.148	0.103	0.896	0.080
	15068HS	0.688	4.41	4.592	1.328	0.102	1.273	0.098	1.021	0.079
	15075HS	0.750	3.89	5.217	1.453	0.099	1.398	0.095	1.146	0.078
	15081HS	0.813	3.47	5.842	1.578	0.096	1.523	0.092	1.271	0.077
	15087HS	0.875	3.14	6.467	1.703	0.093	1.648	0.090	1.396	0.076
	15093HS	0.938	2.86	7.092	1.828	0.091	1.773	0.089	1.521	0.076
	15100HS	1.000	2.63	7.717	1.953	0.090	1.898	0.087	1.646	0.076
	15112HS	1.125	2.26	8.967	2.203	0.087	2.148	0.085	1.896	0.075
	15118HS	1.188	2.12	9.592	2.328	0.086	2.273	0.084	2.021	0.075
	15125HS	1.250	1.99	10.217	2.453	0.085	2.398	0.083	2.146	0.074
	15137HS	1.375	1.77	11.467	2.703	0.084	2.648	0.082	2.396	0.074
1AMCA	15150HS	1.500	1.60	12.717	2.953	0.082	2.898	0.081	2.646	0.074
	15200HS	2.000	1.15	17.717	3.953	0.079	3.898	0.078	3.646	0.073
	15250HS	2.500	0.89	22.717	4.953	0.077	4.898	0.076	4.646	0.072
	15300HS	3.000	0.73	27.717	5.953	0.076	5.898	0.075	5.646	0.072
	15400HS	4.000	0.54	37.717	7.953	0.075	7.898	0.074	7.646	0.072

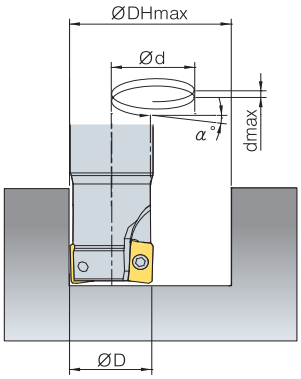
$$L\ min = \frac{ap}{\tan \alpha^{\circ}} \text{ (inch)}$$

Cutting condition for ramping and helical operation

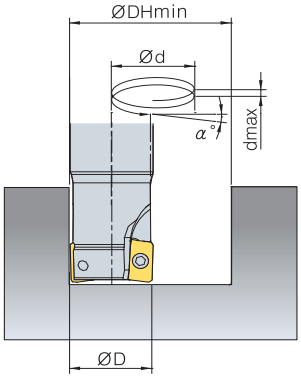
1. Ramping



2. Helical cutting for blind hole



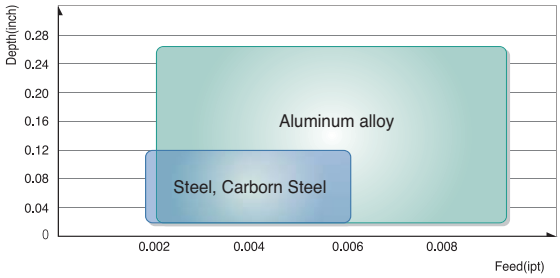
3. Helical cutting for through hole



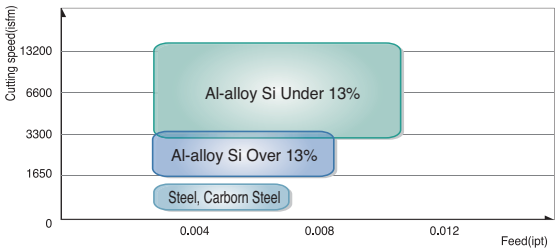
Designation		Tool Dia. ØD(min)	Ramping		Helical cutting for blind hole				Helical cutting for through hole	
			Maximum angle (α°)	Lmin(inch)	Max. desirable hole Dia. ØDHmax(inch)	Max. pitch dmax(inch)	Min. desirable hole Dia. ØDHmin(inch)	Max. pitch dmax(inch)	Min. desirable hole Dia. ØDHmin(inch)	Max. pitch dmax(inch)
AMSA	2050HS	0.500	11.69	1.903	0.921	0.191	0.858	0.178	0.646	0.134
	2056HS	0.563	7.55	2.969	1.046	0.139	0.983	0.130	0.771	0.102
	2063HS	0.625	10.30	2.165	1.171	0.213	1.093	0.199	0.896	0.163
	2069HS	0.688	8.23	2.723	1.296	0.187	1.218	0.176	1.021	0.148
	2075HS	0.750	5.60	4.016	1.421	0.139	1.343	0.132	1.146	0.112
	2088HS	0.875	5.15	4.366	1.671	0.151	1.593	0.144	1.396	0.126
	2100HS	1.000	3.92	5.748	1.921	0.132	1.843	0.126	1.646	0.113
	2125HS	1.250	2.70	8.346	2.421	0.114	2.343	0.110	2.146	0.101
	2150HS	1.500	1.98	11.378	2.921	0.101	2.843	0.098	2.646	0.092
	2200HS	2.000	1.48	15.197	3.921	0.102	3.843	0.100	3.646	0.094
	2250HS	2.500	1.11	20.236	4.921	0.096	4.843	0.094	4.646	0.090
AMCA	2150HS	1.500	0.36	62.047	2.921	0.019	2.843	0.018	2.646	0.017
	2200HS	2.000	0.36	62.047	3.921	0.025	3.843	0.024	3.646	0.023
	2250HS	2.500	0.27	82.835	4.921	0.023	4.843	0.023	4.646	0.022
	2300HS	3.000	0.21	109.606	5.921	0.021	5.843	0.021	5.646	0.020
	2400HS	4.000	0.16	141.102	7.921	0.022	7.843	0.022	7.646	0.021
AMSA	3100HS	1.000	4.72	4.764	1.921	0.159	1.843	0.152	1.449	0.120
	3125HS	1.250	3.00	7.520	2.421	0.127	2.343	0.123	1.949	0.102
	3150HS	1.500	2.29	9.843	2.921	0.117	2.843	0.114	2.449	0.098
	3200HS	2.000	1.64	13.780	3.921	0.112	3.843	0.110	3.449	0.099
	3250HS	2.500	1.22	18.504	4.921	0.105	4.843	0.103	4.449	0.095
AMCA	3150HS	1.500	1.99	11.319	2.921	0.102	2.843	0.099	2.449	0.085
	3200HS	2.000	1.67	13.504	3.921	0.114	3.843	0.112	3.449	0.101
	3250HS	2.500	1.22	18.504	4.921	0.105	4.843	0.103	4.449	0.095
	3300HS	3.000	0.90	25.039	5.921	0.093	5.843	0.092	5.449	0.086
	3400HS	4.000	0.69	32.677	7.921	0.095	7.843	0.094	7.449	0.090
AMSA	2100MH	1.000	1.50	30.070	1.921	0.050	1.843	0.048	-	-
	2125MH	1.250	1.50	45.104	2.421	0.063	2.343	0.061	-	-
AMSA	3150MH	1.500	1.50	60.139	2.921	0.076	2.843	0.074	-	-
AMSA	4125HS	1.250	3.42	10.737	2.453	0.147	2.398	0.143	2.146	0.128
	4150HS	1.500	2.65	13.871	2.953	0.137	2.898	0.134	2.646	0.122
	4200HS	2.000	1.82	20.141	3.953	0.126	3.898	0.124	3.646	0.116
	4250HS	2.500	1.39	26.410	4.953	0.120	4.898	0.119	4.646	0.113
AMCA	4200HS	2.000	1.82	20.141	3.953	0.126	3.898	0.124	3.646	0.116
	4250HS	2.500	1.39	26.410	4.953	0.120	4.898	0.119	4.646	0.113
	4300HS	3.000	1.12	32.679	5.953	0.117	5.898	0.116	5.646	0.111
	4400HS	4.000	0.81	45.217	7.953	0.113	7.898	0.112	7.646	0.109
	4500HS	5.000	0.64	57.756	9.953	0.111	9.898	0.110	9.646	0.107

$$L\,min = \frac{ap}{\tan \alpha^{\circ}} \text{ (inch)}$$

Application range as per workpiece



Cutting speed



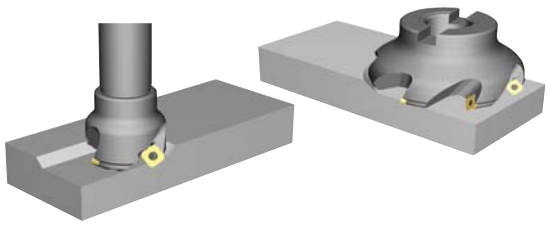
Max. available revolution

Cutter diameter	Max. revolution
Ø2.5	20,000
Ø3.0	16,000
Ø4.0	13,000
Ø5.0	10,000
Ø6.0	8,000
Ø8.0	6,500
Ø10.0	5,000
Ø12.0	4,000

Future Mill(FMA)

Features

- ▶ General milling cutter for high productivity
- ▶ Adjustable pitch of cutter and various chip breaker offer wide application range.
- ▶ Light cutter body allows high speed cutting and can be used in low horse power machine
- ▶ Smooth cutting with low cutting load is accomplished with high rake angle



Chip breaker

Type	Chip breaker	Cutting edge	Features of chip breaker
Light cutting	Non C/B		Superior surface roughness at finishing due to ground type cermet insert
	MF		Superior cutting quality for light and difficult-to-cut material machining through the low cutting load of chip breaker
General cutting	MM		Suitable for various cutting due to special shape design for general cutting
Roughing	MR		Tough cutting edge provides stable cutting performance in severe interruption
For aluminum	MA		Superior cutting quality for aluminum due to sharp cutting edge and buffed surface • SOET-MA: Sharp cutting edge due to high accurate grinding • SOXT-MA: Suitablecutting edge for roughing

Recommended cutting condition

ISO	C/B / Grade	MF		MM		MR		MA	
		vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)	vc(sfm)	fz(ipt)
P	NC5330	660~990	0.002~0.008	500~990	0.004~0.012	500~820	0.004~0.012	-	-
	NCM325	660~990	0.002~0.008	500~990	0.004~0.012	500~820	0.004~0.012	-	-
	PC3500	660~990	0.002~0.008	500~990	0.004~0.012	500~820	0.004~0.012	-	-
M	PC9530	330~660	0.002~0.006	400~600	0.004~0.012	-	-	-	-
	NCM335	400~660	0.002~0.006	400~600	0.004~0.012	-	-	-	-
K	PC5300	500~820	0.002~0.008	500~820	0.004~0.012	-	-	-	-
Aluminum	H01	-	-	-	-	-	-	1150~3280	0.004~0.014

Recommended Cutting Condition

• Side milling, Slotting, Ramping, Copying

	Workpiece	Hardness	Grades	Cutting speed (sfm)	FMR1000		FMR1500		FMR2000		FMR2500		FMR3000		FMR4000		FMR5000		FMR6000	
					ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)
P	General structure steel	200HB≤	PC3500	350~850	≤0.04	≤0.016	≤0.05	≤0.016	≤0.06	≤0.016	≤0.07	≤0.016	≤0.08	≤0.020	≤0.09	≤0.024	≤0.12	≤0.028	≤0.16	≤0.031
P	General carbon steel	30HRC≤	PC5300	350~750	≤0.03	≤0.016	≤0.05	≤0.016	≤0.06	≤0.016	≤0.07	≤0.016	≤0.08	≤0.020	≤0.09	≤0.024	≤0.12	≤0.028	≤0.16	≤0.031
P	High carbon steel,Alloy steel	30~40HRC	PC3545	350~650	≤0.03	≤0.008	≤0.04	≤0.008	≤0.05	≤0.008	≤0.06	≤0.008	≤0.07	≤0.012	≤0.08	≤0.016	≤0.11	≤0.020	≤0.15	≤0.024
P	High carbon steel,Alloy steel	40~50HRC	PC3545	300~500	≤0.03	≤0.008	≤0.04	≤0.008	≤0.05	≤0.008	≤0.06	≤0.008	≤0.07	≤0.012	≤0.08	≤0.016	≤0.11	≤0.020	≤0.15	≤0.024
P	Alloy steel	50HRC≥	PC3545	300~500	≤0.03	≤0.008	≤0.04	≤0.008	≤0.05	≤0.008	≤0.06	≤0.008	≤0.07	≤0.012	≤0.08	≤0.016	≤0.11	≤0.020	≤0.15	≤0.024
M	Stainless steel	270HB≤	PC5300	200~650	≤0.03	≤0.008	≤0.04	≤0.008	≤0.05	≤0.008	≤0.06	≤0.008	≤0.07	≤0.012	≤0.08	≤0.016	≤0.11	≤0.020	≤0.15	≤0.024
K	Cast iron, Ductile cast iron	Tensile strength 350Mpa≤	PC5300	500~850	≤0.04	≤0.016	≤0.05	≤0.016	≤0.06	≤0.016	≤0.07	≤0.016	≤0.08	≤0.020	≤0.09	≤0.024	≤0.12	≤0.028	≤0.16	≤0.031

• Pocketing

	Workpiece	Hardness	Grades	Cutting speed (sfm)	FMR1000		FMR1500		FMR2000		FMR2500		FMR3000		FMR4000		FMR5000		FMR6000	
					ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)
P	General structure steel	200HB≤	PC3500	350~850	≤0.04	≤0.012	≤0.05	≤0.012	≤0.06	≤0.012	≤0.07	≤0.012	≤0.08	≤0.016	≤0.09	≤0.020	≤0.12	≤0.024	≤0.16	≤0.028
P	General carbon steel	30HRC≤	PC5300	350~750	≤0.03	≤0.012	≤0.05	≤0.012	≤0.06	≤0.012	≤0.07	≤0.012	≤0.08	≤0.016	≤0.09	≤0.020	≤0.12	≤0.024	≤0.16	≤0.028
P	High carbon steel,Alloy steel	30~40HRC	PC3545	350~650	≤0.03	≤0.004	≤0.04	≤0.004	≤0.05	≤0.004	≤0.06	≤0.004	≤0.07	≤0.008	≤0.08	≤0.012	≤0.11	≤0.016	≤0.15	≤0.020
P	High carbon steel,Alloy steel	40~50HRC	PC3545	300~500	≤0.03	≤0.004	≤0.04	≤0.004	≤0.05	≤0.004	≤0.06	≤0.004	≤0.07	≤0.008	≤0.08	≤0.012	≤0.11	≤0.016	≤0.15	≤0.020
P	Alloy steel	50HRC≥	PC3545	300~500	≤0.03	≤0.004	≤0.04	≤0.004	≤0.05	≤0.004	≤0.06	≤0.004	≤0.07	≤0.008	≤0.08	≤0.012	≤0.11	≤0.016	≤0.15	≤0.020
M	Stainless steel	270HB≤	PC5300	200~650	≤0.03	≤0.004	≤0.04	≤0.004	≤0.05	≤0.004	≤0.06	≤0.004	≤0.07	≤0.008	≤0.08	≤0.012	≤0.11	≤0.016	≤0.15	≤0.020
K	Cast iron, Ductile cast iron	Tensile strength 350Mpa≤	PC5300	500~850	≤0.04	≤0.012	≤0.05	≤0.012	≤0.06	≤0.012	≤0.07	≤0.012	≤0.08	≤0.016	≤0.09	≤0.020	≤0.12	≤0.024	≤0.16	≤0.028

• Plunging

	Workpiece	Hardness	Grades	Cutting speed (sfm)	FMR1000		FMR1500		FMR2000		FMR2500		FMR3000		FMR4000		FMR5000		FMR6000	
					ae (inch)	fz (ipt)	ae (inch)	fz (ipt)	ae (inch)	fz (ipt)	ae (inch)	fz (ipt)	ae (inch)	fz (ipt)	ae (inch)	fz (ipt)	ae (inch)	fz (ipt)	ae (inch)	fz (ipt)
P	General structure steel	200HB≤	PC3500	350~850	≤0.10	≤0.008	≤0.12	≤0.008	≤0.14	≤0.008	≤0.16	≤0.008	≤0.20	≤0.012	≤0.24	≤0.016	≤0.31	≤0.020	≤0.39	≤0.024
P	General carbon steel	30HRC≤	PC5300	350~750	≤0.10	≤0.008	≤0.12	≤0.008	≤0.14	≤0.008	≤0.16	≤0.008	≤0.20	≤0.012	≤0.24	≤0.016	≤0.31	≤0.020	≤0.39	≤0.024
P	High carbon steel,Alloy steel	30~40HRC	PC3545	350~650	≤0.10	≤0.004	≤0.12	≤0.004	≤0.14	≤0.004	≤0.16	≤0.004	≤0.20	≤0.008	≤0.24	≤0.012	≤0.31	≤0.016	≤0.39	≤0.020
P	High carbon steel,Alloy steel	40~50HRC	PC3545	300~500	≤0.10	≤0.004	≤0.12	≤0.004	≤0.14	≤0.004	≤0.16	≤0.004	≤0.20	≤0.008	≤0.24	≤0.012	≤0.31	≤0.016	≤0.39	≤0.020
P	Alloy steel	50HRC≥	PC3545	300~500	≤0.10	≤0.004	≤0.12	≤0.004	≤0.14	≤0.004	≤0.16	≤0.004	≤0.20	≤0.008	≤0.24	≤0.012	≤0.31	≤0.016	≤0.39	≤0.020
M	Stainless steel	270HB≤	PC5300	200~650	≤0.10	≤0.004	≤0.12	≤0.004	≤0.14	≤0.004	≤0.16	≤0.004	≤0.20	≤0.008	≤0.24	≤0.012	≤0.31	≤0.016	≤0.39	≤0.020
K	Cast iron, Ductile cast iron	Tensile strength 350Mpa≤	PC5300	500~850	≤0.10	≤0.008	≤0.12	≤0.008	≤0.14	≤0.008	≤0.16	≤0.008	≤0.20	≤0.012	≤0.24	≤0.016	≤0.31	≤0.020	≤0.39	≤0.024

• Helical cutting

	Workpiece	Hardness	Grades	Cutting speed (sfm)	FMR1000		FMR1500		FMR2000		FMR2500		FMR3000		FMR4000		FMR5000		FMR6000	
					ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)	ap (inch)	fz (ipt)
P	General structure steel	200HB≤	PC3500	350~850	≤0.04	≤0.008	≤0.04	≤0.008	≤0.04	≤0.008	≤0.04	≤0.008	≤0.08	≤0.012	≤0.08	≤0.016	≤0.16	≤0.020	≤0.16	≤0.024
P	General carbon steel	30HRC≤	PC5300	350~750	≤0.03	≤0.008	≤0.03	≤0.008	≤0.03	≤0.008	≤0.03	≤0.008	≤0.08	≤0.012	≤0.08	≤0.016	≤0.16	≤0.020	≤0.16	≤0.024
P	High carbon steel,Alloy steel	30~40HRC	PC3545	350~650	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.07	≤0.008	≤0.07	≤0.012	≤0.15	≤0.016	≤0.15	≤0.020
P	High carbon steel,Alloy steel	40~50HRC	PC3545	300~500	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.07	≤0.008	≤0.07	≤0.012	≤0.15	≤0.016	≤0.15	≤0.020
P	Alloy steel	50HRC≥	PC3545	300~500	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.07	≤0.008	≤0.07	≤0.012	≤0.15	≤0.016	≤0.15	≤0.020
M	Stainless steel	270HB≤	PC5300	200~650	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.03	≤0.004	≤0.07	≤0.008	≤0.07	≤0.012	≤0.15	≤0.016	≤0.15	≤0.020
K	Cast iron, Ductile cast iron	Tensile strength 350Mpa≤	PC5300	500~850	≤0.04	≤0.008	≤0.04	≤0.008	≤0.04	≤0.008	≤0.04	≤0.008	≤0.08	≤0.012	≤0.08	≤0.016	≤0.16	≤0.020	≤0.16	≤0.024

$$Lmin = \frac{ap}{\tan \alpha^{\circ}} \text{ (inch)}$$

$$\text{ØDc} = \text{ØDh} - \text{ØD}$$

ØDc = Tool pass of tool center
ØDh = Desirable hole diameter on workpiece
ØD = Tool Dia.

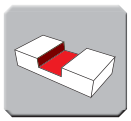
- Adjust feed to under 70% of Recommended cutting condition when ramping & helical cutting
- In helical ramping, max. cutting depth per 1 helical revolution of cutter should not exceed max. cutting depth as per insert size
- in ramping, max. cutting depth for 1 ramping process should not exceed max. depth of cut as per used insert size

Designation		Tool Dia. ØD(inch)	Efficient cutting diameter ØDe(inch)	Ramping			Helical ramping	
				Max. ap(inch)	Max. angle α°	Cutting Length Lmin (inch)	Dh Min. Cutting diameter(inch)	Dh Max. Cutting diameter(inch)
HRMDSA	06068HR	0.688	0.433	0.039	3.7	0.603	1.052	1.281
	06075HR	0.750	0.495	0.039	3.3	0.676	1.177	1.406
	06087HR	0.875	0.619	0.039	2.1	1.063	1.427	1.656
	06100HR	1.000	0.741	0.039	2.6	0.858	1.677	1.909
	06112HR	1.125	0.866	0.039	1.9	1.175	1.927	2.156
	06125HR	1.250	0.992	0.039	0.6	3.724	2.177	2.406
	06137HR	1.375	1.115	0.039	0.4	5.586	2.427	2.656
HRMDSA	09100HR-2□□□	1.000	0.606	0.059	5.4	0.622	1.480	1.843
	09106HR-2□□□	1.063	0.646	0.059	5.0	0.669	1.559	1.921
	09118HR-3□□□	1.188	0.803	0.059	3.9	0.866	1.874	2.236
	09125HR-3□□□	1.250	0.878	0.059	3.5	0.965	2.031	2.394
	09131HR-3□□□	1.313	0.917	0.059	3.3	1.016	2.110	2.472
	09137HR-4□□□	1.375	1.000	0.059	3.0	1.114	2.268	2.630
	09150HR-4□□□	1.500	1.125	0.059	2.5	1.351	2.512	2.874
	09162HR-4□□□	1.625	1.189	0.059	2.5	1.358	2.661	3.024
	09200HR-□□□□	2.000	1.583	0.059	1.8	1.850	3.449	3.811
	13125HR-2□□□□	1.250	0.760	0.079	5.7	0.787	1.850	2.362
	13131HR-2□□□□	1.313	0.799	0.079	5.4	0.839	1.929	2.441
	13137HR-2□□□□	1.375	0.878	0.079	4.8	0.945	2.087	2.598
	13150HR-3□□□□	1.500	0.996	0.079	3.7	1.222	2.331	2.843
	13162HR-3□□□□	1.625	1.071	0.079	3.7	1.209	2.480	2.992
	13200HR-□□□□	2.000	1.457	0.079	2.6	1.732	3.268	3.780
	13250HR-□□□□	2.500	1.969	0.079	1.9	2.413	4.291	4.803
HRMDCA	09200HR-□	2.000	1.583	0.059	1.8	1.850	3.449	3.811
	09250HR-□	2.500	2.091	0.059	1.4	2.492	4.472	4.835
	09300HR-□	3.000	2.760	0.059	1.0	3.327	5.811	6.173
	09400HR-□	4.000	3.543	0.059	0.8	4.311	7.386	7.748
	13200HR-□	2.000	1.457	0.079	2.6	1.732	3.268	3.780
	13250HR-□	2.500	1.969	0.079	1.9	2.413	4.291	4.803
	13300HR-□	3.000	2.634	0.079	1.4	3.307	5.630	6.142
	13400HR-□	4.000	3.421	0.079	1.0	4.358	7.205	7.717
	13500HR-□	5.000	4.406	0.079	0.8	4.488	9.173	9.685
HRMDCA	16300HR-□	3.000	2.343	0.098	1.5	3.742	5.134	5.843
	16400HR-□	4.000	3.344	0.098	1.0	5.614	7.134	7.843
	16500HR-□	5.000	4.345	0.098	0.8	7.018	9.134	9.843
	16600R-□	6.000	5.345	0.098	0.6	9.357	11.134	11.843
	16800R-□	8.000	7.346	0.098	0.3	18.716	15.134	15.843
	161000R-□	10.000	9.346	0.098	0.2	28.074	19.134	19.843
	161200R-□	12.000	11.346	0.098	0.1	56.149	23.134	23.843

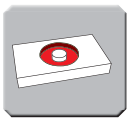
Application area


Copying

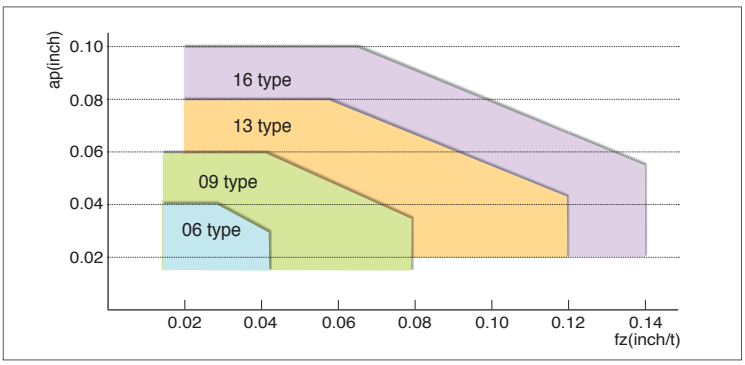

Facing


Slotting


Ramping


Helical cutting


Through coolant system



Recommended cutting condition

Workpiece		Hardness	Grades	vc (sfm)	fz (ipt)
P	General structural steel, Mild steel	Under 200HB	PC3500	650(330~750)	1.0 ~ 2.0
			PC3545		
	Carbon steel, Alloy steel	Under 30HRC	PC3500	590(330~720)	1.0 ~ 1.5
			PC3545		
	High Carbon steel, Alloy steel	30~40 HRC	PC3500	520(330~660)	0.8 ~ 1.3
			PC3545		
	Pre-hardened steel	40~50 HRC	PC3500	390(260~190)	0.6 ~ 1.2
			PC5300		
M	Stainless steel	Under 270HB	PC5300	390(260~490)	0.8 ~ 1.3
			PC3545		
K	Cast iron	Under 350N/mm²	PC5300	590(330~720)	1.2 ~ 1.8

Machining Example - I

Working condition

Work piece : AISI 1045 (SM45C, HRC22)
Cutting speed : vc = 930sfm
fz = 0.055ipt
vf = 398ipm
ap = 0.032inch
ae = 1.378inch
Coolant: Dry, Machining: Copying
Machine: Horizontal MCT
Overhang of tool: 10inch

Tool information : HRMDCM13050HR-4
WNMX130520ZNN-MM(PC3500)

Productivity : 40% increased Tool cost : 80% decreased

※**Test result** - In comparing HRMD with our competitor using the same cutting conditions, the cutting speed of HRMD was higher with the same depth of cut (ap×ae), the cycle time was reduced by 40% and the tool life was increased to over 60%. HRMD is economically more efficient due to the use of 6 cutting edges compared to EDNW type with positive insert

Machining Example - II

Working condition

Work piece : AISI 304 (STS304)
Cutting speed : vc = 430sfm
fz = 0.047ipt
vf = 117ipm
ap = 0.04inch
ae = 3.15inch
Coolant: Wet
Machining : Facing and Slotting
Machine: Vertical MCT
Overhang of tool: 10inch

Tool information : HRMDCM13100HR-6
WNMX130520ZNN-MM(PC3545)

Productivity : 80% increased Tool cost : 25% decreased

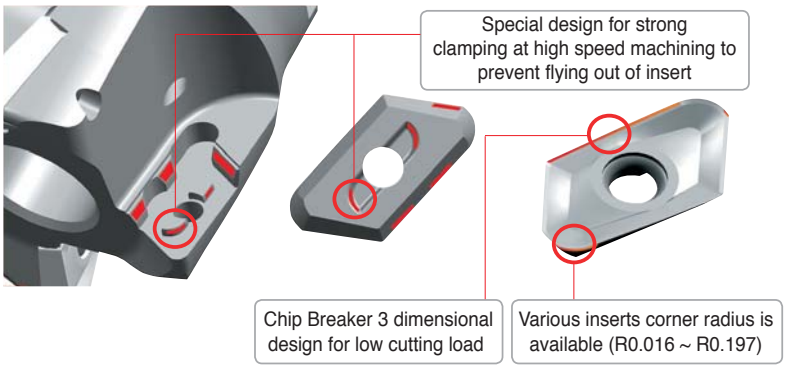
※**Test result** - In comparing HRMD with our competitor using the same cutting conditions, the cutting speed of HRMD was higher with the same depth of cut (ap×ae), the cycle time was reduced by 80% and the tool life was same, but HRMD is economically more efficient due to the use of 6 cutting edges compared to SDKN type with positive insert

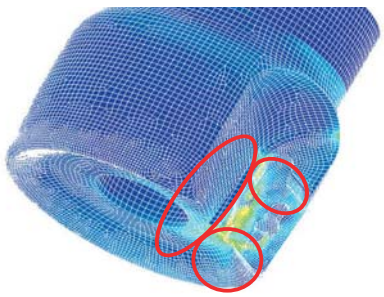
Strong clamping due to the concave design of insert bottom

Pro-X Mill

- Strong clamping due to the concave design of insert bottom
- Good chip flow and less build up edge acheived with the buffed surface of insert
- High rake angle of insert provides good surface finish and low cutting load
- Specially designed for high speed machining of aluminum
- Suitable for square shouldering and curved surface machining

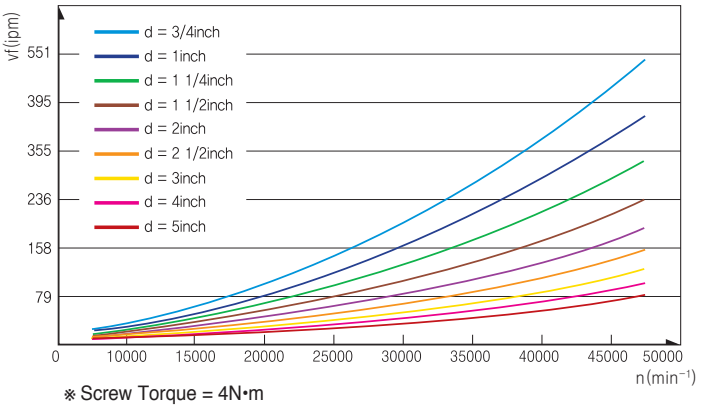
Clamping system for high speed





• Clamping design as per FEM analysis
• Strong clamping of insert

Centrifugal force as per RPM



※ Screw Torque = 4N•m
※ Indexable insert : 6.8g

Marking [• Designation • Max. RPM]

Max. RPM as per cutting diameter

Cutting diameter ØD(inch)		Max. RPM	
5000 type	6000 type	n(min⁻¹)	vc(sfm)
3/4	-	15,000	7,564
1	1	32,600	8,445
1 1/4	1 1/4	28,800	9,549
1 1/2	1 1/2	25,800	10,693
2	2	23,000	11,916
2 1/2	2 1/2	20,500	13,382
3	3	18,200	15,087
4	4	16,300	16,890
5	5	14,600	18,910

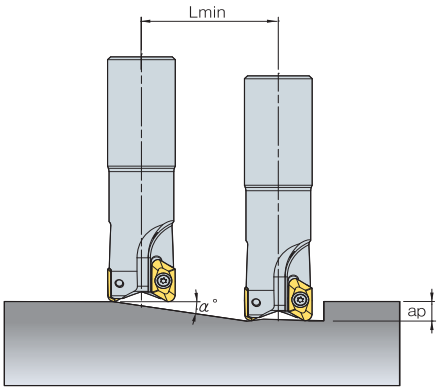
※ In case of actual machining accidental breakage of insert or tool could happen even under the written RPM special cover or door is necessary to prevent damage from broken insert or broken tool

Recommended cutting condition

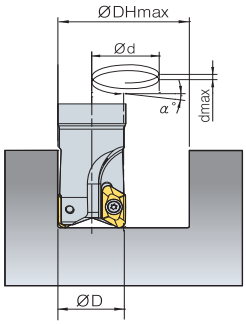
Workpiece		Cutting Speed vc(sfm)	Feed fz(ipt)
Aluminum alloy	Rm280 < MPa	3960	0.012
	Rm280 > MPa	3300	0.010
Copper alloy	Long chipping	1320	0.008
Thermo plastic	-	1150	0.006
Aluminum alloy	Si <12%	3300	0.010
	Si ≥12%	-	-
Copper alloy	Short chipping	1650	0.008
Magnesium alloy	-	1480	0.008
Duroplastics	-	680	0.006

Pro-X Mill Ramping & Helical cutting technical data

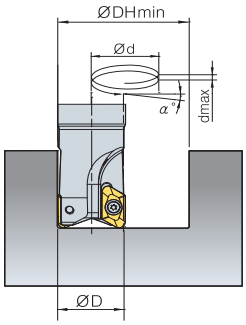
1. Ramping



2. Blind hole Helical cutting



3. Thru hole Helical cutting



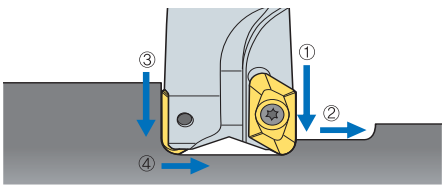
Designation	ØD(inch)	Ramping		Blind hole Helical cutting				Thru hole Helical cutting	
		α°(max)	Lmin(inch)	ØDHmax(inch)	dmax(inch)	ØDHmin(inch)	dmax(inch)	ØDHmin(inch)	dmax(inch)
PAXSA5075HR	0.75	9.1	2.47	1.264	0.008	1.185	0.007	0.988	0.006
PAXSA5100HR	1.00	11.9	1.86	1.764	0.015	1.685	0.014	1.488	0.012
PAXSA5125HR	1.25	9.0	2.49	2.264	0.014	2.185	0.014	1.988	0.012
PAXSA5150HR	1.50	7.2	3.11	2.764	0.014	2.685	0.013	2.488	0.012
PAXCA5200HR	2.00	5.2	4.36	3.764	0.013	3.685	0.013	3.488	0.012
PAXCA5250HR	2.50	4.0	5.61	4.764	0.013	4.685	0.013	4.488	0.012
PAXCA5300HR	3.00	3.3	6.86	5.764	0.013	5.685	0.013	5.488	0.012
PAXCA5400HR	4.00	2.4	9.36	7.764	0.013	7.685	0.013	7.488	0.012
PAXCA5500HR	5.00	1.9	11.86	9.764	0.013	9.685	0.013	9.488	0.012
PAXSA6100HR	1.00	9.0	2.48	1.764	0.011	1.685	0.011	1.488	0.009
PAXSA6125HR	1.25	6.8	3.31	2.264	0.011	2.185	0.010	1.988	0.009
PAXSA6150HR	1.50	10.8	2.07	2.764	0.021	2.685	0.020	2.488	0.019
PAXCA6200HR	2.00	7.7	2.91	3.764	0.020	3.685	0.020	3.488	0.019
PAXCA6250HR	2.50	6.0	3.74	4.764	0.020	4.685	0.019	4.488	0.019
PAXCA6300HR	3.00	4.9	4.57	5.764	0.020	5.685	0.019	5.488	0.019
PAXCA6400HR	4.00	3.6	6.24	7.764	0.019	7.685	0.019	7.488	0.019
PAXCA6500HR	5.00	2.9	7.91	9.764	0.019	9.685	0.019	9.488	0.019

- Lmin : when ap=0.394inch
- Lmin : Minimum inclination cutting length

α° : Max. rampig angle
ap : Depth of cut

$$Lmin = \frac{ap}{\tan \alpha^{\circ}} \text{ (inch)}$$

Plunging, Slotting, Drilling technical data



1. When drilling, grooving machining sequence is ① → ② → ③ → ④
2. When drilling, grooving, decrease the feed and cutting speed 30%~50% from the recommended data

• Cutting condition for drilling

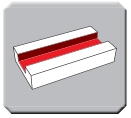
Holder	ap(inch)	
	5000 Type	6000 Type
Ø3/4	0.315	-
Ø1	0.157	0.433
Ø1 1/4	0.157	0.236
Ø1 1/2~5	0.157	0.236

Insert	ap(inch)
XETK19	0.157
XETK25	0.236

Uses


Copying


Helical cutting


Slotting & Shouldering


Ramping