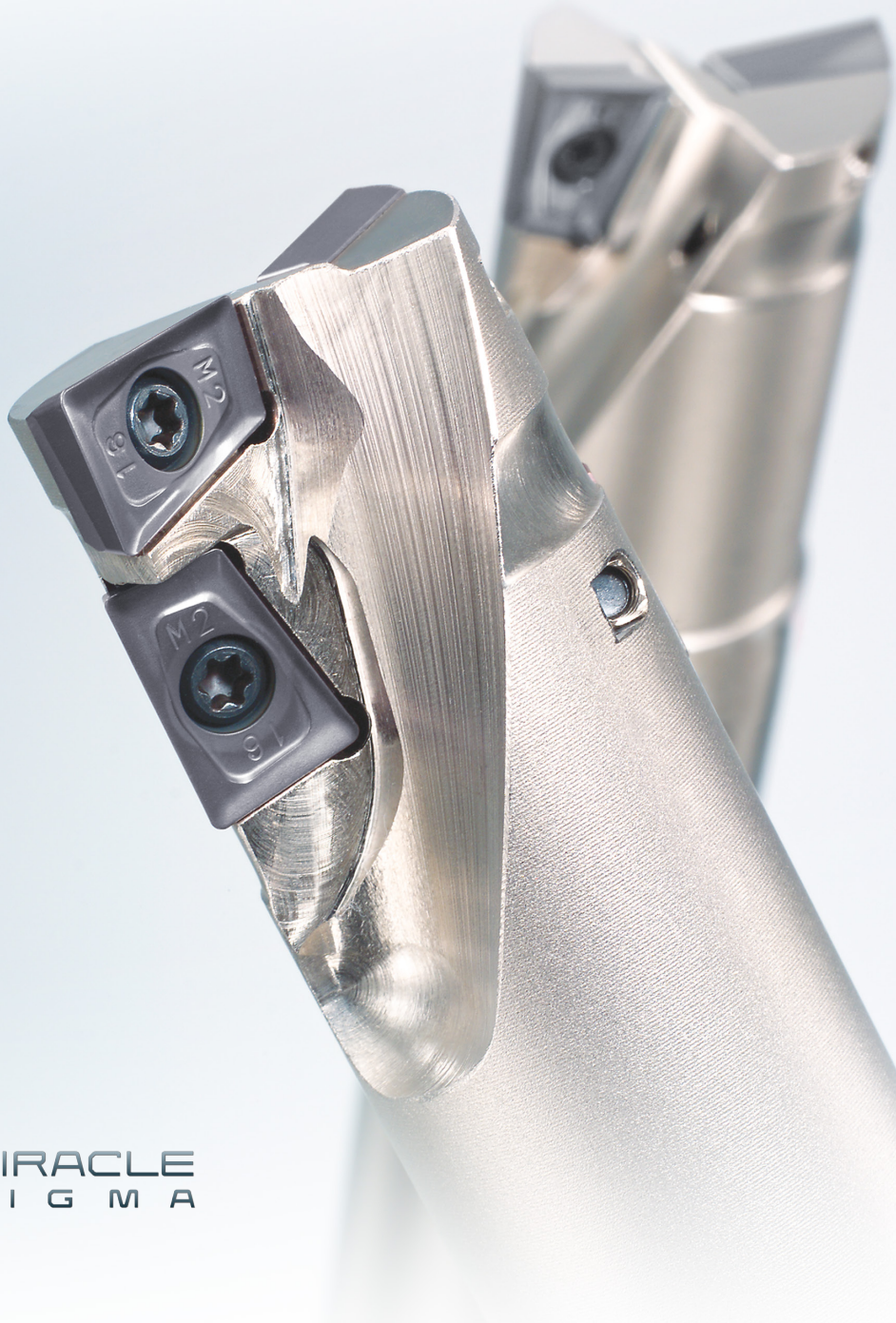
MITSUBISHI MITSUBISHI MATERIALS TOOL NEWS
2016.8 Update B021A YOUR GLOBAL CRAFTSMAN STUDIO

Multi-functional Indexable Insert End Mill

AQX Series

Insert Grade Expansion

A cutting tool to operate from drilling to end milling.



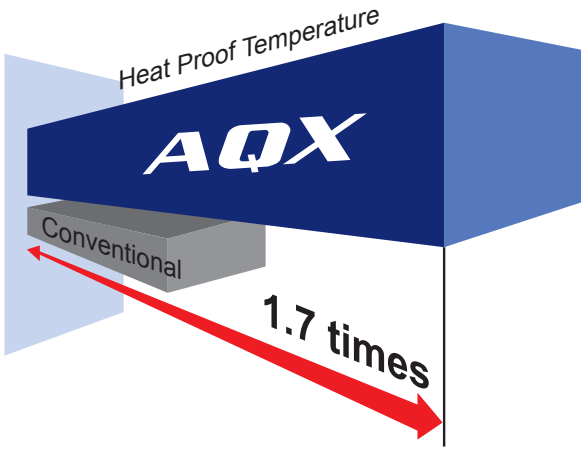
MIRACLE SIGMA

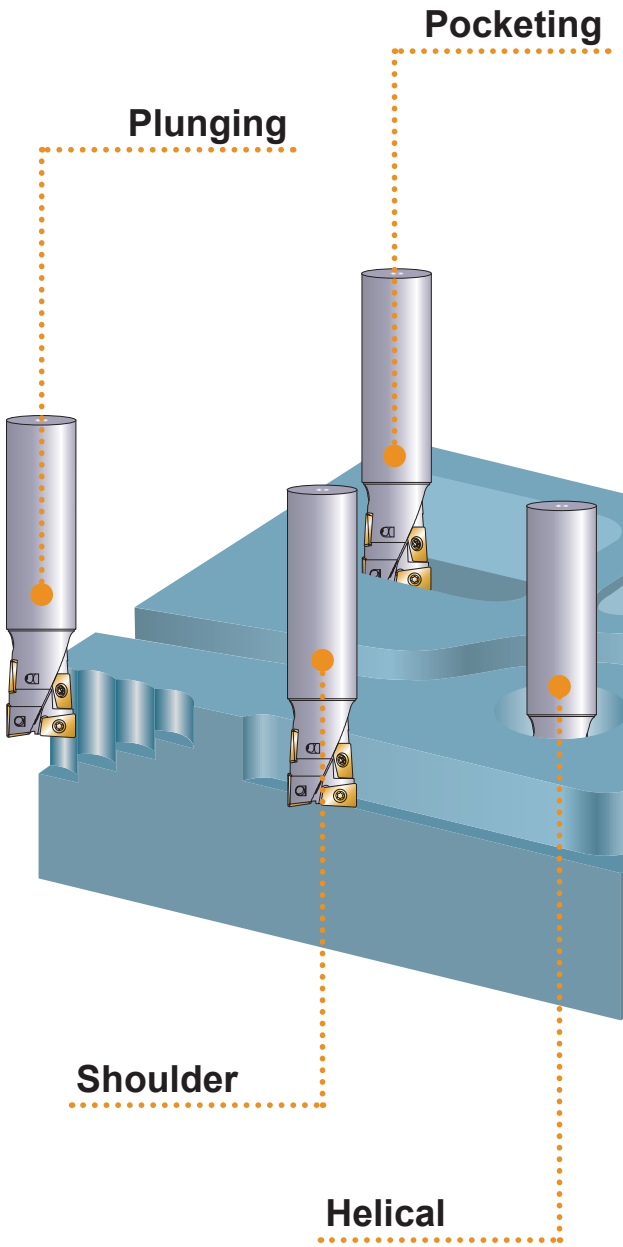
Multi-functional Indexable Insert End Mill

AQX Series

Heat Resistant Body

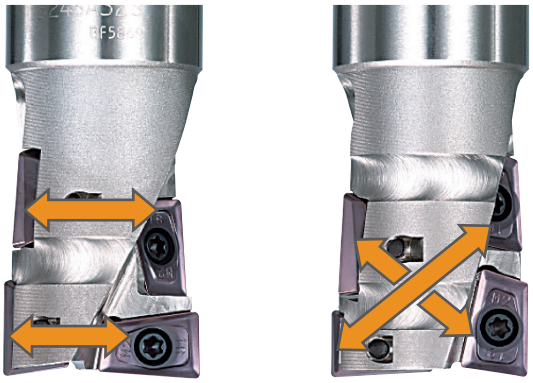
The body of the tool is made from a special alloy steel that has high heat resistant properties.
A special surface treatment is used to increase wear and corrosion resistance.



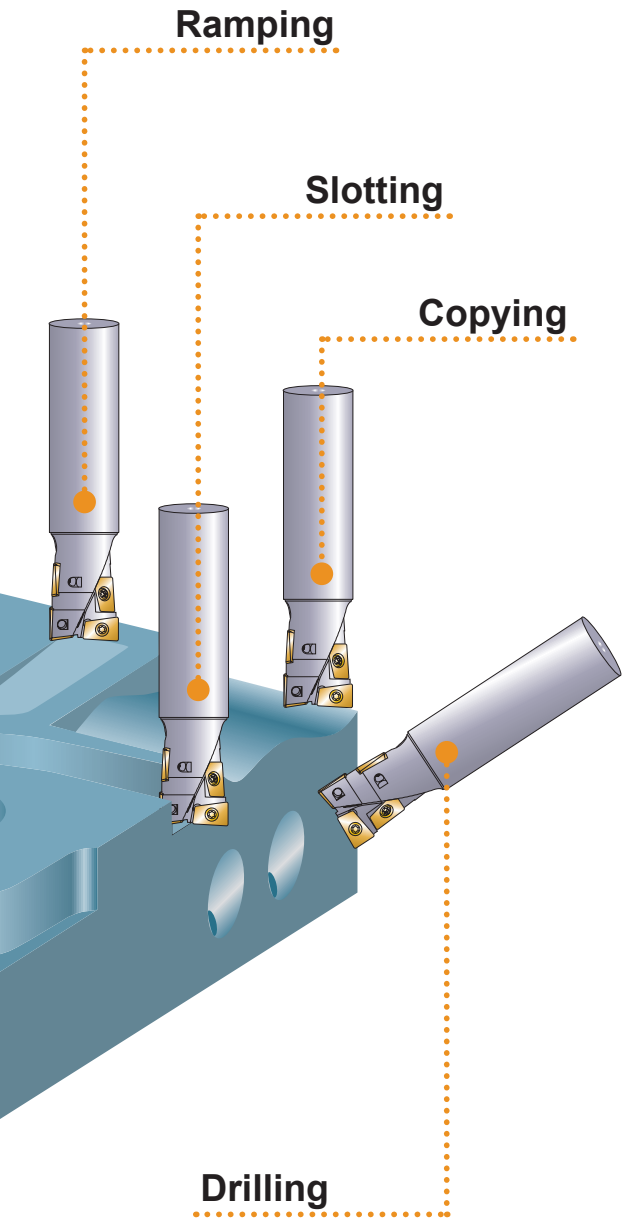


One Insert Type

Tool management is simplified by using only one type of insert for all 4 cutting edges. By rotating the inserts it's possible to use inserts twice.



Insert Rotation

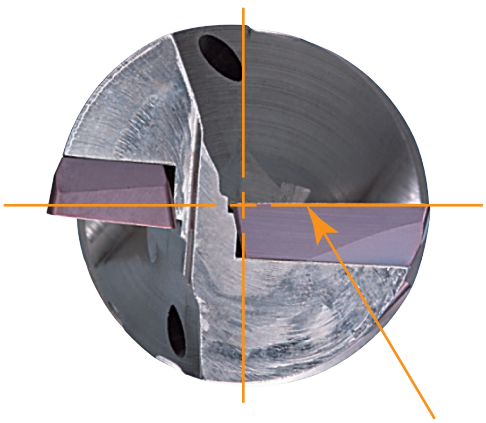


2 Insert Bottom Cutting Edge

The lower cutting edge consists of 2 inserts, resulting in higher cutting edge strength and increased tool life.

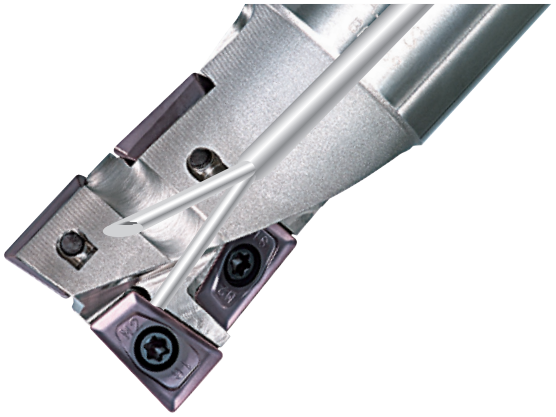
Center Cutting Edge

The AQX is designed with a center cutting edge, making it possible to drill, helical mill and pocket without a prepared hole.



Through Coolant Holes

The body is designed with through coolant holes to improve cooling and chip disposal.
The AQX is also available without coolant holes.



Short Edge Type

An economical short edge type body is available with only 2 inserts for short depth of cut applications.

Standard Edge Type

Short Edge Type

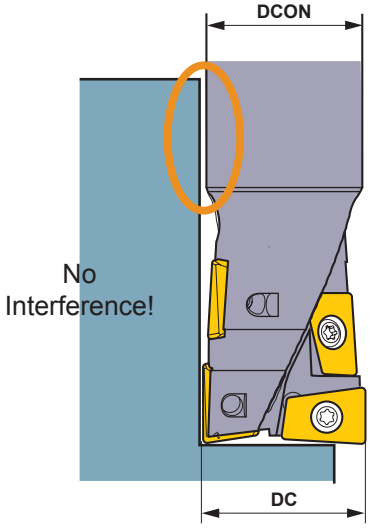
Undercut Type Standardized

The cutting edge diameter DC has been designed so that it is larger than the shank diameter DCON, making it possible to machine vertical faces without any interference.

(inch)

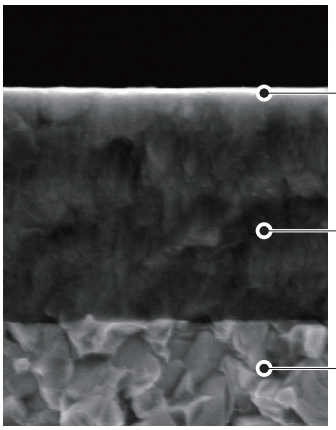
Order Number	DC	DCON
AQXUR11○SA10L	.672	.625
AQXUR13○SA12L	.797	.750
AQXUR17○SA16L	1.047	1.000
AQXUR21○SA20L	1.297	1.250
AQXUR24○○A20○	1.500	1.250

For further details please refer to page 6.



New PVD Coated Grades
MP6100/MP7100/MP9100

Wide range of grades for specific materials
MIRACLE SIGMA accumulated Al-Ti-Cr-N based PVD coating.



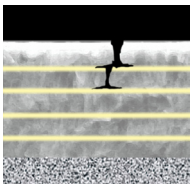
TOUGH-Σ Technology

A fusion of the separate coating technologies;
PVD and multi-layering provides extra toughness.

PVD Accumulated Coating

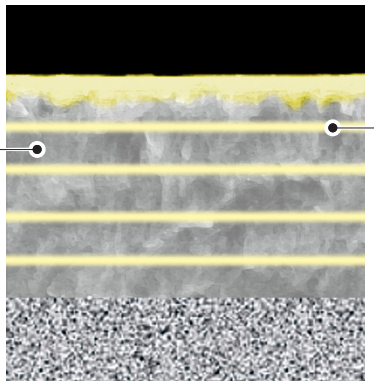
Base Layer
High Al-(Al, Ti)N

The new technology Al-(Al, Ti)N coating provides stabilization of the high hardness phase and succeeds in dramatically improving wear, crater and welding resistance.



Multi-layering of the coating prevents any cracks penetrating through to the substrate.

*Graphical Representation.

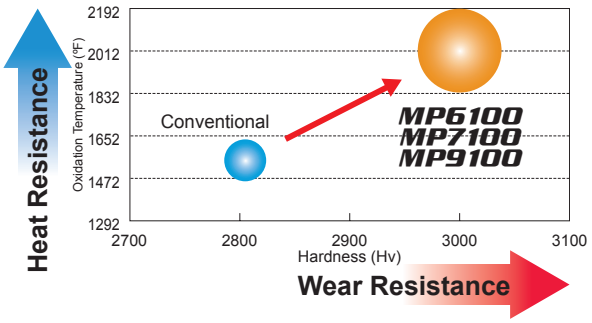


*Graphical Representation.

Best Layer of Each Work Material

P		(Al,Cr)N Tough! Thermal Cracks
M		TiN Tough! Notching
S		CrN Tough! Resistant Chipping

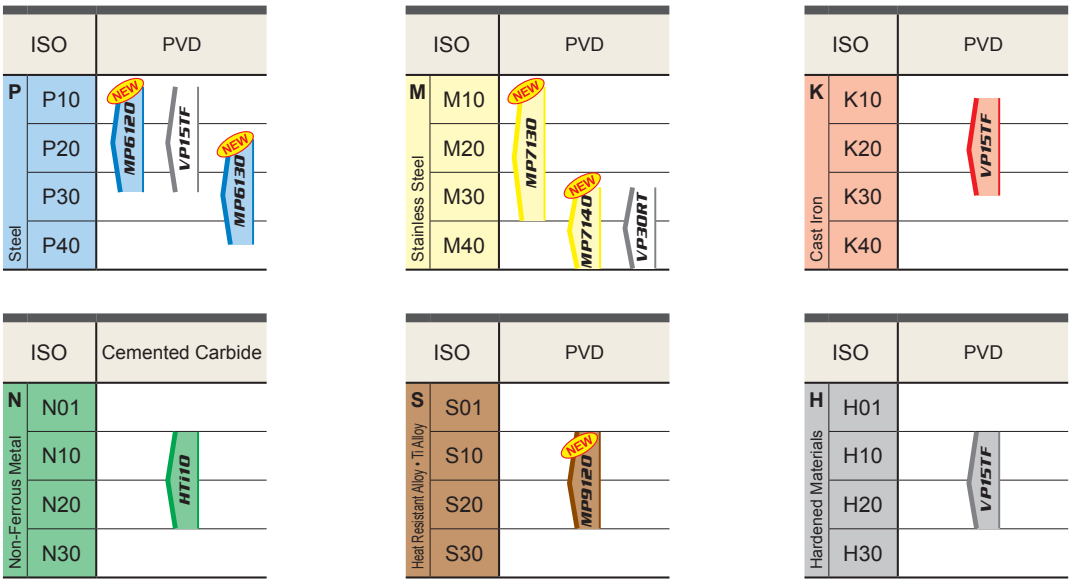
Dramatically improving the heat and wear resistance!



Excellent welding resistance due to low coefficient friction!

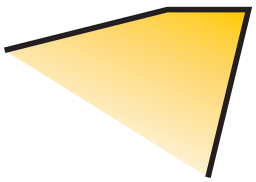
	Work Material	Grade	Coefficient of Friction Measured at 1112ºF		
			1055	304	Ti-6Al-4V
P	Carbon Steel, Alloy Steel	MP6100	.4		
M	Stainless Steel	MP7100		.5	
S	Titanium Alloy, Heat Resistant Alloy	MP9100			.3
	Conventional		.7	.7	.7

Insert Grades for a Wide Range of Materials



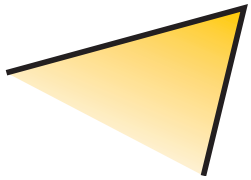
Wide Range of Inserts

M2 Breaker



Economical molded inserts.
Suitable for machining a wide range of work materials under various cutting conditions.

G1 Breaker



High accuracy peripherally ground inserts.
Large rake angle to provide high cutting edge sharpness.
An HTi10 insert is available with a polished rake face to prevent welding problems when machining aluminum alloys.

MULTI FUNCTIONAL MILLING

0°

Roughing

Including Flat faces

AQX

P M K N S H

- Air / coolant through.
- The center bottom cutting edge enables drilling and end milling without prepared hole.

Fig.1

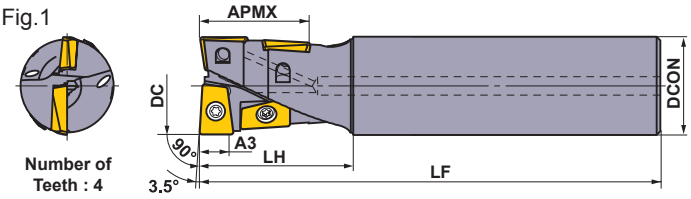


Fig.2

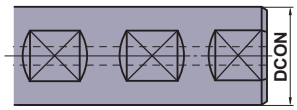
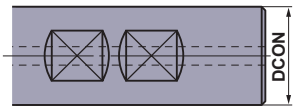


Fig.3



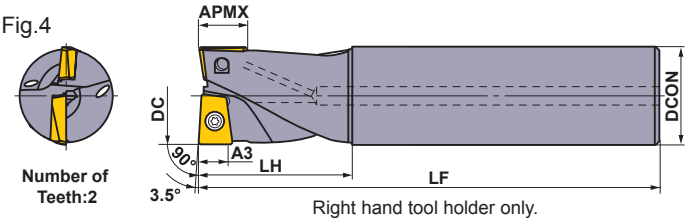
Right hand tool holder only.

Standard Edge Type KAPR :90°

Type	Order Number	Stock	Dimensions (inch)						Fig.	*2	① ②	
		R	DC	LF	DCON	LH	A3*1	APMX		Insert Screw	Wrench	Insert
Standard	AQXUR124WA12S	●	.750	4.125	.750	1.375	.219	.750	3	TS25	①TKY08F	QOG/MT0934R-○○
	AQXUR164WA16S	●	1.000	4.875	1.000	1.625	.281	1.000	2	TS32	②TKY08D	QOG/MT1443R-○○
	AQXUR204WA20S	●	1.250	5.250	1.250	2.000	.375	1.250	2	TS407	②TKY15D	QOG/MT1651R-○○
	AQXUR244WA20S	●	1.500	5.625	1.250	2.375	.438	1.500	2	TS5	②TKY25D	QOG/MT1959R-○○
Long	AQXUR124SA12L	●	.750	7.250	.750	2.375	.219	.750	1	TS25	①TKY08F	QOG/MT0934R-○○
	AQXUR134SA12L	●	.797	7.250	.750	1.375	.219	.750	1	TS25	①TKY08F	QOG/MT0934R-○○
	AQXUR164SA16L	●	1.000	8.500	1.000	3.000	.281	1.000	1	TS32	②TKY08D	QOG/MT1443R-○○
	AQXUR174SA16L	●	1.047	8.500	1.000	1.625	.281	1.000	1	TS32	②TKY08D	QOG/MT1443R-○○
	AQXUR204SA20L	●	1.250	9.000	1.250	3.500	.375	1.250	1	TS407	②TKY15D	QOG/MT1651R-○○
	AQXUR214SA20L	●	1.297	9.000	1.250	2.000	.375	1.250	1	TS407	②TKY15D	QOG/MT1651R-○○
	AQXUR244SA20L	●	1.500	9.500	1.250	2.375	.438	1.500	1	TS5	②TKY25D	QOG/MT1959R-○○

*2 Clamp Torque (lbf-in) : TS25=8.9, TS32=8.9, TS407=31, TS5=66

Fig.4



Right hand tool holder only.

Short Edge Type KAPR :90°

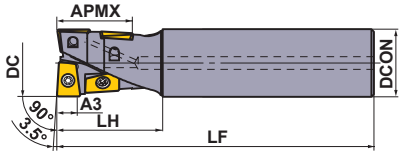
Type	Order Number	Stock	Dimensions (inch)						Fig.	*2	① ②	
		R	DC	LF	DCON	LH	A3*1	APMX		Insert Screw	Wrench	Insert
Standard	AQXUR102WA10S	●	.625	3.688	.625	1.125	.188	.281	3	TS2A	①TKY06F	QOG/MT0830R-○○
	AQXUR122WA12S	●	.750	4.125	.750	1.375	.219	.344	3	TS25	①TKY08F	QOG/MT0934R-○○
	AQXUR162WA16S	●	1.000	4.875	1.000	1.625	.281	.469	2	TS32	②TKY08D	QOG/MT1443R-○○
	AQXUR202WA20S	●	1.250	5.250	1.250	2.000	.375	.563	2	TS407	②TKY15D	QOG/MT1651R-○○
	AQXUR242WA20S	●	1.500	5.625	1.250	2.375	.438	.688	2	TS55	②TKY25D	QOG/MT1959R-○○
Long	AQXUR102SA10L	●	.625	6.875	.625	2.000	.188	.281	4	TS2A	①TKY06F	QOG/MT0830R-○○
	AQXUR112SA10L	●	.672	6.875	.625	1.125	.188	.281	4	TS2A	①TKY06F	QOG/MT0830R-○○
	AQXUR122SA12L	●	.750	7.250	.750	2.375	.219	.344	4	TS25	①TKY08F	QOG/MT0934R-○○
	AQXUR132SA12L	●	.797	7.250	.750	1.375	.219	.344	4	TS25	①TKY08F	QOG/MT0934R-○○
	AQXUR162SA16L	●	1.000	8.500	1.000	3.000	.281	.469	4	TS32	②TKY08D	QOG/MT1443R-○○
	AQXUR172SA16L	●	1.047	8.500	1.000	1.625	.281	.469	4	TS32	②TKY08D	QOG/MT1443R-○○
	AQXUR202SA20L	●	1.250	9.000	1.250	3.500	.375	.563	4	TS407	②TKY15D	QOG/MT1651R-○○
	AQXUR212SA20L	●	1.297	9.000	1.250	2.000	.375	.563	4	TS407	②TKY15D	QOG/MT1651R-○○
	AQXUR242SA20L	●	1.500	9.500	1.250	2.375	.438	.688	4	TS55	②TKY25D	QOG/MT1959R-○○

(Note) When exceeding A3 depth of cut, reduce feed rates by 50%(Do not exceed APMX depth of cut). Reference page 10.
*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.
*2 Clamp Torque (lbf-in) : TS2A=5.3, TS25=8.9, TS33=8.9, TS407=31, TS5=66

● : Inventory maintained.

Multi-functional Indexable Insert End Mill

Number of Teeth : 4



Right hand tool holder only.

Metric Standard

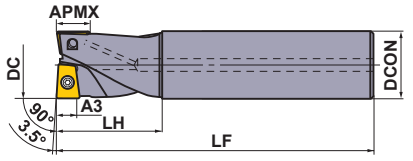
Standard Edge Type KAPR :90°

Type	Order Number	Stock	Coolant Thru *3	Dimensions (mm)						*2	①②③	
		R		DC	LF	DCON	LH	A3 *1	APMX	Insert Screw	Wrench	Insert
Standard	AQXR164SA16S	★	Y	16	120	16	30	4.5	17.6	TS2A	①TKY06F	QOG/MT0830R-G1/M2
	AQXR164SN16S	★	N	16	120	16	30	4.5	17.6	TS2A	①TKY06F	
	AQXR174SA16S	★	Y	17	120	16	30	4.5	17.6	TS2A	①TKY06F	
	AQXR174SN16S	★	N	17	120	16	30	4.5	17.6	TS2A	①TKY06F	
	AQXR204SA20S	★	Y	20	130	20	35	6	22	TS25	①TKY08F	QOG/MT1035R-G1/M2
	AQXR204SN20S	★	N	20	130	20	35	6	22	TS25	①TKY08F	
	AQXR214SA20S	★	Y	21	130	20	35	6	22	TS25	①TKY08F	
	AQXR214SN20S	★	N	21	130	20	35	6	22	TS25	①TKY08F	
	AQXR254SA25S	★	Y	25	140	25	40	7.5	27.5	TS33	②TKY08D	QOG/MT1342R-G1/M2
	AQXR254SN25S	★	N	25	140	25	40	7.5	27.5	TS33	②TKY08D	
	AQXR264SA25S	★	Y	26	140	25	40	7.5	27.5	TS33	②TKY08D	
	AQXR264SN25S	★	N	26	140	25	40	7.5	27.5	TS33	②TKY08D	
	AQXR324SA32S	★	Y	32	150	32	50	9.5	35.2	TS407	②TKY15D	QOG/MT1651R-G1/M2
	AQXR324SN32S	★	N	32	150	32	50	9.5	35.2	TS407	②TKY15D	
	AQXR334SA32S	★	Y	33	150	32	50	9.5	35.2	TS407	②TKY15D	
	AQXR334SN32S	★	N	33	150	32	50	9.5	35.2	TS407	②TKY15D	
	AQXR354SA32S	★	Y	35	150	32	50	11	40	TS407	②TKY15D	QOG/MT1856R-G1/M2
	AQXR354SN32S	★	N	35	150	32	50	11	40	TS407	②TKY15D	
	AQXR404SA32S	★	Y	40	160	32	60	12	44	TS55	②TKY25D	QOG/MT2062R-G1/M2
	AQXR404SN32S	★	N	40	160	32	60	12	44	TS55	②TKY25D	
	AQXR504SA42S	★	Y	50	170	42	70	15	55	TS6S	③TKY30T	QOG/MT2576R-G1/M2
	AQXR504SN42S	★	N	50	170	42	70	15	55	TS6S	③TKY30T	
Long	AQXR164SA16L	★	Y	16	175	16	50	4.5	17.6	TS2A	①TKY06F	QOG/MT0830R-G1/M2
	AQXR164SN16L	★	N	16	175	16	50	4.5	17.6	TS2A	①TKY06F	
	AQXR174SA16L	★	Y	17	175	16	30	4.5	17.6	TS2A	①TKY06F	
	AQXR174SN16L	★	N	17	175	16	30	4.5	17.6	TS2A	①TKY06F	
	AQXR204SA20L	★	Y	20	185	20	60	6	22	TS25	①TKY08F	QOG/MT1035R-G1/M2
	AQXR204SN20L	★	N	20	185	20	60	6	22	TS25	①TKY08F	
	AQXR214SA20L	★	Y	21	185	20	35	6	22	TS25	①TKY08F	
	AQXR214SN20L	★	N	21	185	20	35	6	22	TS25	①TKY08F	
	AQXR254SA25L	★	Y	25	220	25	75	7.5	27.5	TS33	②TKY08D	QOG/MT1342R-G1/M2
	AQXR254SN25L	★	N	25	220	25	75	7.5	27.5	TS33	②TKY08D	
	AQXR264SA25L	★	Y	26	220	25	40	7.5	27.5	TS33	②TKY08D	
	AQXR264SN25L	★	N	26	220	25	40	7.5	27.5	TS33	②TKY08D	
	AQXR324SA32L	★	Y	32	230	32	90	9.5	35.2	TS407	②TKY15D	QOG/MT1651R-G1/M2
	AQXR324SN32L	★	N	32	230	32	90	9.5	35.2	TS407	②TKY15D	
	AQXR334SA32L	★	Y	33	230	32	50	9.5	35.2	TS407	②TKY15D	
	AQXR334SN32L	★	N	33	230	32	50	9.5	35.2	TS407	②TKY15D	
	AQXR354SA32L	★	Y	35	230	32	50	11	40	TS407	②TKY15D	QOG/MT1856R-G1/M2
	AQXR354SN32L	★	N	35	230	32	50	11	40	TS407	②TKY15D	
	AQXR404SA32L	★	Y	40	240	32	60	12	44	TS55	②TKY25D	QOG/MT2062R-G1/M2
	AQXR404SN32L	★	N	40	240	32	60	12	44	TS55	②TKY25D	
	AQXR504SA42L	★	Y	50	250	42	70	15	55	TS6S	③TKY30T	QOG/MT2576R-G1/M2
	AQXR504SN42L	★	N	50	250	42	70	15	55	TS6S	③TKY30T	

*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.
*2 Clamp Torque (lbf-in) : TS2A=5.3, TS25=8.9, TS33=8.9, TS407=31,
TS55=66, TS6S=89
*3 Y=Yes, N=No

★ : Inventory maintained in Japan.

Number of Teeth : 2



Right hand tool holder only.

Metric Standard

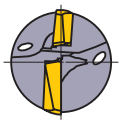
Short Edge Type

KAPR :90°

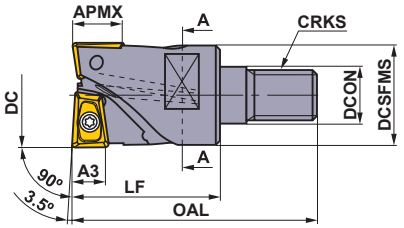
Type	Order Number	Stock	Coolant Thru *3	Dimensions (mm)						*2 Insert Screw	①②③ Wrench	Insert
		R		DC	LF	DCON	LH	A3 *1	APMX			
Standard	AQXR162SA16S	★	Y	16	120	16	30	4.5	7.4	TS2A	①TKY06F	QO○T0830R-○○
	AQXR162SN16S	★	N	16	120	16	30	4.5	7.4	TS2A	①TKY06F	
	AQXR172SA16S	★	Y	17	120	16	30	4.5	7.4	TS2A	①TKY06F	
	AQXR172SN16S	★	N	17	120	16	30	4.5	7.4	TS2A	①TKY06F	
	AQXR202SA20S	★	Y	20	130	20	35	6	9.2	TS25	①TKY08F	QO○T1035R-○○
	AQXR202SN20S	★	N	20	130	20	35	6	9.2	TS25	①TKY08F	
	AQXR212SA20S	★	Y	21	130	20	35	6	9.2	TS25	①TKY08F	
	AQXR212SN20S	★	N	21	130	20	35	6	9.2	TS25	①TKY08F	
	AQXR252SA25S	★	Y	25	140	25	40	7.5	11.5	TS33	②TKY08D	QO○T1342R-○○
	AQXR252SN25S	★	N	25	140	25	40	7.5	11.5	TS33	②TKY08D	
	AQXR262SA25S	★	Y	26	140	25	40	7.5	11.5	TS33	②TKY08D	
	AQXR262SN25S	★	N	26	140	25	40	7.5	11.5	TS33	②TKY08D	
	AQXR322SA32S	★	Y	32	150	32	50	9.5	14.5	TS407	②TKY15D	QO○T1651R-○○
	AQXR322SN32S	★	N	32	150	32	50	9.5	14.5	TS407	②TKY15D	
	AQXR332SA32S	★	Y	33	150	32	50	9.5	14.5	TS407	②TKY15D	
	AQXR332SN32S	★	N	33	150	32	50	9.5	14.5	TS407	②TKY15D	
	AQXR352SA32S	★	Y	35	150	32	50	11	16	TS407	②TKY15D	QO○T1856R-○○
	AQXR352SN32S	★	N	35	150	32	50	11	16	TS407	②TKY15D	
	AQXR402SA32S	★	Y	40	160	32	60	12	18	TS55	②TKY25D	QO○T2062R-○○
	AQXR402SN32S	★	N	40	160	32	60	12	18	TS55	②TKY25D	
	AQXR502SA42S	★	Y	50	170	42	70	15	23	TS6S	③TKY30T	QO○T2576R-○○
	AQXR502SN42S	★	N	50	170	42	70	15	23	TS6S	③TKY30T	
Long	AQXR162SA16L	★	Y	16	175	16	50	4.5	7.4	TS2A	①TKY06F	QO○T0830R-○○
	AQXR162SN16L	★	N	16	175	16	50	4.5	7.4	TS2A	①TKY06F	
	AQXR172SA16L	★	Y	17	175	16	30	4.5	7.4	TS2A	①TKY06F	
	AQXR172SN16L	★	N	17	175	16	30	4.5	7.4	TS2A	①TKY06F	
	AQXR202SA20L	★	Y	20	185	20	60	6	9.2	TS25	①TKY08F	QO○T1035R-○○
	AQXR202SN20L	★	N	20	185	20	60	6	9.2	TS25	①TKY08F	
	AQXR212SA20L	★	Y	21	185	20	35	6	9.2	TS25	①TKY08F	
	AQXR212SN20L	★	N	21	185	20	35	6	9.2	TS25	①TKY08F	
	AQXR252SA25L	★	Y	25	220	25	75	7.5	11.5	TS33	②TKY08D	QO○T1342R-○○
	AQXR252SN25L	★	N	25	220	25	75	7.5	11.5	TS33	②TKY08D	
	AQXR262SA25L	★	Y	26	220	25	40	7.5	11.5	TS33	②TKY08D	
	AQXR262SN25L	★	N	26	220	25	40	7.5	11.5	TS33	②TKY08D	
	AQXR322SA32L	★	Y	32	230	32	90	9.5	14.5	TS407	②TKY15D	QO○T1651R-○○
	AQXR322SN32L	★	N	32	230	32	90	9.5	14.5	TS407	②TKY15D	
	AQXR332SA32L	★	Y	33	230	32	50	9.5	14.5	TS407	②TKY15D	
	AQXR332SN32L	★	N	33	230	32	50	9.5	14.5	TS407	②TKY15D	
	AQXR352SA32L	★	Y	35	230	32	50	11	16	TS407	②TKY15D	QO○T1856R-○○
	AQXR352SN32L	★	N	35	230	32	50	11	16	TS407	②TKY15D	
	AQXR402SA32L	★	Y	40	240	32	60	12	18	TS55	②TKY25D	QO○T2062R-○○
	AQXR402SN32L	★	N	40	240	32	60	12	18	TS55	②TKY25D	
	AQXR502SA42L	★	Y	50	250	42	70	15	23	TS6S	③TKY30T	QO○T2576R-○○
	AQXR502SN42L	★	N	50	250	42	70	15	23	TS6S	③TKY30T	

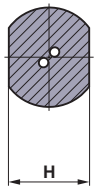
*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.
*2 Clamp Torque (lbf-in) : TS2A=5.3, TS25=8.9, TS33=8.9, TS407=31, TS55=66, TS6S=89
*3 Y=Yes, N=No

Multi-functional Indexable Insert End Mill



Number of Teeth : 2





Section **A-A**

Metric Standard

Right hand tool holder only.

Screw-in Type

KAPR :90°

Order Number	Stock	Coolant Thru *4	Dimensions (mm)									*2	① ②	
	R		DC	DCON	DCSFMS	OAL	LF	H	CRKS *3	A3 *1	APMX	Insert Screw	Wrench	Insert
AQXR162M08A30	★	Y	16	8.5	14.7	48	30	10	M8	4.5	7.4	TS2A	①TKY06F	QO○T0830R-○○
AQXR172M08A30	★	Y	17	8.5	14.5	48	30	10	M8	4.5	7.4	TS2A	①TKY06F	
AQXR202M10A30	★	Y	20	10.5	18.6	49	30	14	M10	6	9.2	TS25	①TKY08F	QO○T1035R-○○
AQXR212M10A30	★	Y	21	10.5	18.5	49	30	14	M10	6	9.2	TS25	①TKY08F	
AQXR252M12A35	★	Y	25	12.5	23.5	57	35	19	M12	7.5	11.5	TS33	②TKY08D	QO○T1342R-○○
AQXR262M12A35	★	Y	26	12.5	23.5	57	35	19	M12	7.5	11.5	TS33	②TKY08D	
AQXR322M16A40	★	Y	32	17	28.5	63	40	24	M16	9.5	14.5	TS407	②TKY15D	QO○T1651R-○○
AQXR332M16A40	★	Y	33	17	28.5	63	40	24	M16	9.5	14.5	TS407	②TKY15D	
AQXR352M16A40	★	Y	35	17	28.5	63	40	24	M16	11	16	TS407	②TKY15D	QO○T1856R-○○
AQXR402M16A45	★	Y	40	17	28.5	68	45	24	M16	12	18	TS55	②TKY25D	QO○T2062R-○○

*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.
*2 Clamp Torque (lbf-in) : TS2A=5.3, TS25=8.9, TS33=8.9, TS407=31, TS55=66
*3 Clamp Torque of the Head (lbf-ft) : M8=17.1, M10=33.8, M12=59.2, M16=66.7
*4 Y=Yes

● : Inventory maintained. ★ : Inventory maintained in Japan.

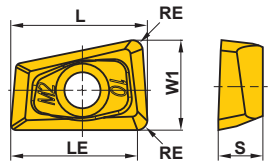
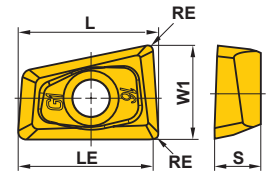
Inserts

(inch)

Work Material		
	P	Steel
	M	Stainless Steel
	K	Cast Iron
	N	Non-ferrous Metal
	S	Heat-resistant Alloy, Titanium Alloy
	H	Hardened Materials

Cutting Conditions (Guide):
●: Stable Cutting ◐: General Cutting ✱: Unstable Cutting

Honing:
E: Round F: Sharp

Shape	Order Number	DC	Class	Honing	Coated							Carbide			L	LE	W1	S	RE	Geometry
					MP6120	MP6130	MP7130	MP7140	MP9120	VP15TF	VP30RT	HTi10									
	**QOMT0830R-M2**	.625, .672	M	E	●	●	●	●	●	●	●				.350	.291	.220	.120	.031	
	QOMT0934R-M2	.750, .797	M	E	●	●	●	●	●	●	●				.401	.342	.264	.134	.031	
	QOMT1443R-M2	1.000, 1.047	M	E	●	●	●	●	●	●	●				.528	.469	.350	.169	.031	
	QOMT1651R-M2	1.250, 1.297	M	E	●	●	●	●	●	●	●				.650	.571	.433	.200	.031	
	QOMT1959R-M2	1.500	M	E	●	●	●	●	●	●	●				.768	.709	.512	.232	.031	
	**QOGT0830R-G1**	.625, .672	G	E*	●				●	★		●			.350	.291	.220	.120	.016	
	QOGT0934R-G1	.750, .797	G	E*	●				●			●			.401	.342	.264	.134	.016	
	QOGT1443R-G1	1.000, 1.047	G	E*	●				●			●			.528	.469	.350	.169	.016	
	QOGT1651R-G1	1.250, 1.297	G	E*	●				●	★		●			.650	.571	.433	.200	.016	
	QOGT1959R-G1	1.500	G	E*	●				●			●			.768	.709	.512	.232	.016	

* HTi10 insert honing is "F" type.

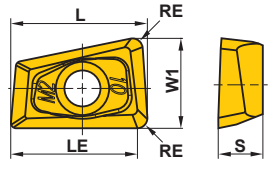
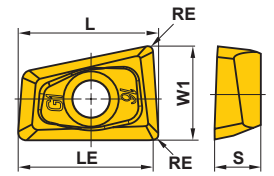
For Metric Standard

(mm)

Work Material		
	P	Steel
	M	Stainless Steel
	K	Cast Iron
	N	Non-ferrous Metal
	S	Heat-resistant Alloy, Titanium Alloy
	H	Hardened Materials

Cutting Conditions (Guide):
●: Stable Cutting ◐: General Cutting ✱: Unstable Cutting

Honing:
E: Round F: Sharp

Shape	Order Number	DC	Class	Honing	Coated							Carbide			L	LE	W1	S	RE	Geometry
					MP6120	MP6130	MP7130	MP7140	MP9120	VP15TF	VP30RT	HTi10									
	**QOMT0830R-M2**	ϕ16,17	M	E	●	●	●	●	●	●	●				8.4	7.4	5.5	3	0.8	
	QOMT1035R-M2	ϕ20,21	M	E	★	★	★	★	★	★	★				10.6	9.2	7	3.5	0.8	
	QOMT1342R-M2	ϕ25,26	M	E	★	★	★	★	★	★	★				13.1	11.5	8.7	4.2	0.8	
	QOMT1651R-M2	ϕ32,33	M	E	●	●	●	●	●	●	●				16.5	14.5	11	5.1	0.8	
	QOMT1856R-M2	ϕ35	M	E	★	★	★	★	★	★	★				18	16	12	5.6	0.8	
	QOMT2062R-M2	ϕ40	M	E	★	★	★	★	★	★	★				20.4	18	13.6	6.2	0.8	
	QOMT2576R-M2	ϕ50	M	E	★	★	★	★	★	★	★				25.8	23	17.2	7.6	0.8	
	**QOGT0830R-G1**	ϕ16,17	G	E*	●				●	★		●			8.4	7.4	5.5	3	0.4	
	QOGT1035R-G1	ϕ20,21	G	E*	★				★	★		★			10.6	9.2	7	3.5	0.4	
	QOGT1342R-G1	ϕ25,26	G	E*	★				★	★		★			13.1	11.5	8.7	4.2	0.4	
	QOGT1651R-G1	ϕ32,33	G	E*	●				●	★		●			16.5	14.5	11	5.1	0.4	
	QOGT1856R-G1	ϕ35	G	E*	★				★	★		★			18	16	12	5.6	0.4	
	QOGT2062R-G1	ϕ40	G	E*	★				★	★		★			20.4	18	13.6	6.2	0.4	
	QOGT2576R-G1	ϕ50	G	E*	★				★	★		★			25.8	23	17.2	7.6	0.4	

* HTi10 insert honing is "F" type.

Recommended Cutting Conditions

Cutting Speed

(inch)

	Work Material	No.	Hardness	Breaker	Cutting Speed for Different Grades **vc** (SFM)		
P					**MP6120**	**VP15TF**	**MP6130**
	Mild Steel	1	≤180HB	**M2**	655 (560—785)	590 (490—720)	525 (425—655)
	Carbon Steel Alloy Steel	2	180—350HB	**M2**	590 (460—720)	525 (395—655)	460 (330—590)
M					**MP7130**	**MP7140**	**VP30RT (VP15TF)**
	Austenitic Stainless Steel	1	≤200HB	**M2**	560 (395—655)	525 (330—590)	490 (395—590)
	Austenitic Stainless Steel	2	>200HB	**M2**			
	Ferritic and Martensitic Stainless Steel	3	≤200HB	**M2**			
	Ferritic and Martensitic Stainless Steel	4	>200HB	**M2**			
K					**VP15TF**		
	Gray Cast Iron	1	≤350MPa	**M2**	590 (490—720)	—	—
	Ductile Cast Iron	2	≤450MPa	**M2**	590 (490—720)	—	—
N					**HTi10**		
	Aluminum Alloy	1	Si<5%	**G1**	1640 (655—2625)	—	—
	Aluminum Alloy	2	5%≤Si≤10%	**G1**	330 (165—985)	—	—
	Aluminum Alloy	3	Si>5%	**G1**	330 (165—985)	—	—
S					**MP9120**		
	Titanium Alloy	1	—	**M2**	165 (100—230)	—	—
H					**VP15TF**		
	Hardened Steel	1	40—55HRC	**M2**	260 (165—395)	—	—

* Wet cutting is recommended for Titanium alloy.

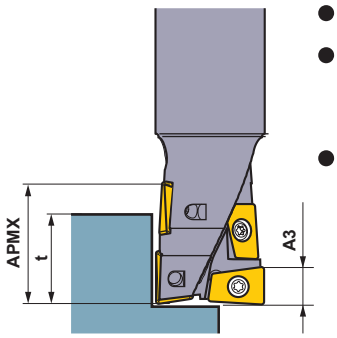
Cutting Conditions for Shoulder Milling

(inch)

	Work Material	No.	Hardness	ϕ.625", .672" ϕ16mm , 17mm ap	ae	f (IPR)	ϕ.750", .797" ϕ20mm , 21mm ap	ae	f (IPR)	ϕ1.000", 1.047" ϕ25mm , 26mm ap	ae	f (IPR)
P	Mild Steel	1	≤180HB	≤.177	≤.315	.010	≤.236	≤ .394	.012	≤.295	≤ .492	.014
				.177—.472	≤.197	.006	.236—.551	≤ .276	.010	.295— .669	≤ .315	.011
				.472—.669	≤.118	.004	.551—.866	≤ .157	.007	.669—1.063	≤ .197	.008
	Carbon Steel Alloy Steel	2	180—350HB	≤.177	≤.315	.008	≤.236	≤ .394	.010	≤.295	≤ .492	.012
				.177—.472	≤.157	.006	.236—.551	≤ .236	.008	.295— .669	≤ .276	.010
				.472—.669	≤.079	.003	.551—.866	≤ .118	.006	.669—1.063	≤ .157	.007
M	Stainless Steel	1,2,3,4	≤270HB	≤.177	≤.315	.008	≤.236	≤ .394	.010	≤.295	≤ .492	.012
				.177—.472	≤.157	.006	.236—.551	≤ .236	.008	.295— .669	≤ .276	.010
				.472—.669	≤.079	.003	.551—.866	≤ .118	.006	.669—1.063	≤ .157	.007
K	Cast Iron	1,2	≤350MPa	≤.177	≤.315	.010	≤.236	≤ .394	.012	≤.295	≤ .492	.014
				.177—.472	≤.197	.006	.236—.551	≤ .276	.010	.295— .669	≤ .315	.011
				.472—.669	≤.118	.004	.551—.866	≤ .157	.007	.669—1.063	≤ .197	.008
N	Aluminum Alloy	1,2,3	—	≤.177	≤.433	.012	≤.236	≤ .551	.014	≤.295	≤ .492	.016
				.177—.472	≤.315	.008	.236—.551	≤ .394	.012	.295— .669	≤ .276	.013
				.472—.669	≤.197	.006	.551—.866	≤ .236	.009	.669—1.063	≤ .157	.010
S	Titanium Alloy	1	—	≤.177	≤.315	.006	≤.236	≤ .394	.007	≤.295	≤ .689	.008
				.177—.472	≤.157	.004	.236—.551	≤ .236	.006	.295— .669	≤ .492	.007
				.472—.669	≤.079	.002	.551—.866	≤ .118	.004	.669—1.063	≤ .295	.005
H	Hardened Steel	1	40—55HRC	≤.177	≤.197	.006	≤.236	≤ .236	.008	≤.295	≤ .276	.009
				.177—.472	≤.118	.004	.236—.551	≤ .157	.006	.295— .669	≤ .157	.007
				.472—.669	≤.039	.002	.551—.866	≤ .079	.005	.669—1.063	≤ .079	.006

	Work Material	No.	Hardness	ϕ1.250", 1.297" ϕ32mm , 33mm ap	ae	f (IPR)	ϕ1.500" ϕ40mm ap	ae	f (IPR)
P	Mild Steel	1	≤180HB	≤ .374	≤.630	.016	≤ .472	≤.787	.020
				.374— .866	≤.433	.013	.472—1.102	≤.512	.016
				.866—1.378	≤.236	.010	1.102—1.732	≤.276	.012
	Carbon Steel Alloy Steel	2	180—350HB	≤ .374	≤.630	.014	≤ .472	≤.787	.016
				.374— .866	≤.394	.011	.472—1.102	≤.472	.013
				.866—1.378	≤.197	.008	1.102—1.732	≤.236	.010
M	Stainless Steel	1,2,3,4	≤270HB	≤ .374	≤.630	.014	≤ .472	≤.787	.016
				.374— .866	≤.394	.011	.472—1.102	≤.472	.013
				.866—1.378	≤.197	.008	1.102—1.732	≤.236	.010
K	Cast Iron	1,2	≤350MPa	≤ .374	≤.630	.016	≤ .472	≤.787	.020
				.374— .866	≤.433	.013	.472—1.102	≤.512	.016
				.866—1.378	≤.236	.010	1.102—1.732	≤.276	.012
N	Aluminum Alloy	1,2,3	—	≤ .374	≤.630	.018	≤ .472	≤.787	.022
				.374— .866	≤.394	.015	.472—1.102	≤.472	.018
				.866—1.378	≤.197	.012	1.102—1.732	≤.236	.014
S	Titanium Alloy	1	—	≤ .374	≤.906	.010	≤ .472	≤1.102	.011
				.374— .866	≤.630	.008	.472—1.102	≤.787	.009
				.866—1.378	≤.394	.006	1.102—1.732	≤.472	.007
H	Hardened Steel	1	40—55HRC	≤ .374	≤.315	.010	≤ .472	≤.394	.012
				.374— .866	≤.197	.008	.472—1.102	≤.236	.009
				.866—1.378	≤.079	.006	1.102—1.732	≤.079	.007

(Note 1) Please pay special attention on the depth of cut when using the short edge type.
(Note 2) When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.
(Note 3) For more information on "No.", please refer to page 11 for cutting speed.

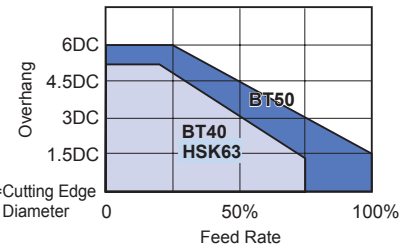


∗Figures for A3 and APMX are shown in the table of holder standard.

- A3 is the depth of cut for the full dual blade portion at the end of the cutting edge.
- Beyond the range of A3 where overlapping occurs, there is an area where the cutting edge becomes single bladed, not forming full dual blade configuration.
  As such, please pay special attention to the relationship between depth of cut and feed.
- In general, the edge at the border of cut tends to suffer from damages. At large depth of cut operations, applying the following depth of cut (**t**), at which the edge is full dual bladed at the border of cut, is recommended to prevent damage to the cutting edge.

(inch)

Tool Diameter	Recommended Depth of Cut **t**
ϕ.625, .672	.472—.551
ϕ.750, .797	.551—.669
ϕ1.000, 1.047	.669—.866
ϕ1.250, 1.297	.866—1.102
ϕ1.500	1.102—1.378



- Chatter vibration and other problems tend to occur at operations where overhang length is large and/or machine rigidity is low, resulting in unstable machining.
- Please reduce feed accordingly, using the above chart as a guideline.

Cutting Conditions for Slotting

(inch)

Work Material		No.	Hardness	ϕ.625", .672" ϕ16mm , 17mm		ϕ.750", .797" ϕ20mm , 21mm		ϕ1.000", 1.047" ϕ25mm , 26mm	
				ap	f (IPR)	ap	f (IPR)	ap	f (IPR)
P	Mild Steel	1	≤180HB	≤.177	.006	≤.236	.007	≤ .295	.008
				.177—.472	.004	.236—.551	.006	.295— .669	.006
				.472—.669	.003	.551—.866	.004	.669—1.063	.005
	Carbon Steel Alloy Steel	2	180—350HB	≤.177	.006	≤.236	.006	≤ .295	.007
				.177—.472	.004	.236—.551	.005	.295— .669	.006
				.472—.669	.002	.551—.866	.004	.669—1.063	.004
M	Stainless Steel	1,2,3,4	≤270HB	≤.177	.006	≤.236	.006	≤ .295	.007
				.177—.472	.004	.236—.551	.005	.295— .669	.006
				.472—.669	.002	.551—.866	.004	.669—1.063	.004
K	Cast Iron	1,2	≤350MPa	≤.177	.006	≤.236	.007	≤ .295	.008
				.177—.472	.004	.236—.551	.006	.295— .669	.006
				.472—.669	.003	.551—.866	.004	.669—1.063	.005
N	Aluminum Alloy	1,2,3	—	≤.177	.007	≤.236	.008	≤ .295	.009
				.177—.472	.005	.236—.551	.006	.295— .669	.007
				.472—.669	.004	.551—.866	.005	.669—1.063	.006
S	Titanium Alloy	1	—	≤.177	.004	≤.236	.005	≤ .295	.006
				.177—.472	.002	.236—.551	.003	.295— .669	.004
				.472—.669	.001	.551—.866	.002	.669—1.063	.003
H	Hardened Steel	1	40—55HRC	≤.177	.004	≤.236	.005	≤ .295	.006
				.177—.472	.003	.236—.551	.004	.295— .669	.005

Work Material		No.	Hardness	ϕ1.250", 1.297" ϕ32mm,33mm		ϕ1.500" ϕ40mm	
				ap	f (IPR)	ap	f (IPR)
P	Mild Steel	1	≤180HB	≤ .374	.010	≤ .472	.012
				.374— .866	.008	.472—1.102	.010
				.866—1.378	.006	1.102—1.732	.007
	Carbon Steel Alloy Steel	2	180—350HB	≤ .374	.008	≤ .472	.010
				.374— .866	.006	.472—1.102	.008
				.866—1.378	.005	1.102—1.732	.006
M	Stainless Steel	1,2,3,4	≤270HB	≤ .374	.008	≤ .472	.010
				.374— .866	.006	.472—1.102	.008
				.866—1.378	.005	1.102—1.732	.006
K	Cast Iron	1,2	≤350MPa	≤ .374	.010	≤ .472	.012
				.374— .866	.008	.472—1.102	.010
				.866—1.378	.006	1.102—1.732	.007
N	Aluminum Alloy	1,2,3	—	≤ .374	.011	≤ .472	.013
				.374— .866	.009	.472—1.102	.011
				.866—1.378	.006	1.102—1.732	.008
S	Titanium Alloy	1	—	≤ .374	.007	≤ .472	.009
				.374— .866	.005	.472—1.102	.008
				.866—1.378	.004	1.102—1.732	.006
H	Hardened Steel	1	40—55HRC	≤ .374	.006	≤ .472	.007
				.374— .866	.005	.472—1.102	.006

(Note 1) Please pay special attention on the depth of cut when using the short edge type.
(Note 2) When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.
(Note 3) For more information on "No.", please refer to page 11 for cutting speed.

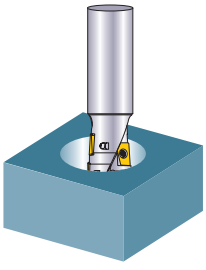
For Helical Cutting

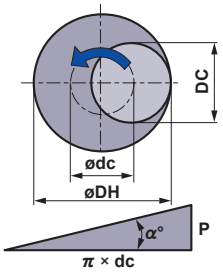
(inch)

	Work Material	No.	Hardness	ϕ.625", .672" ϕ16mm , 17mm				ϕ.750", .797" ϕ20mm , 21mm				ϕ1.000", 1.047" ϕ25mm , 26mm			
				DH	APMX	f (IPR)	P (inch/pass)	DH	APMX	f (IPR)	P (inch/pass)	DH	APMX	f (IPR)	P (inch/pass)
P	Mild Steel	1	≤180HB	.787	.315	.006	.017	.945	.394	.007	.017	1.181	.492	.008	.022
				.984	.472	.006	.039	1.181	.591	.006	.043	1.496	.748	.007	.056
				1.142	.630	.005	.056	1.417	.787	.006	.069	1.772	.984	.006	.087
	Carbon Steel Alloy Steel	2	180—350HB	.787	.315	.006	.013	.945	.394	.006	.013	1.181	.492	.007	.016
				.984	.472	.005	.029	1.181	.591	.006	.032	1.496	.748	.006	.042
				1.142	.630	.004	.042	1.417	.787	.005	.052	1.772	.984	.006	.065
M	Stainless Steel	1,2,3,4	≤270HB	.787	.118	.006	.009	.945	.157	.006	.009	1.181	.197	.007	.011
				.984	.197	.005	.019	1.181	.276	.006	.022	1.496	.354	.006	.028
				1.142	.315	.004	.028	1.417	.394	.005	.035	1.772	.492	.006	.043
K	Cast Iron	1,2	≤350MPa	.787	.394	.006	.022	.945	.551	.007	.022	1.181	.709	.008	.027
				.984	.512	.006	.048	1.181	.669	.006	.054	1.496	.827	.007	.070
				1.142	.630	.005	.070	1.417	.787	.006	.086	1.772	.984	.006	.108
N	Aluminum Alloy	1,2,3	—	.787	.394	.007	.017	.945	.551	.008	.017	1.181	.709	.009	.022
				.984	.512	.006	.039	1.181	.669	.007	.043	1.496	.827	.008	.056
				1.142	.630	.006	.056	1.417	.787	.006	.069	1.772	.984	.007	.087
S	Titanium Alloy	1	—	.787	.118	.004	.009	.945	.157	.004	.009	1.181	.197	.005	.011
				.984	.197	.003	.019	1.181	.276	.004	.022	1.496	.354	.004	.028
				1.142	.315	.003	.028	1.417	.394	.003	.035	1.772	.492	.004	.043
H	Hardened Steel	1	40—55HRC	.787	.118	.004	.009	.945	.157	.005	.009	1.181	.197	.006	.011
				.984	.197	.003	.019	1.181	.276	.004	.022	1.496	.354	.005	.028
				1.142	.315	.002	.028	1.417	.394	.003	.035	1.772	.492	.004	.043

	Work Material	No.	Hardness	ϕ1.250", 1.297" ϕ32mm , 33mm				ϕ1.500" ϕ40mm			
				DH	APMX	f (IPR)	P (inch/pass)	DH	APMX	f (IPR)	P (inch/pass)
P	Mild Steel	1	≤180HB	1.496	.630	.010	.026	1.890	.787	.012	.035
				1.890	.945	.009	.069	2.362	1.181	.010	.086
				2.283	1.260	.008	.112	2.835	1.575	.009	.138
	Carbon Steel Alloy Steel	2	180—350HB	1.496	.630	.008	.019	1.890	.787	.010	.026
				1.890	.945	.007	.052	2.362	1.181	.009	.065
				2.283	1.260	.006	.084	2.835	1.575	.008	.104
M	Stainless Steel	1,2,3,4	≤270HB	1.496	.236	.008	.013	1.890	.315	.010	.017
				1.890	.433	.007	.035	2.362	.551	.009	.043
				2.283	.630	.006	.056	2.835	.787	.008	.069
K	Cast Iron	1,2	≤350MPa	1.496	.866	.010	.032	1.890	1.102	.012	.043
				1.890	1.063	.009	.086	2.362	1.339	.010	.108
				2.283	1.260	.008	.141	2.835	1.575	.009	.173
N	Aluminum Alloy	1,2,3	—	1.496	.866	.011	.026	1.890	1.102	.013	.035
				1.890	1.063	.009	.069	2.362	1.339	.011	.086
				2.283	1.260	.009	.112	2.835	1.575	.009	.138
S	Titanium Alloy	1	—	1.496	.236	.006	.013	1.890	.315	.007	.017
				1.890	.433	.005	.035	2.362	.551	.006	.043
				2.283	.630	.004	.056	2.835	.787	.006	.069
H	Hardened Steel	1	40—55HRC	1.496	.236	.006	.013	1.890	.315	.007	.017
				1.890	.433	.006	.035	2.362	.551	.006	.043
				2.283	.630	.005	.056	2.835	.787	.006	.069

Helical grooving is strongly recommended for machining of tempered steel.
(Note 1) When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.
(Note 2) For more information on "No.", please refer to page 11 for cutting speed.





● How to calculate the theoretical center of the cutter path.

$$Ø\,dc = Ø\,DH - DC$$

Ø dc: Theoretical center of the tool; Ø DH: Desired hole diameter; DC: Cutting edge diameter

● Depth of cut for a pass.

$$P = \pi \times dc \times \tan\alpha°$$

* $\alpha° \leq 3°$

● Min. machined hole diameter at helical cutting : 1.2DC
Max. machined hole diameter at helical cutting : 1.8DC

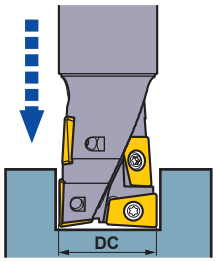
● For chip discharge, please always apply air blow.
(When aluminum cutting, please use coolant.)

● When helical cutting, it is recommended to reduce the feed rate by 40%.

● When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.

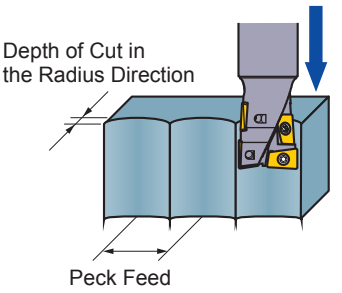
For Drilling and Plunging

● Drilling



- The recommended drilling depth is less than .5DC.
- Use step feed when drilling (.010－.020 inch) to ensure that the chips are effectively broken.
- Use internal or external cooling to ensure that the chips disposal is sufficiently achieved.
- The chips generated can discharge in any direction, so ensure that adequate safety precautions are taken.

● Plunging



- The feed for plunging is the same as the feed for drilling.
- No step feed necessary.
- Please refer to the following table for the depth of cut at plunging operations.

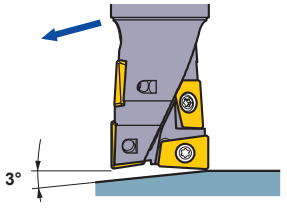
Depth of Cut in the Radius Direction	≤ .4DC
Peck Feed	≤ .5DC

(inch)

	Work Material	No.	Hardness	ϕ.625", .672" ϕ16mm , 17mm		ϕ.750", .797" ϕ20mm , 21mm		ϕ1.000", 1.047" ϕ25mm , 26mm		ϕ1.250", 1.297" ϕ32mm, 33mm, 35mm		ϕ1.500" ϕ40mm	
				f (IPR)	Step	f (IPR)	Step	f (IPR)	Step	f (IPR)	Step	f (IPR)	Step
P	Mild Steel	1	≤180HB	.001	.008	.002	.012	.002	.012	.002	.012	.002	.012
P	Carbon Steel Alloy Steel	2	180－350HB	.001	.008	.002	.012	.002	.012	.002	.012	.002	.012
M	Stainless Steel	1,2,3,4	≤270HB	.001	.006	.002	.010	.002	.010	.002	.010	.002	.010
K	Gray Cast Iron	1	≤350MPa	.002	.016	.002	.020	.002	.020	.003	.020	.003	.020
N	Aluminum Alloy	1,2,3	–	.002	.008	.002	.012	.002	.012	.003	.012	.003	.012
H	Hardened Steel	1	40－55HRC	.001	.006	.001	.010	.001	.010	.002	.010	.002	.010

Helical grooving is strongly recommended for machining of tempered steel.
(Note 1) When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.
(Note 2) For more information on "No.", please refer to page 11 for cutting speed.

For Ramping



- When machining steel the recommended ramping angle is 3°. If a ramping angle larger than 3° is used, then the chips may not be broken effectively resulting in chips wrapping around the tool.
- When ramping, it is recommended to reduce the feed rate by 40%.

Memo

Memo

Memo

Multi-functional Indexable Insert End Mill

AQX

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

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