MITSUBISHI

MITSUBISHI CARBIDE

TOOLS NEWS

2005.10.Update B021G

Multi-functional Indexable Insert Endmill

AQX

Additional cutting diameter Ø35

A multi-functional milling tool with a center cutting edge.

Ø35 now available!

World standard multi-function endmills

A single insert geometry for easy tool management.
(It's possible to use the inserts twice by rotating them.)

The double insert configuration strengthens the bottom cutting edge and increases tool life.

Miracle Coating Insert *VP15TF*

Excellent fracture and wear resistance. Ideal for milling a wide range of materials from alloy tool steel to cast iron

Multi-functional Indexable Insert Endmill

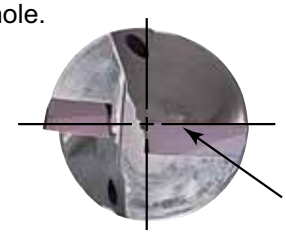
AQX

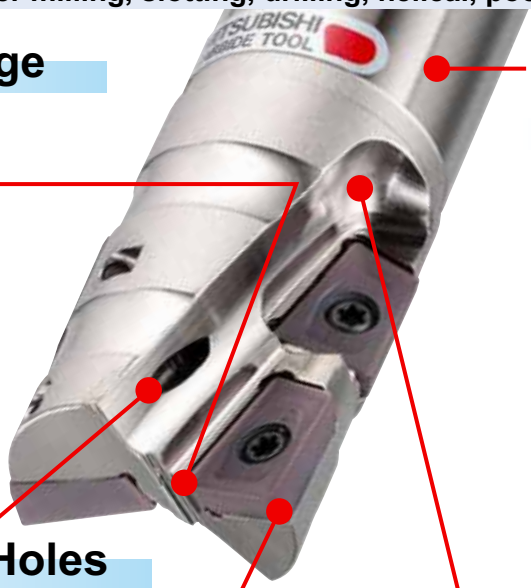
Features

Sizes available	**ø16, ø17, ø20, ø21, ø25, ø26, ø32, ø33, NEW ø35, ø40, ø50**
Application	**Shoulder milling, slotting, drilling, helical, pocketing, ramping, copying**

Center Cutting Edge

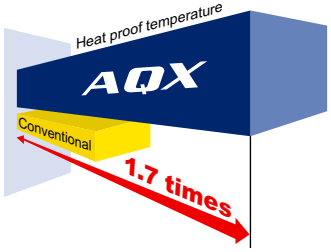
The ***AQX*** is designed with a center cutting edge, making it is possible to sink, helical mill and pocket without a pre-prepared hole.





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.



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.

Improved pocket shape for better chip discharge

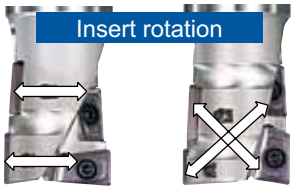
Improved pocket design maintains high body rigidity.

2 Insert Bottom Cutting Edge

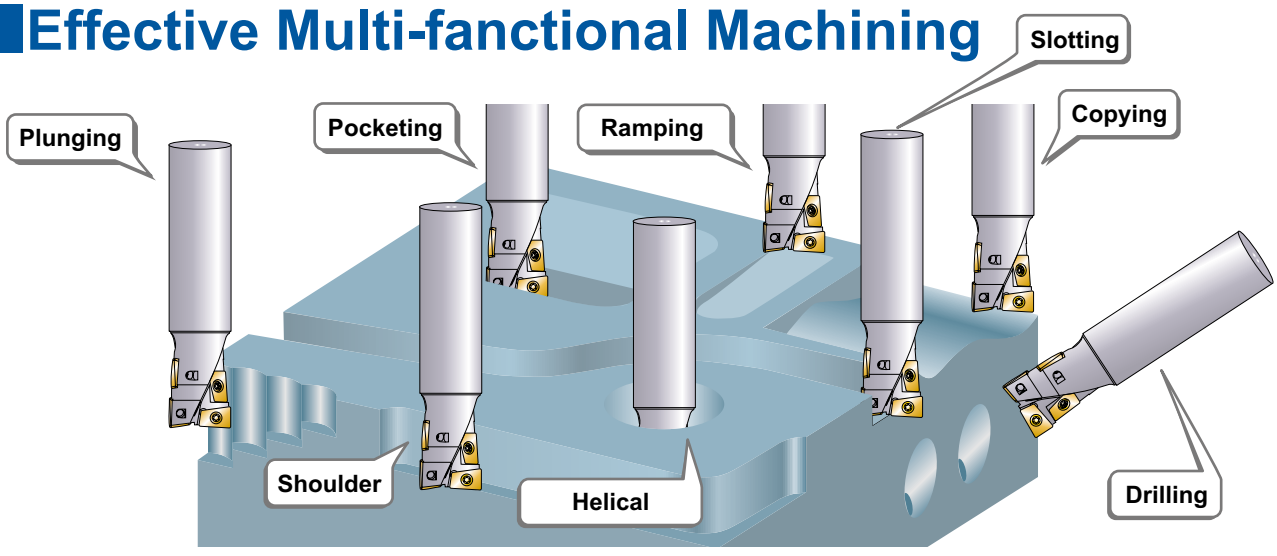
The lower cutting edge consists of 2 inserts, resulting in higher cutting edge strength and increased tool life.

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 all 4 corners.



Effective Multi-fanctional Machining



A large variety of products suitable for a wide application area

Sizes available
ø16-50 **88 Items LINE UP**

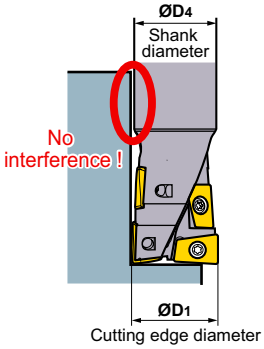
ø16 ●Standard & long shank type ●With & without through coolant holes ●Standard & short edge type ø50

Undercut Type

The cutting edge diameter has been designed so it is 1mm larger than the shank diameter, making it possible to machine vertical faces without any interference.

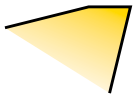
Order number	D_1	D_4
AQXR17○S○16○	17	16
AQXR21○S○20○	21	20
AQXR26○S○25○	26	25
AQXR33○S○32○	33	32
AQXR35○S○32○	35	32
AQXR40○S○32○	40	32
AQXR50○S○42○	50	42

For further details please refer to the Page 3.



Wide Range of Inserts

M2 breaker



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

G1 breaker

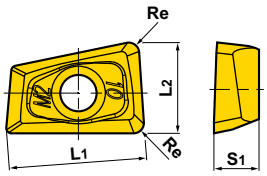
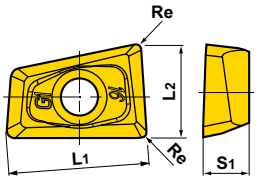
- High accuracy peripherally ground inserts.
- Large rake angle to provide high cutting edge sharpness.
- An HTi10 insert is available with a polished rake face to prevent welding problems when machining aluminium alloys.

Insert

Workpiece		
P	Carbon Steel	● ✤
M	Stainless Steel	◕ ✤
K	Cast Iron	✤
N	Non-ferrous Matal	◕
S	Heat-resistant Alloy,Titanium Alloy	◕
H	Hardened Materials	◕

Cutting Conditions(Guide) :
● : Stable Cutting ◕ : General Cutting ✤ : Unstable Cutting

Honing :
E : Round

Sharp	Order Number	Cutter Diameter	Class	Honing	Coating VP15TF	Coating VP30RT	Carbide HTi10	Dimensions (mm) L_1	L_2	S_1	Re	Geometry
	QOMT0830R-M2	ϕ16,17	M	E	●	●		8.4	5.5	3	0.8	
	1035R-M2	ϕ20,21	M	E	●	●		10.6	7	3.5	0.8	
	1342R-M2	ϕ25,26	M	E	●	●		13.1	8.7	4.2	0.8	
	1651R-M2	ϕ32,33	M	E	●	●		16.5	11	5.1	0.8	
	NEW 1856R-M2	ϕ35	M	E	●	●		18	12	5.6	0.8	
	2062R-M2	ϕ40	M	E	●	●		20.4	13.6	6.2	0.8	
	2576R-M2	ϕ50	M	E	●	●		25.8	17.2	7.6	0.8	
	QOGT0830R-G1	ϕ16,17	G	E	●		●	8.4	5.5	3	0.4	
	1035R-G1	ϕ20,21	G	E	●		●	10.6	7	3.5	0.4	
	1342R-G1	ϕ25,26	G	E	●		●	13.1	8.7	4.2	0.4	
	1651R-G1	ϕ32,33	G	E	●		●	16.5	11	5.1	0.4	
	NEW 1856R-G1	ϕ35	G	E	●		●	18	12	5.6	0.4	
	2062R-G1	ϕ40	G	E	●		●	20.4	13.6	6.2	0.4	
	2576R-G1	ϕ50	G	E	●		●	25.8	17.2	7.6	0.4	

● : Inventory maintained

MIRACLE® coated VP15TF

Miracle coated ***VP15TF*** displays high welding resistance making it suitable for a wide range of workpiece materials from mild and low carbon steels through to hardened steels.

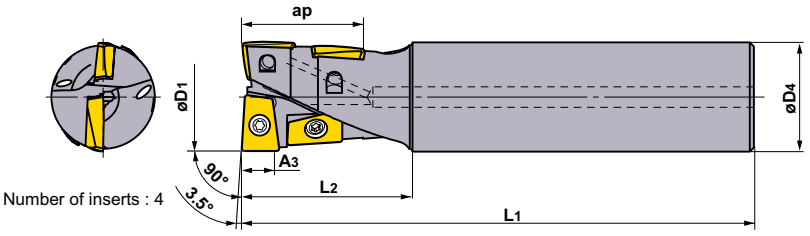
MIRACLE® coated VP30RT

A combination of a tough cemented carbide substrate and ***MIRACLE®*** coating provides excellent fracture resistance. Ideal for heavy interrupted cutting of stainless and alloy steels.

Multi-functional Indexable Insert Endmill

AQX

Standard Edge Type



Number of inserts : 4

Right hand tool holder only.

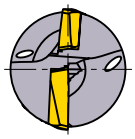
Type	Order Number	Stock	Coolant Hole	Dimensions (mm)						Clamp Screw	Wrench	Insert
		R		D1	L1	D4	L2	A3 *1	ap *2			
Standard	AQXR164SA16S	●	○	16	120	16	30	4.5	17.6	TS2A	①TKY06F	QOG/MT0830R-G1/M2
	164SN16S	●	–	16	120	16	30	4.5	17.6	TS2A	①TKY06F	
	174SA16S	●	○	17	120	16	30	4.5	17.6	TS2A	①TKY06F	
	174SN16S	●	–	17	120	20	30	4.5	17.6	TS2A	①TKY06F	
	204SA20S	●	○	20	130	20	35	6	22	TS25	①TKY08F	QOG/MT1035R-G1/M2
	204SN20S	●	–	20	130	20	35	6	22	TS25	①TKY08F	
	214SA20S	●	○	21	130	20	35	6	22	TS25	①TKY08F	
	214SN20S	●	–	21	130	20	35	6	22	TS25	①TKY08F	
	254SA25S	●	○	25	140	25	40	7.5	27	TS33	②TKY08D	QOG/MT1342R-G1/M2
	254SN25S	●	–	25	140	25	40	7.5	27	TS33	②TKY08D	
	264SA25S	●	○	26	140	25	40	7.5	27	TS33	②TKY08D	
	264SN25S	●	–	26	140	25	40	7.5	27	TS33	②TKY08D	
	324SA32S	●	○	32	150	32	50	9.5	35	TS407	②TKY15D	QOG/MT1651R-G1/M2
	324SN32S	●	–	32	150	32	50	9.5	35	TS407	②TKY15D	
	334SA32S	●	○	33	150	32	50	9.5	35	TS407	②TKY15D	
	334SN32S	●	–	33	150	32	50	9.5	35	TS407	②TKY15D	
	NEW 354SA32S	●	○	35	150	32	50	11	40	TS407	②TKY15D	QOG/MT1856R-G1/M2
	NEW 354SN32S	●	–	35	150	32	50	11	40	TS407	②TKY15D	
	404SA32S	●	○	40	160	32	60	12	44	TS55	②TKY25D	QOG/MT2062R-G1/M2
	404SN32S	●	–	40	160	32	60	12	44	TS55	②TKY25D	
	504SA42S	●	○	50	170	42	70	15	55	TS6S	③TKY30T	QOG/MT2576R-G1/M2
	504SN42S	●	–	50	170	42	70	15	55	TS6S	③TKY30T	
Long	AQXR164SA16L	●	○	16	175	16	50	4.5	17.6	TS2A	①TKY06F	QOG/MT0830R-G1/M2
	164SN16L	●	–	16	175	16	50	4.5	17.6	TS2A	①TKY06F	
	174SA16L	●	○	17	175	16	30	4.5	17.6	TS2A	①TKY06F	
	174SN16L	●	–	17	175	16	30	4.5	17.6	TS2A	①TKY06F	
	204SA20L	●	○	20	185	20	60	6	22	TS25	①TKY08F	QOG/MT1035R-G1/M2
	204SN20L	●	–	20	185	20	60	6	22	TS25	①TKY08F	
	214SA20L	●	○	21	185	20	35	6	22	TS25	①TKY08F	
	214SN20L	●	–	21	185	20	35	6	22	TS25	①TKY08F	
	254SA25L	●	○	25	220	25	75	7.5	27	TS33	②TKY08D	QOG/MT1342R-G1/M2
	254SN25L	●	–	25	220	25	75	7.5	27	TS33	②TKY08D	
	264SA25L	●	○	26	220	25	40	7.5	27	TS33	②TKY08D	
	264SN25L	●	–	26	220	25	40	7.5	27	TS33	②TKY08D	
	324SA32L	●	○	32	230	32	90	9.5	35	TS407	②TKY15D	QOG/MT1651R-G1/M2
	324SN32L	●	–	32	230	32	90	9.5	35	TS407	②TKY15D	
	334SA32L	●	○	33	230	32	50	9.5	35	TS407	②TKY15D	
	334SN32L	●	–	33	230	32	50	9.5	35	TS407	②TKY15D	
	NEW 354SA32L	●	○	35	230	32	50	11	40	TS407	②TKY15D	QOG/MT1856R-G1/M2
	NEW 354SN32L	●	–	35	230	32	50	11	40	TS407	②TKY15D	
	404SA32L	●	○	40	240	32	60	12	44	TS55	②TKY25D	QOG/MT2062R-G1/M2
	404SN32L	●	–	40	240	32	60	12	44	TS55	②TKY25D	
	504SA42L	●	○	50	250	42	70	15	55	TS6S	③TKY30T	QOG/MT2576R-G1/M2
	504SN42L	●	–	50	250	42	70	15	55	TS6S	③TKY30T	

*1 A3 : Max depth of cut to maintain the full two bottom insert contact with workpiece.

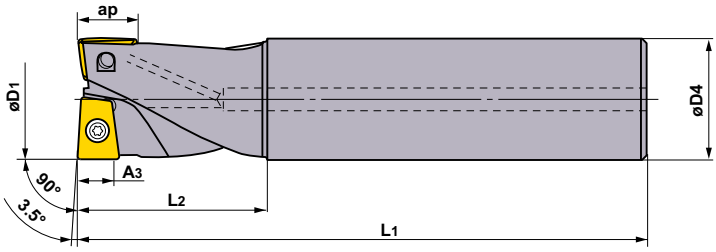
*2 ap : Maximum overall depth of cut.

● : Inventory maintained

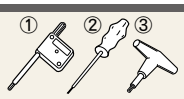
Short Edge Type



Number of inserts : 2



Right hand tool holder only.

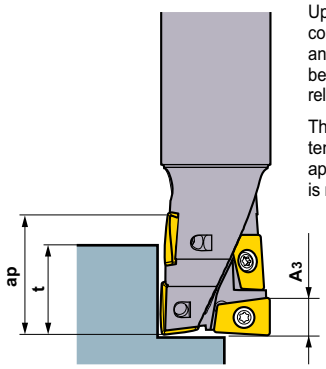
Type	Order Number	Stock	Coolant Hole	Dimensions (mm)								
		R		D1	L1	D4	L2	A3 *1	ap *2	Clamp Screw	Wrench	Insert
Standard	**AQXR162SA16S**	●	○	16	120	16	30	4.5	7.4	TS2A	①TKY06F	QOG/MT0830R-G1/M2
	162SN16S	●	–	16	120	16	30	4.5	7.4	TS2A	①TKY06F	
	172SA16S	●	○	17	120	16	30	4.5	7.4	TS2A	①TKY06F	
	172SN16S	●	–	17	120	16	30	4.5	7.4	TS2A	①TKY06F	
	202SA20S	●	○	20	130	20	35	6	9.2	TS25	①TKY08F	QOG/MT1035R-G1/M2
	202SN20S	●	–	20	130	20	35	6	9.2	TS25	①TKY08F	
	212SA20S	●	○	21	130	20	35	6	9.2	TS25	①TKY08F	
	212SN20S	●	–	21	130	20	35	6	9.2	TS25	①TKY08F	
	252SA25S	●	○	25	140	25	40	7.5	11.5	TS33	②TKY08D	QOG/MT1342R-G1/M2
	252SN25S	●	–	25	140	25	40	7.5	11.5	TS33	②TKY08D	
	262SA25S	●	○	26	140	25	40	7.5	11.5	TS33	②TKY08D	
	262SN25S	●	–	26	140	25	40	7.5	11.5	TS33	②TKY08D	
	322SA32S	●	○	32	150	32	50	9.5	14.5	TS407	②TKY15D	QOG/MT1651R-G1/M2
	322SN32S	●	–	32	150	32	50	9.5	14.5	TS407	②TKY15D	
	332SA32S	●	○	33	150	32	50	9.5	14.5	TS407	②TKY15D	
	332SN32S	●	–	33	150	32	50	9.5	14.5	TS407	②TKY15D	
	NEW **352SA32S**	●	○	35	150	32	50	11	16	TS407	②TKY15D	QOG/MT1856R-G1/M2
	NEW **352SN32S**	●	–	35	150	32	50	11	16	TS407	②TKY15D	
	402SA32S	●	○	40	160	32	60	12	18	TS55	②TKY25D	QOG/MT2062R-G1/M2
	402SN32S	●	–	40	160	32	60	12	18	TS55	②TKY25D	
	502SA42S	●	○	50	170	42	70	15	23	TS6S	③TKY30T	QOG/MT2576R-G1/M2
	502SN42S	●	–	50	170	42	70	15	23	TS6S	③TKY30T	
Long	**AQXR162SA16L**	●	○	16	175	16	50	4.5	7.4	TS2A	①TKY06F	QOG/MT0830R-G1/M2
	162SN16L	●	–	16	175	16	50	4.5	7.4	TS2A	①TKY06F	
	172SA16L	●	○	17	175	16	30	4.5	7.4	TS2A	①TKY06F	
	172SN16L	●	–	17	175	16	30	4.5	7.4	TS2A	①TKY06F	
	202SA20L	●	○	20	185	20	60	6	9.2	TS25	①TKY08F	QOG/MT1035R-G1/M2
	202SN20L	●	–	20	185	20	60	6	9.2	TS25	①TKY08F	
	212SA20L	●	○	21	185	20	35	6	9.2	TS25	①TKY08F	
	212SN20L	●	–	21	185	20	35	6	9.2	TS25	①TKY08F	
	252SA25L	●	○	25	220	25	75	7.5	11.5	TS33	②TKY08D	QOG/MT1342R-G1/M2
	252SN25L	●	–	25	220	25	75	7.5	11.5	TS33	②TKY08D	
	262SA25L	●	○	26	220	25	40	7.5	11.5	TS33	②TKY08D	
	262SN25L	●	–	26	220	25	40	7.5	11.5	TS33	②TKY08D	
	322SA32L	●	○	32	230	32	90	9.5	14.5	TS407	②TKY15D	QOG/MT1651R-G1/M2
	322SN32L	●	–	32	230	32	90	9.5	14.5	TS407	②TKY15D	
	332SA32L	●	○	33	230	32	50	9.5	14.5	TS407	②TKY15D	
	332SN32L	●	–	33	230	32	50	9.5	14.5	TS407	②TKY15D	
	NEW **352SA32L**	●	○	35	230	32	50	11	16	TS407	②TKY15D	QOG/MT1856R-G1/M2
	NEW **352SN32L**	●	–	35	230	32	50	11	16	TS407	②TKY15D	
	402SA32L	●	○	40	240	32	60	12	18	TS55	②TKY25D	QOG/MT2062R-G1/M2
	402SN32L	●	–	40	240	32	60	12	18	TS55	②TKY25D	
	502SA42L	●	○	50	250	42	70	15	23	TS6S	③TKY30T	QOG/MT2576R-G1/M2
	502SN42L	●	–	50	250	42	70	15	23	TS6S	③TKY30T	

*1 A3 : Max depth of cut to maintain the full two bottom insert contact with workpiece.

*2 ap : Maximum overall depth of cut.

AQX

Recommended Cutting Conditions

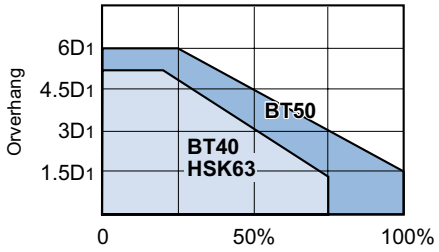


*Figures for A3 and ap are shown in the standard holders tables on the previous pages.

Up to A3 depth of cut, the two lower cutting edges maintain contact with the woprkpiece. Beyond the range of A3, there is an area where the cutting edge contact with the workpiece becomes single bladed. Please pay special attention to the relationship between the depth of cut and the feed in this area.

The insert in contact with the top edge of the workpiece tends to suffer from damage. At large depths of cut, applying depth of cut (t), where there are 2 inserts in contact is recommended to reduce wear and damage to the inserts.

Tool diameter	Recommended depth of cut t (mm)
ϕ16,17	12 – 14
ϕ20,21	14 – 17
ϕ25,26	17 – 22
ϕ32,33	22 – 28
ϕ35	25 – 32
ϕ40	28 – 35
ϕ50	35 – 45



*D1=Cutting edge diameter

Chatter, vibration and other operational problems tend to occur with a long tool overhang and/or low machine rigidity, resulting in unstable machining.

Please reduce the feed accordingly in these conditions, using the chart above as a guideline.

Cutting Conditions for Shoulder Milling

	Workpiece	Hardness	Grade	Cutting Speed (m/min)	ϕ16, 17			ϕ20, 21		
					Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)
P	Mild steel (JIS SS400, SCM440)	≤180HB	**VP15TF**	180 (150–220)	–4.5	–8	0.25	–6	–10	0.30
					4.5–12	–5	0.16	6–14	–7	0.25
					12–17	–3	0.10	14–22	–4	0.18
	Carbon Steel Alloy Steel (JIS S50C,SCM440)	180–350HB	**VP15TF**	160 (120–200)	–4.5	–8	0.20	–6	–10	0.25
					4.5–12	–4	0.14	6–14	–6	0.20
					12–17	–2	0.08	14–22	–3	0.16
M	Stainless Steel (JIS SUS304)	≤270HB	**VP30RT (VP15TF)**	150 (120–180)	–4.5	–8	0.20	–6	–10	0.25
					4.5–12	–4	0.14	6–14	–6	0.20
					12–17	–2	0.08	14–22	–3	0.16
K	Cast Iron (JIS FC300)	Tensile strength ≤450MPa	**VP15TF**	180 (150–220)	–4.5	–8	0.25	–6	–10	0.30
					4.5–12	–5	0.16	6–14	–7	0.25
					12–17	–3	0.10	14–22	–4	0.18
N	Aluminium Alloy	–	**HTi10** (G1 breaker)	500 (200–800)	–4.5	–11	0.30	–6	–14	0.35
					4.5–12	–8	0.21	6–14	–10	0.30
					12–17	–5	0.15	14–22	–6	0.23
H	Hardened Steel	40–55HRC	**VP15TF**	80 (50–120)	–4.5	–5	0.16	–6	–6	0.20
					4.5–12	–3	0.10	6–14	–4	0.16
					12–17	–1	0.06	14–22	–2	0.12

*1 Please pay special attention to the depth of cut when using the short edge type.
*2 When using the G1 breaker (VP15TF), reduce the feed rate by at least 20%.

Cutting Conditions for Slotting

	Workpiece	Hardness	Grade	Cutting Speed (m/min)	ϕ16, 17		ϕ20, 21	
					Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)
P	Mild steel (JIS SS400, SCM440)	≤180HB	**VP15TF**	180 (150–220)	–4.5	0.16	–6	0.18
					4.5–12	0.10	6–14	0.14
					12–17	0.07	14–22	0.10
	Carbon Steel Alloy Steel (JIS S50C,SCM440)	180–350HB	**VP15TF**	160 (120–200)	–4.5	0.14	–6	0.16
					4.5–12	0.09	6–14	0.12
					12–17	0.05	14–22	0.10
M	Stainless Steel (JIS SUS304)	≤270HB	**VP30RT (VP15TF)**	150 (120–180)	–4.5	0.14	–6	0.16
					4.5–12	0.09	6–14	0.12
					12–17	0.05	14–22	0.10
K	Cast Iron (JIS FC300)	Tensile strength ≤450MPa	**VP15TF**	180 (150–220)	–4.5	0.16	–6	0.18
					4.5–12	0.10	6–14	0.14
					12–17	0.07	14–22	0.10
N	Aluminium Alloy	–	**HTi10** (G1 breaker)	500 (200–800)	–4.5	0.18	–6	0.20
					4.5–12	0.12	6–14	0.16
					12–17	0.09	14–22	0.12
H	Hardened Steel	40–55HRC	**VP15TF**	80 (50–120)	–4.5	0.10	–6	0.12
					4.5–12	0.07	6–14	0.10

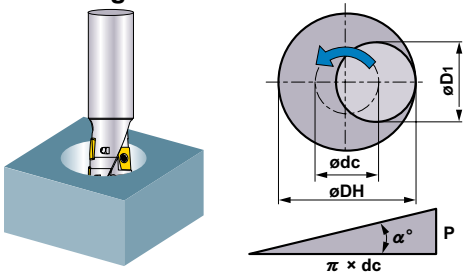
*1 Please pay special attention to the depth of cut when using the short edge type.
*2 When using the G1 breaker (VP15TF), reduce the feed rate by at least 20%.

	ϕ25, 26			ϕ32, 33			ϕ35			ϕ40			ϕ50		
	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Width of Cut (mm)	Feed (mm/rev)
	−7.5	−12.5	0.35	−9.5	−16	0.40	−11	−17.5	0.45	−12	−20	0.50	−15	−25	0.60
	7.5−17	−8	0.28	9.5−22	−11	0.32	11−25	−12	0.35	12−28	−13	0.40	15−35	−16	0.50
	17−27	−5	0.20	22−35	−6	0.25	25−40	−6.5	0.28	28−44	−7	0.30	35−55	−10	0.35
	−7.5	−12.5	0.30	−9.5	−16	0.35	−11	−17.5	0.37	−12	−20	0.40	−15	−25	0.50
	7.5−17	−7	0.25	9.5−22	−10	0.28	11−25	−11	0.30	12−28	−12	0.32	15−35	−14	0.40
	17−27	−4	0.18	22−35	−5	0.20	25−40	−5.5	0.22	28−44	−6	0.25	35−55	− 8	0.30
	−7.5	−12.5	0.30	−9.5	−16	0.35	−11	−17.5	0.37	−12	−20	0.40	−15	−25	0.50
	7.5−17	−7	0.25	9.5−22	−10	0.28	11−25	−12	0.30	12−28	−12	0.32	15−35	−14	0.40
	17−27	−4	0.18	22−35	−5	0.20	25−40	−6.5	0.22	28−44	−6	0.25	35−55	−8	0.30
	−7.5	−12.5	0.35	−9.5	−16	0.40	−11	−17.5	0.45	−12	−20	0.50	−15	−25	0.60
	7.5−17	−8	0.28	9.5−22	−11	0.32	11−25	−12	0.35	12−28	−13	0.40	15−35	−16	0.50
	17−27	−5	0.20	22−35	−6	0.25	25−40	−6.5	0.28	28−44	−7	0.30	35−55	−10	0.35
	−7.5	−17.5	0.40	−9.5	−23	0.45	−11	−24.5	0.50	−12	−28	0.55	−15	−35	0.65
	7.5−17	−12.5	0.33	9.5−22	−16	0.37	11−25	−17.5	0.40	12−28	−20	0.45	15−35	−25	0.55
	17−27	−7.5	0.25	22−35	−10	0.30	25−40	−10.5	0.32	28−44	−12	0.35	35−55	−15	0.40
	−7.5	−7	0.22	−9.5	−8	0.25	−11	−9	0.28	−12	−10	0.30	−15	−14	0.35
	7.5−17	−4	0.18	9.5−22	−5	0.20	11−25	−5.5	0.22	12−28	−6	0.24	15−35	−8	0.30
	17−27	−2	0.14	22−35	−2	0.16	25−40	−2	0.17	28−44	−2	0.18	35−55	−4	0.22

	ϕ25, 26		ϕ32, 33		ϕ35		ϕ40		ϕ50	
	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)	Depth of Cut (mm)	Feed (mm/rev)
	−7.5	0.20	−9.5	0.25	−11	0.27	−12	0.30	−15	0.35
	7.5−17	0.16	9.5−22	0.20	11−25	0.22	12−28	0.25	15−35	0.30
	17−27	0.12	22−35	0.14	25−40	0.16	28−44	0.18	35−55	0.22
	−7.5	0.18	−9.5	0.20	−11	0.22	−12	0.25	−15	0.30
	7.5−17	0.14	9.5−22	0.16	11−25	0.18	12−28	0.20	15−35	0.25
	17−27	0.10	22−35	0.12	25−40	0.13	28−44	0.14	35−55	0.16
	−7.5	0.18	−9.5	0.20	−11	0.22	−12	0.25	−15	0.30
	7.5−17	0.14	9.5−22	0.16	11−25	0.18	12−28	0.20	15−35	0.25
	17−27	0.10	22−35	0.12	25−40	0.13	28−44	0.14	35−55	0.16
	−7.5	0.20	−9.5	0.25	−11	0.27	−12	0.30	−15	0.35
	7.5−17	0.16	9.5−22	0.20	11−25	0.22	12−28	0.25	15−35	0.30
	17−27	0.12	22−35	0.14	25−40	0.16	28−44	0.18	35−55	0.22
	−7.5	0.22	−9.5	0.27	−11	0.30	−12	0.32	−15	0.37
	7.5−17	0.18	9.5−22	0.22	11−25	0.25	12−28	0.27	15−35	0.32
	17−27	0.14	22−35	0.16	25−40	0.18	28−44	0.20	35−55	0.25
	−7.5	0.14	−9.5	0.16	−11	0.17	−12	0.18	−15	0.22
	7.5−17	0.12	9.5−22	0.12	11−25	0.13	12−28	0.14	15−35	0.16

Recommended Cutting Conditions

Cutting Conditions for Helical Cutting



●How to derive a locus of the center of the tool.

$$\text{Ø dc} = \text{Ø DH} - \text{Ø D}_1$$

Ø dc: Locus of the center of the tool; Ø DH: Desired hole diameter; Ø D1: Cutting edge diameter

●Depth of cut for each pass.

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

*α°≤3°

●Min. machined hole diameter for helical cutting : $1.2D_1$
Max. machined hole diameter for helical cutting : $1.8D_1$

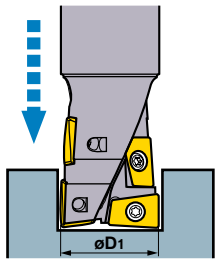
●For efficient chip discharge, always apply air blow.

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

	Workpiece	Hardness	Grade	Cutting Speed (m/min)	φ16, 17				φ20, 21				φ25, 26			
					Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)
P	Mild steel (JIS SS400 SCM440)	≤180HB	VP15TF	180 (150−220)	20	8	0.16	0.44	24	10	0.18	0.44	30	12.5	0.20	0.55
					25	12	0.14	0.99	30	15	0.16	1.10	38	19	0.18	1.43
					29	16	0.12	1.43	36	20	0.14	1.76	45	25	0.16	2.20
	Carbon Steel Alloy Steel (JIS S50C,SCM440)	180−350HB	VP15TF	160 (120−200)	20	8	0.14	0.33	24	10	0.16	0.33	30	12.5	0.18	0.41
					25	12	0.12	0.74	30	15	0.14	0.82	38	19	0.16	1.07
					29	16	0.10	1.07	36	20	0.12	1.32	45	25	0.14	1.65
M	Stainless Steel (JIS SUS304)	≤270HB	VP30RT (VP15TF)	150 (120−180)	20	3	0.14	0.22	24	4	0.16	0.22	30	5	0.18	0.27
					25	5	0.12	0.49	30	7	0.14	0.55	38	9	0.16	0.71
					29	8	0.10	0.71	36	10	0.12	0.88	45	12.5	0.14	1.10
K	Cast Iron (JIS FC300)	Tensile strength ≤450MPa	VP15TF	180 (150−220)	20	10	0.16	0.55	24	14	0.18	0.55	30	18	0.20	0.69
					25	13	0.14	1.23	30	17	0.16	1.37	38	21	0.18	1.78
					29	16	0.12	1.78	36	20	0.14	2.19	45	25	0.16	2.74
N	Aluminium Alloy	–	HTi10 (G1 breaker)	500 (200−800)	20	10	0.18	0.44	24	14	0.20	0.44	30	18	0.22	0.55
					25	13	0.16	0.99	30	17	0.18	1.10	38	21	0.20	1.43
					29	16	0.14	1.43	36	20	0.16	1.76	45	25	0.18	2.20
H	Hardened Steel	40−55HRC	VP15TF	80 (50−120)	20	3	0.10	0.22	24	4	0.12	0.22	30	5	0.14	0.27
					25	5	0.08	0.49	30	7	0.10	0.55	38	9	0.12	0.71
					29	8	0.06	0.71	36	10	0.08	0.88	45	12.5	0.10	1.10

Cutting Conditions for Drilling and Plunging

●Drilling



●The recommended drilling depth is less than 0.5 x D_1.

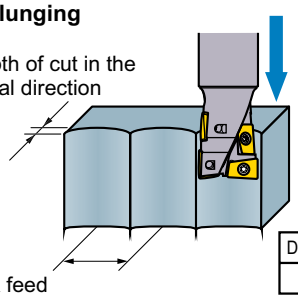
●Use step feed when drilling (0.25~0.5mm) to ensure the chips are effectively broken.

●Use step feed when drilling (0.25~0.5mm) to ensure the chips are effectively broken.

●The chips generated can disperse in any direction, ensure that adequate safety precautions are taken.

●Plunging

Depth of cut in the radial direction



Pick feed

●The feed rate for plunging is the same as the feed for drilling.

●No step feed is necessary.

●Please refer to the following table for the depths of cut for plunging operations.

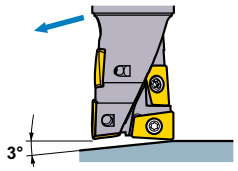
Depth of cut in the radial direction	≤ 0.4D_1
Pick feed	≤ 0.5D_1

	Workpiece	Hardness	Grade	Cutting Speed (m/min)	φ16, 17		φ20, 21		φ25, 26	
					Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)
P	Mild steel (JIS SS400, SCM440)	≤180HB	VP15TF	180 (150−220)	0.035	0.2	0.045	0.3	0.05	0.3
	Carbon Steel, Alloy Steel (JIS S50C,SCM440)	180−350HB	VP15TF	160 (120−200)	0.03	0.2	0.04	0.3	0.045	0.3
M	Stainless Steel (JIS SUS304)	≤270HB	VP30RT (VP15TF)	150 (120−180)	0.03	0.15	0.04	0.25	0.045	0.25
K	Cast Iron (JIS FC300)	Tensile strength ≤450MPa	VP15TF	180 (150−220)	0.04	0.4	0.05	0.5	0.06	0.5
N	Aluminium Alloy	–	HTi10 (G1 breaker)	500 (200−800)	0.04	0.2	0.05	0.3	0.06	0.3
H	Hardened Steel	40−55HRC	VP15TF	80 (50−120)	0.02	0.15	0.03	0.25	0.035	0.25

Note: Helical drilling is strongly recommended for machining hardened steels. *When using the G1 breaker (VP15TF), reduce the feed rate by at least 20%.

	ϕ32, 33				ϕ35				ϕ40				ϕ50			
	Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)	Machining diameter (mm)	Max. depth of cut (mm)	Feed (mm/rev)	DOC/pass (mm/pass)
	38	16	0.25	0.66	42	18	0.28	0.77	48	20	0.30	0.88	60	25	0.35	1.10
	48	24	0.22	1.76	53	27	0.24	1.97	60	30	0.26	2.19	75	38	0.30	2.74
	58	32	0.20	2.85	63	35	0.21	3.07	72	40	0.22	3.51	90	50	0.26	4.39
	38	16	0.20	0.49	42	18	0.22	0.58	48	20	0.25	0.66	60	25	0.28	0.82
	48	24	0.18	1.32	53	27	0.2	1.48	60	30	0.22	1.65	75	38	0.26	2.06
	58	32	0.16	2.14	63	35	0.18	2.3	72	40	0.20	2.63	90	50	0.24	3.29
	38	6	0.20	0.33	42	7	0.22	0.38	48	8	0.25	0.44	60	10	0.28	0.55
	48	11	0.18	0.88	53	13	0.2	0.99	60	14	0.22	1.10	75	18	0.26	1.37
	58	16	0.16	1.43	63	18	0.18	1.53	72	20	0.20	1.75	90	25	0.24	2.19
	38	22	0.25	0.82	42	25	0.28	0.95	48	28	0.30	1.10	60	35	0.35	1.37
	48	27	0.22	2.19	53	30	0.24	2.47	60	34	0.26	2.74	75	43	0.30	3.43
	58	32	0.20	3.57	63	35	0.21	3.84	72	40	0.22	4.39	90	50	0.26	5.49
	38	22	0.27	0.66	42	25	0.3	0.77	48	28	0.32	0.88	60	35	0.37	1.10
	48	27	0.24	1.76	53	30	0.26	1.97	60	34	0.28	2.19	75	43	0.32	2.74
	58	32	0.22	2.85	63	35	0.21	3.07	72	40	0.24	3.51	90	50	0.27	4.39
	38	6	0.16	0.33	42	7	0.17	0.38	48	8	0.18	0.44	60	10	0.20	0.55
	48	11	0.14	0.88	53	13	0.15	0.99	60	14	0.16	1.10	75	18	0.18	1.37
	58	16	0.12	1.43	63	18	0.13	1.53	72	20	0.14	1.75	90	25	0.16	2.19

Cutting Conditions for Ramping

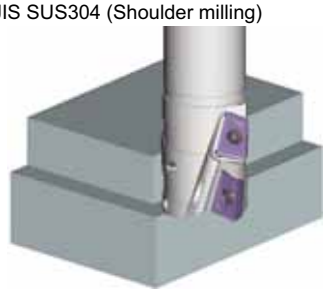
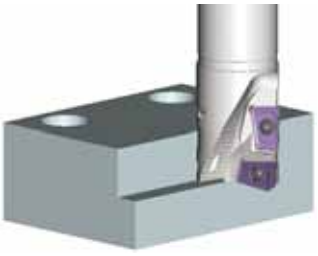
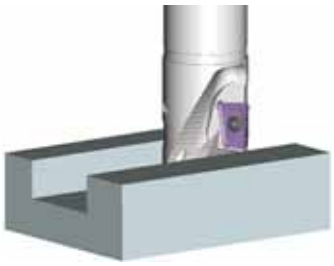


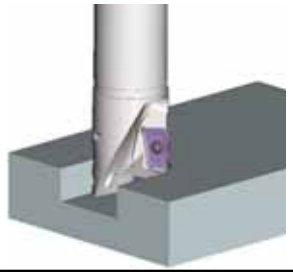
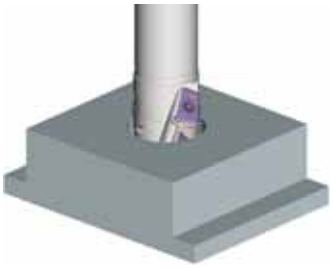
- When machining steel, the recommended ramping angle is 3°. If a ramping angle larger than 3° is used, the chips may not be broken effectively resulting in chips wrapping around the tool.
- During ramping, it is recommended to reduce the feed rate by 40% from the cutting conditions listed for slotting on page 5.

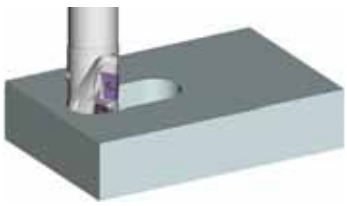
	ϕ32, 33, ϕ35		ϕ40		ϕ50	
	Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)	Feed (mm/rev)	Step (mm)
	0.055	0.3	0.06	0.3	0.065	0.3
	0.05	0.3	0.055	0.3	0.06	0.3
	0.05	0.25	0.055	0.25	0.06	0.25
	0.065	0.5	0.07	0.5	0.075	0.5
	0.065	0.3	0.07	0.3	0.075	0.3
	0.04	0.25	0.045	0.25	0.05	0.25

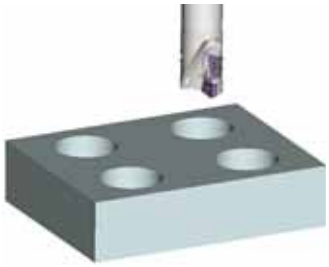
AQX

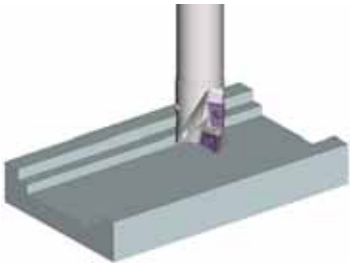
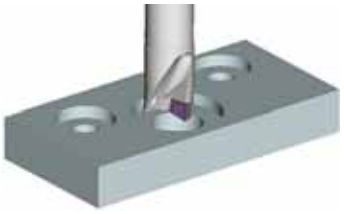
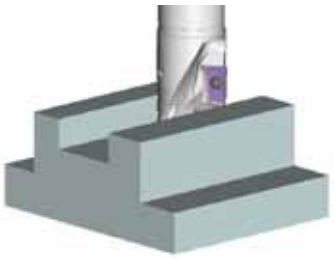
Application Examples

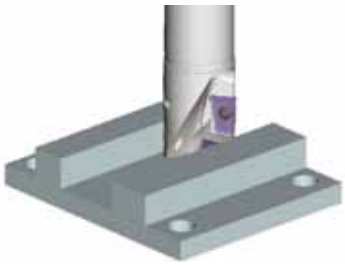
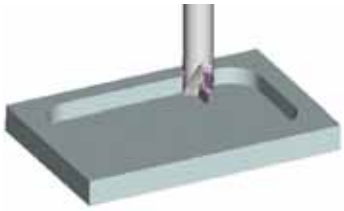
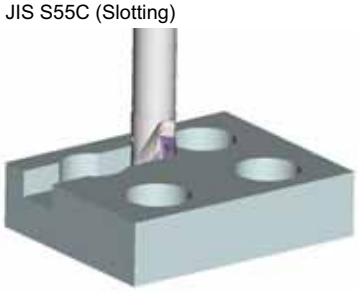
Tool	AQXR204SA20S(VP30RT)	AQXR204SA20S(VP15TF)	AQXR254SA25S(HTi10)
Workpiece	JIS SUS304 (Shoulder milling) 	Inconel 713 (Shoulder milling) 	JIS A7075 (Slotting) 
Component	Machine part	Machine part	Machine part
Cutting Conditions: Cutting Speed (m/min)	150	30	500
Cutting Conditions: Feed (mm/rev)	0.15	0.03	0.28
Result	Higher fracture resistance than conventional products. Insert life extended 2 - 3 times.	Lower cutting resistance and longer tool life.	Improved tool sharpness and surface finish compared to conventional products.

Tool	AQXR204SA20L(VP30RT)	AQXR174SN16S(VP15TF)	AQXR354SA32S(VP15TF)
Workpiece	JIS S45C (Slotting) 	JIS SS400 (Slotting) 	JIS FCD700 (Helical milling) 
Component	Machine part	Mold	Machine part
Cutting Conditions: Cutting Speed (m/min)	80	80	100
Cutting Conditions: Feed (mm/rev)	0.1	0.2	0.1
Result	Tool life doubled.	Better sharpness and wear resistance.	Lower cutting resistance and better chip control than conventional products.

Tool	AQXR504SA42L(VP15TF)	AQXR504SA42L(VP15TF)	AQXR354SN32L(VP15TF)
Workpiece	JIS FCD600 (Slotting) 	JIS SKD61 (Drilling+Slotting) 	JIS SKD61 (Slotting) 
Component	Machine part	Mold	Mold part
Cutting Conditions: Cutting Speed (m/min)	110	102	100
Cutting Conditions: Feed (mm/rev)	0.25	0.25	0.25
Result	Higher body rigidity allows for double machining depth.	Better sharpness and longer tool life than conventional products.	Higher fracture and wear resistance.

Tool	AQXR254SA25S(VP15TF)	AQXR324SA32S(VP15TF)	AQXR204SA20S(VP15TF)
Workpiece	JIS S55C (Drilling) 	JIS FC250 (Helical milling) 	JIS S55C (Slotting) 
Component	Machine part	Mold part	Machine part
Cutting Conditions: Cutting Speed (m/min)	160	120	150
Cutting Conditions: Feed (mm/rev)	0.05	0.2	0.15
Result	Conventional drilling was not possible. The AQX reduced the cutting time by 85%.	A competitor's conventional product suffered from chipping due to its single insert end face configuration. This also prevented the feed from being increased. The AQX achieved twice the feed due to the dual edge configuration.	AQX displayed stable grooving performance. The inside part of the workpiece, which used to be thrown away as generated.

Tool	AQXR204SN20S(VP15TF)	AQXR162SN16S(VP15TF)	AQXR174SA16S(VP15TF)
Workpiece	JIS SKD11 (Shoulder milling) 	JIS SS400(Pocketing) 	JIS S55C (Slotting) 
Component	Mold part	Mold part	Machine part
Cutting Conditions: Cutting Speed (m/min)	126	120	120
Cutting Conditions: Feed (mm/rev)	0.15	0.2	0.2
Result	Increased stability without insert fracturing became possible.	Better machining without suffering from vibrations.	Superior machining performance without vibration and improved surface finish when compared to conventional products.

Tool	AQXR204SN20S(VP15TF)	AQXR404SN32S(VP15TF)	AQXR334SA32L(VP15TF)
Workpiece	JIS S50C (Slotting) 	JIS FC300 (Pocketing) 	JIS S55C (Slotting) 
Component	Mold	Mold part	Mold part
Cutting Conditions: Cutting Speed (m/min)	120	150	110
Cutting Conditions: Feed (mm/rev)	0.15	0.15	0.3
Result	More stable machining with lower cutting noise became possible and insert life increased by 150%.	Lower cutting resistance allowed for increased machining efficiency.	Increased machining efficiency without vibration.

For Your Safety
●Don't touch 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 cover and wear safety glasses. ●When using compounded cutting oils, please take fire preventions. ●When attaching inserts or spare parts, please use the attached wrench or spanner. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

MITSUBISHI MATERIALS CORPORATION

Tsukuba Plant ISO 9001-2000 Registration No. JSAQ 080 Gifu Plant ISO 9001-2000 Registration No. JSAQ 094

Tsukuba Plant ISO 14001-1996 Registration No. JSAE 036

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(Tools specifications subject to change without notice.)

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