

# AQX

## MULTI-FUNCTIONAL INDEXABLE INSERT END MILL

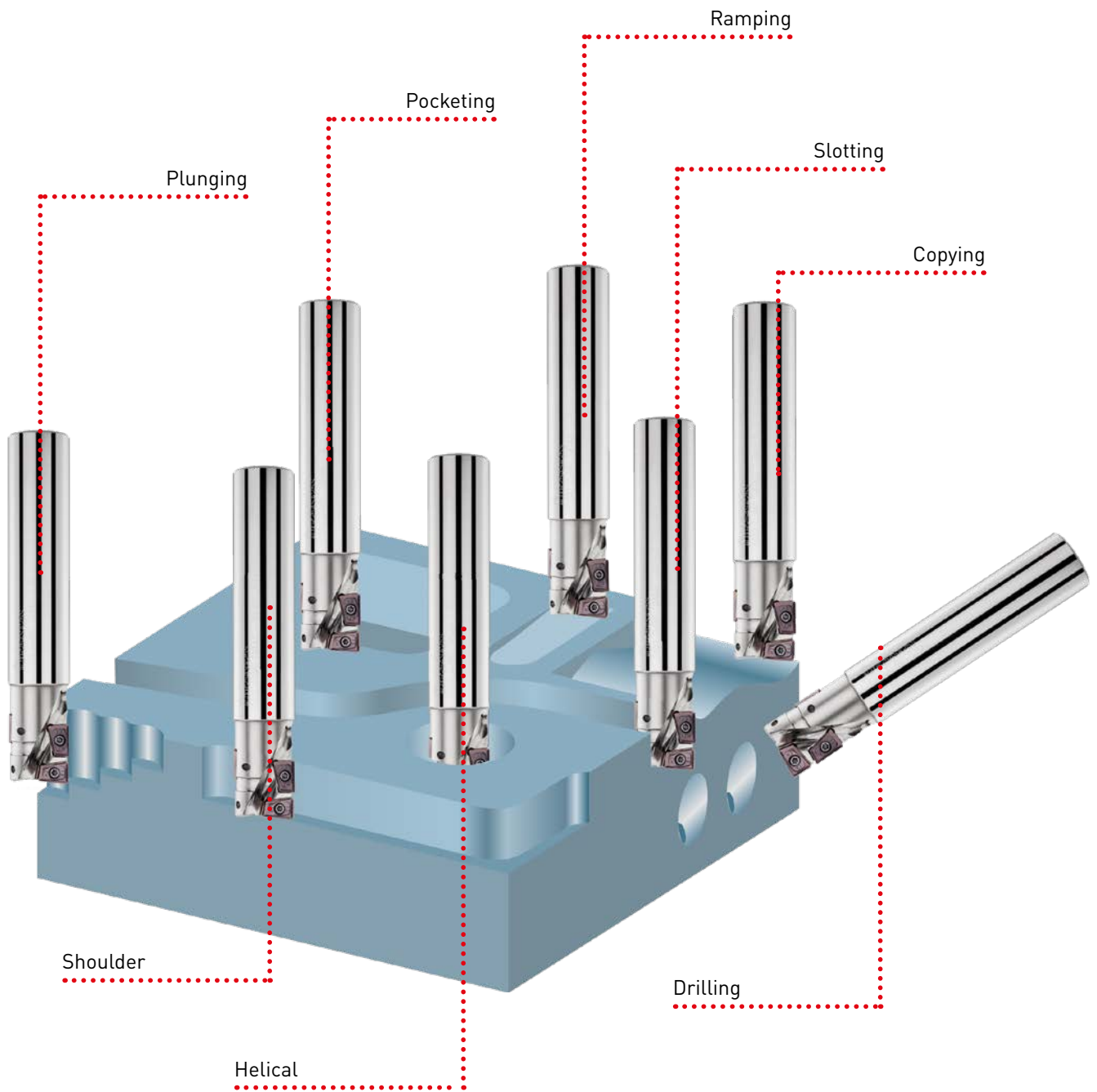


**DIA**  **EDGE**

 **MITSUBISHI MATERIALS**

# AQX

## MULTI-FUNCTIONAL INDEXABLE INSERT END MILL

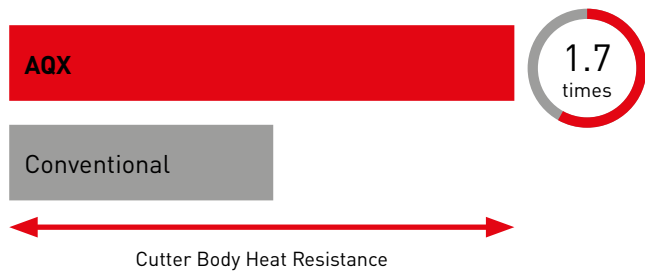


# AQX

## MULTI-FUNCTIONAL INDEXABLE INSERT END MILL

### 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.



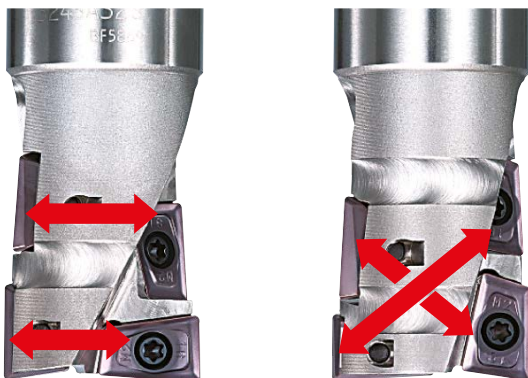
### 2 INSERT BOTTOM CUTTING EDGE

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



### ONE INSERT TYPE

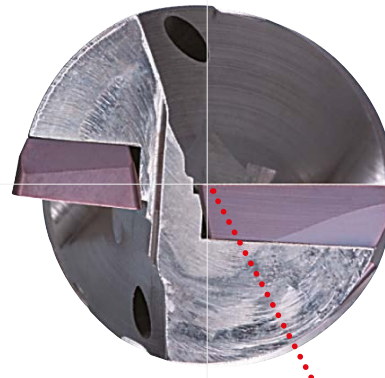
Tool management is simplified by using only one type of insert for all 4 cutting edges. By rotating the inserts it's possible to use all 4 corners.



Insert Rotation

### CENTRE CUTTING EDGE

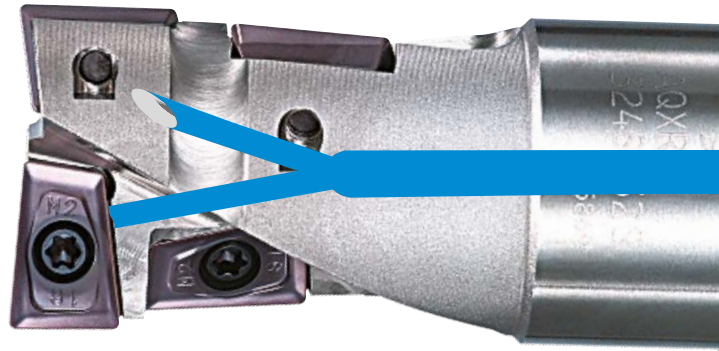
The AQX is designed with a centre cutting edge, making it possible to sink, helical mill and pocket machine without a pre-drilled hole.



Centre Cutting Edge

# THROUGH COOLANT HOLES

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



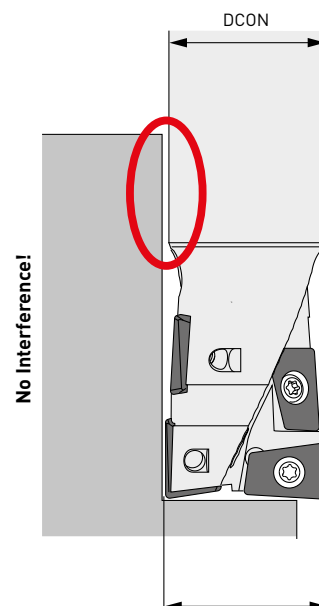
# SHORT EDGE TYPE

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



# OFFSET TYPE

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



Order number	DC	DCON
AQXR170S0160	17	16
AQXR210S0200	21	20
AQXR260S0250	26	25
AQXR330S0320	33	32
AQXR350S0320	35	32
AQXR400S0320	40	32
AQXR500S0420	50	42

# NEW PVD COATED GRADES

## MP6100 / MP7100 / MP9100

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



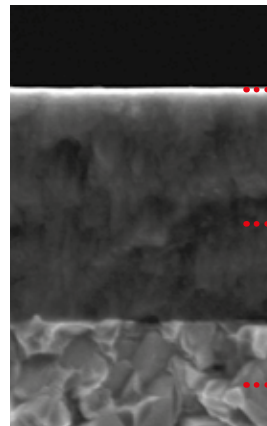
MP6100



MP7100



MP9100



Excellent welding resistance due to low coefficient of friction

PVD accumulated coating prevents abnormal damage

Special cemented carbide substrate

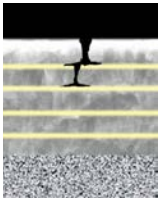
# TOUGH-Σ TECHNOLOGY

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

# PVD ACCUMULATED COATING

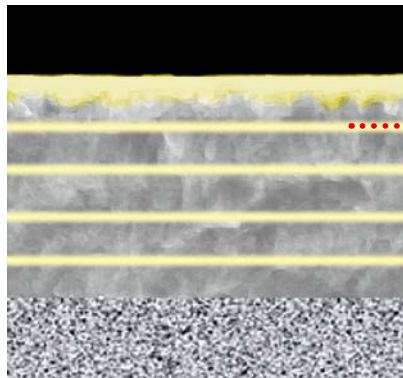
Base Layer with high compressed (Al,Ti,Cr)N

The new coating technology with compressed (Al,Ti,Cr)N layers provides stabilisation 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

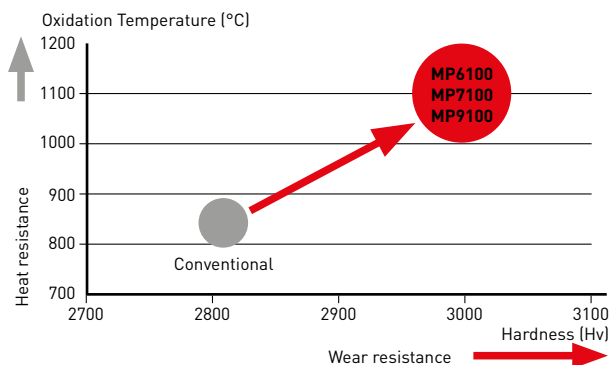


Graphical Representation

Layers for each application

P		(Al,Ti,Cr)N Thermal crack resistant
M		(Al,Ti,Cr)N-Ti Notch resistant
S		(Al,Ti,Cr)N Chipping resistant

## DRAMATICALLY IMPROVING HEAT AND WEAR RESISTANCE!



## EXCELLENT WELDING RESISTANCE DUE TO LOW COEFFICIENT OF FRICTION!

Material	Grade	Friction coefficient		
		Measured at 600° C		
		Ck55	X5CrNi189	Ti-6Al-4V
P	Carbon steel, Alloy steel	MP6100	0.4	
M	Stainless steel	MP7100	0.5	
S	Titanium alloy, Heat resistant alloy	MP9100		0.3
	Conventional		0.7	0.7

# INSERT GRADES FOR A WIDE RANGE OF MATERIALS

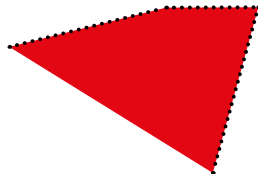
P	PVD	M	PVD	K	PVD
P10	MP6120	M10	MP7130	K10	VP15TF
P20	VP15TF	M20	MP7140	K20	VP15TF
P30	MP6130	M30	VP30RT	K30	
P40		M40		K40	

N	PVD	S	PVD	H	PVD
N01		S01		H01	
N10	HTI10	S10	MP9120	H10	VP15TF
N20		S20		H20	
N30		S30		H30	

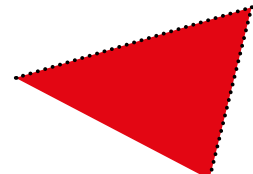
## WIDE RANGE OF INSERTS

### M2 CHIPBREAKER



Economical moulded inserts.  
Suitable for machining a wide range of materials and applications.

### G1 CHIPBREAKER



High accuracy peripherally ground inserts. Large rake angle to provide high cutting edge sharpness.

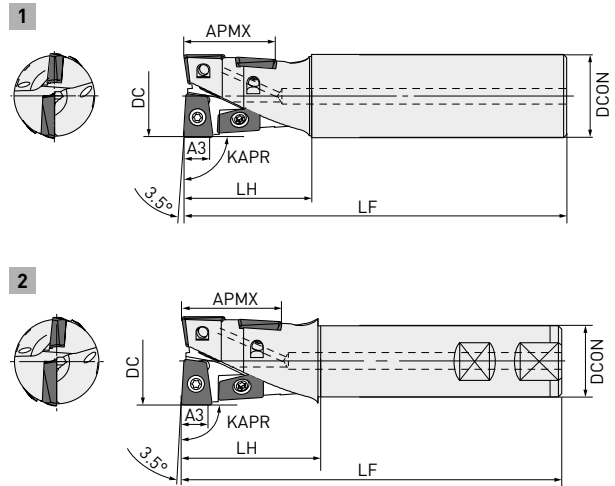
An HTI10 insert is available with a polished rake face to prevent welding problems when machining aluminium alloys.




# AQX



## MULTI FUNCTIONAL MILLING




Right hand tool holder only.

Order number	Stock	Coolant hole	DC	LF	DCON	LH	A3*1	APMX	Type	
<b>STANDARD</b>										
AQXR164SA16S	●	○	16	120	16	30	4.5	17.6	1	
AQXR164SN16S	★		16	120	16	30	4.5	17.6	1	QOG/MT0830R-G1/M2
AQXR174SA16S	●	○	17	120	16	30	4.5	17.6	1	
AQXR174SN16S	★		17	120	16	30	4.5	17.6	1	
AQXR204SA20S	●	○	20	130	20	35	6	22	1	
AQXR204SN20S	★		20	130	20	35	6	22	1	QOG/MT1035R-G1/M2
AQXR214SA20S	●	○	21	130	20	35	6	22	1	
AQXR214SN20S	★		21	130	20	35	6	22	1	
AQXR254SA25S	●	○	25	140	25	40	7.5	27.5	1	
AQXR254SN25S	★		25	140	25	40	7.5	27.5	1	QOG/MT1342R-G1/M2
AQXR264SA25S	●	○	26	140	25	40	7.5	27.5	1	
AQXR264SN25S	★		26	140	25	40	7.5	27.5	1	
AQXR324SA32S	●	○	32	150	32	50	9.5	35.2	1	
AQXR324SN32S	★		32	150	32	50	9.5	35.2	1	QOG/MT1651R-G1/M2
AQXR334SA32S	●	○	33	150	32	50	9.5	35.2	1	
AQXR334SN32S	★		33	150	32	50	9.5	35.2	1	
AQXR354SA32S	●	○	35	150	32	50	11	40	1	QOG/MT1856R-G1/M2
AQXR354SN32S	★		35	150	32	50	11	40	1	
AQXR404SA32S	●	○	40	160	32	60	12	44	1	QOG/MT2062R-G1/M2
AQXR404SN32S	★		40	160	32	60	12	44	1	
AQXR504WA40S	●	○	50	170	40	70	15	55	2	
AQXR504SA42S	★	○	50	170	42	70	15	55	1	QOG/MT2576R-G1/M2
AQXR504SN42S	★		50	170	42	70	15	55	1	

\*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.



# AQX

Order number	Stock	Coolant hole	DC	LF	DCON	LH	A3*1	APMX	Type	
<b>LONG</b>										
AQXR164SA16L	●	○	16	175	16	50	4.5	17.6	1	QOG/MT0830R-G1/M2
AQXR164SN16L	★		16	175	16	50	4.5	17.6	1	
AQXR174SA16L	●	○	17	175	16	30	4.5	17.6	1	
AQXR174SN16L	★		17	175	16	30	4.5	17.6	1	
AQXR204SA20L	●	○	20	185	20	60	6	22	1	QOG/MT1035R-G1/M2
AQXR204SN20L	★		20	185	20	60	6	22	1	
AQXR214SA20L	●	○	21	185	20	35	6	22	1	
AQXR214SN20L	★		21	185	20	35	6	22	1	
AQXR254SA25L	●	○	25	220	25	75	7.5	27.5	1	QOG/MT1342R-G1/M2
AQXR254SN25L	★		25	220	25	75	7.5	27.5	1	
AQXR264SA25L	●	○	26	220	25	40	7.5	27.5	1	
AQXR264SN25L	★		26	220	25	40	7.5	27.5	1	
AQXR324SA32L	●	○	32	230	32	90	9.5	35.2	1	QOG/MT1651R-G1/M2
AQXR324SN32L	★		32	230	32	90	9.5	35.2	1	
AQXR334SA32L	●	○	33	230	32	50	9.5	35.2	1	
AQXR334SN32L	★		33	230	32	50	9.5	35.2	1	
AQXR354SA32L	●	○	35	230	32	50	11	40	1	QOG/MT1856R-G1/M2
AQXR354SN32L	★		35	230	32	50	11	40	1	
AQXR404SA32L	●	○	40	240	32	60	12	44	1	QOG/MT2062R-G1/M2
AQXR404SN32L	★		40	240	32	60	12	44	1	
AQXR504WA40L	●	○	50	250	40	70	15	55	2	QOG/MT2576R-G1/M2
AQXR504SA42L	★	○	50	250	42	70	15	55	1	
AQXR504SN42L	★		50	250	42	70	15	55	1	

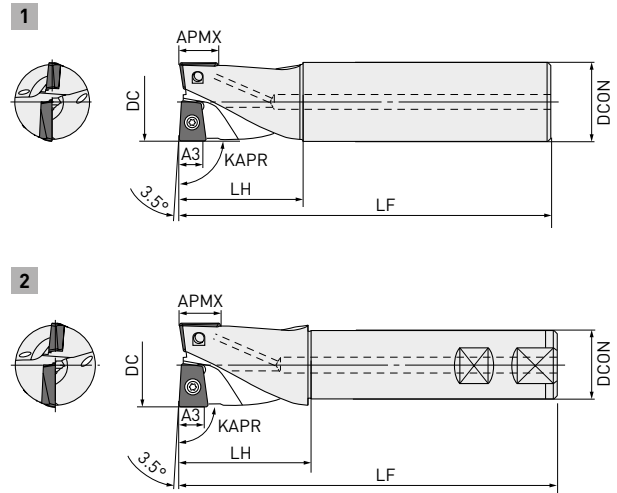
\*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.




# AQX



## MULTI FUNCTIONAL MILLING




Right hand tool holder only.

Order number	Stock	Coolant hole	DC	LF	DCON	LH	A3*1	APMX	Type	
<b>STANDARD</b>										
AQXR162SA16S	●	○	16	120	16	30	4.5	7.4	1	
AQXR162SN16S	★		16	120	16	30	4.5	7.4	1	QOG/MT0830R-G1/M2
AQXR172SA16S	●	○	17	120	16	30		7.4	1	
AQXR172SN16S	★		17	120	16	30	4.5	7.4	1	
AQXR202SA20S	●	○	20	130	20	35	6	9.2	1	
AQXR202SN20S	★		20	130	20	35	6	9.2	1	QOG/MT1035R-G1/M2
AQXR212SA20S	●	○	21	130	20	35	6	9.2	1	
AQXR212SN20S	★		21	130	20	35	6	9.2	1	
AQXR252SA25S	●	○	25	140	25	40	7.5	11.5	1	
AQXR252SN25S	★		25	140	25	40	7.5	11.5	1	QOG/MT1342R-G1/M2
AQXR262SA25S	●	○	26	140	25	40	7.5	11.5	1	
AQXR262SN25S	★		26	140	25	40	7.5	11.5	1	
AQXR322SA32S	●	○	32	150	32	50	9.5	14.5	1	
AQXR322SN32S	★		32	150	32	50	9.5	14.5	1	QOG/MT1651R-G1/M2
AQXR332SA32S	●	○	33	150	32	50	9.5	14.5	1	
AQXR332SN32S	★		33	150	32	50	9.5	14.5	1	
AQXR352SA32S	●	○	35	150	32	50	11	16	1	QOG/MT1856R-G1/M2
AQXR352SN32S	★		35	150	32	50	11	16	1	
AQXR402SA32S	●	○	40	160	32	60	12	18	1	QOG/MT2062R-G1/M2
AQXR402SN32S	★		40	160	32	60	12	18	1	
AQXR502WA40S	●	○	50	170	40	70	15	23	2	
AQXR502SA42S	★	○	50	170	42	70	15	23	1	QOG/MT2576R-G1/M2
AQXR502SN42S	★		50	170	42	70	15	23	1	

\*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.

# AQX

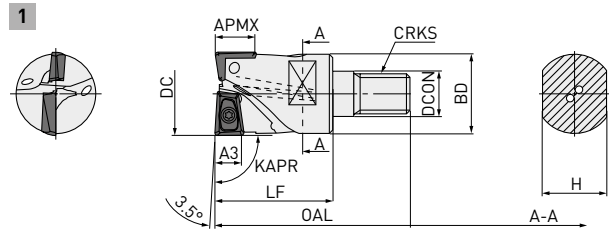
Order number	Stock	Coolant hole	DC	LF	DCON	LH	A3*1	APMX	Type	
<b>LONG</b>										
AQXR162SA16L	●	○	16	175	16	50	4.5	7.4	1	QOG/MT0830R-G1/M2
AQXR162SN16L	★		16	175	16	50	4.5	7.4	1	
AQXR172SA16L	●	○	17	175	16	30	4.5	7.4	1	
AQXR172SN16L	★		17	175	16	30	4.5	7.4	1	
AQXR202SA20L	●	○	20	185	20	60	6	9.2	1	QOG/MT1035R-G1/M2
AQXR202SN20L	★		20	185	20	60	6	9.2	1	
AQXR212SA20L	●	○	21	185	20	35	6	9.2	1	
AQXR212SN20L	★		21	185	20	35	6	9.2	1	
AQXR252SA25L	●	○	25	220	25	75	7.5	11.5	1	QOG/MT1342R-G1/M2
AQXR252SN25L	★		25	220	25	75	7.5	11.5	1	
AQXR262SA25L	●	○	26	220	25	40	7.5	11.5	1	
AQXR262SN25L	★		26	220	25	40	7.5	11.5	1	
AQXR322SA32L	●	○	32	230	32	90	9.5	14.5	1	QOG/MT1651R-G1/M2
AQXR322SN32L	★		32	230	32	90	9.5	14.5	1	
AQXR332SA32L	●	○	33	230	32	50	9.5	14.5	1	
AQXR332SN32L	★		33	230	32	50	9.5	14.5	1	
AQXR352SA32L	●	○	35	230	32	50	11	16	1	QOG/MT1856R-G1/M2
AQXR352SN32L	★		35	230	32	50	11	16	1	
AQXR402SA32L	●	○	40	240	32	60	12	18	1	QOG/MT2062R-G1/M2
AQXR402SN32L	★		40	240	32	60	12	18	1	
AQXR502WA40L	●	○	50	250	40	70	15	23	2	QOG/MT2576R-G1/M2
AQXR502SA42L	★	○	50	250	42	70	15	23	1	
AQXR502SN42L	★		50	250	42	70	15	23	1	

\*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.


# AQX



## MULTI FUNCTIONAL MILLING – SCREW-IN













Right hand tool holder only.

Order number	Stock	Coolant hole	DC	DCON	BD	OAL	LF	H	CRKS	A3*1	APMX	WT	
AQXR162M08A30	●	○	16	8.5	14.7	48	30	10	M8	4.5	7.4	0.1	QO-T0830R-○○
AQXR172M08A30	●	○	17	8.5	14.5	48	30	10	M8	4.5	7.4	0.1	
AQXR202M10A30	●	○	20	10.5	18.6	49	30	14	M10	6	9.2	0.2	QO-T1035R-○○
AQXR212M10A30	●	○	21	10.5	18.5	49	30	14	M10	6	9.2	0.2	
AQXR252M12A35	●	○	25	12.5	23.5	57	35	19	M12	7.5	11.5	0.2	QO-T1342R-○○
AQXR262M12A35	●	○	26	12.5	23.5	57	35	19	M12	7.5	11.5	0.2	
AQXR322M16A40	●	○	32	17	28.5	63	40	24	M16	9.5	14.5	0.3	QO-T1651R-○○
AQXR332M16A40	●	○	33	17	28.5	63	40	24	M16	9.5	14.5	0.3	
AQXR352M16A40	●	○	35	17	28.5	63	40	24	M16	11	16	0.3	QO-T1856R-○○
AQXR402M16A45	●	○	40	17	28.5	68	45	24	M16	12	18	0.3	QO-T2062R-○○

\*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.



## SPARE PARTS

Tool holder	 *1	 1	 2	 3
	Clamp screw	Wrench		
AQXR16	TS2A	 1 TKY06F		
AQXR17	TS25	 1 TKY08F		
AQXR20	TS33	 2 TKY08D		
AQXR21	TS407	 2 TKY15D		
AQXR25	TS55	 2 TKY25D		
AQXR26	TS6S	 3 TKY30T		
AQXR32				
AQXR33				
AQXR35				
AQXR40				
AQXR50				

\*1 Clamp Torque (N • m) : TS2A = 0.6, TS25 = 1.0, TS33 = 1.0, TS407 = 3.5, TS55 = 7.5, TS6S = 10.0

# AQX

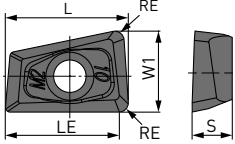
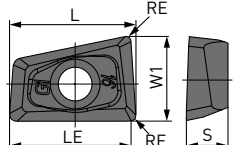
## INSERTS

### AQX MULTI FUNCTIONAL MILLING

P	Steel	●	●					●	✱
M	Stainless steel			●	●			●	✱
K	Cast iron							✱	
S	Heat resistant alloy, Titanium						●	●	
N	Non-ferrous Metal								●
H	Hardened steel							●	

#### Cutting conditions:

●: Stable cutting ●: General cutting ✱: Unstable cutting  
E: Round F: Sharp

Order number	DC	Class	Honing	Honing							L	LE	W1	S	RE	Geometry
				MP6120	MP6130	MP7130	MP7140	MP9120	VP15TF	VP30RT						
QOMT0830R-M2	Ø16.17	M	E	●	●	●	●	●	●	●	8.4	7.4	5.5	3	0.8	
QOMT1035R-M2	Ø20.21	M	E	●	●	●	●	●	●	●	10.6	9.2	7	3.5	0.8	
QOMT1342R-M2	Ø25.26	M	E	●	●	●	●	●	●	●	13.1	11.5	8.7	4.2	0.8	
QOMT1651R-M2	Ø32.33	M	E	●	●	●	●	●	●	●	16.5	14.5	11	5.1	0.8	
QOMT1856R-M2	Ø35	M	E	●	●	●	●	●	●	●	18	16	12	5.6	0.8	
QOMT2062R-M2	Ø40	M	E	●	●	●	●	●	●	●	20.4	18	13.6	6.2	0.8	
QOMT2576R-M2	Ø50	M	E	●	●	●	●	●	●	●	25.8	23	17.2	7.6	0.8	
QOGT0830R-G1	Ø16.17	G	E*	●				●	●	●	8.4	7.4	5.5	3	0.4	
QOGT1035R-G1	Ø20.21	G	E*	●				●	●	●	10.6	9.2	7	3.5	0.4	
QOGT1342R-G1	Ø25.26	G	E*	●				●	●	●	13.1	11.5	8.7	4.2	0.4	
QOGT1651R-G1	Ø32.33	G	E*	●				●	●	●	16.5	14.5	11	5.1	0.4	
QOGT1856R-G1	Ø35	G	E*	●				●	●	●	18	16	12	5.6	0.4	
QOGT2062R-G1	Ø40	G	E*	●				●	●	●	20.4	18	13.6	6.2	0.4	
QOGT2576R-G1	Ø50	G	E*	●				●	●	●	25.8	23	17.2	7.6	0.4	

\* HTi10 insert honing is "F" type.

# AQX

## RECOMMENDED CUTTING CONDITIONS

### AQX MULTI FUNCTIONAL MILLING

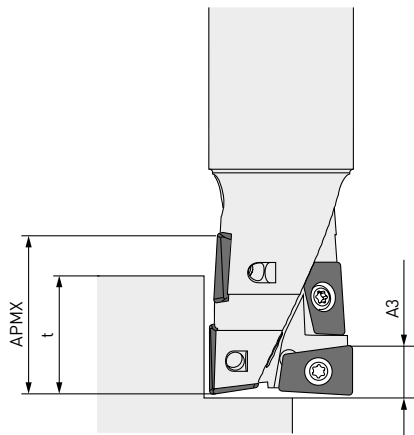
Material	Properties	Grade	Vc
P Mild steel	<180HB	MP6120	200 (170-240)
		VP15TF	180 (150-220)
		MP6130	160 (130-200)
P Carbon steel Alloy steel	180-350HB	MP6120	180 (140-220)
		VP15TF	160 (120-200)
		MP6130	140 (100-180)
M Stainless steel	<270HB	MP7130	170 (120-200)
		MP7140	160 (100-180)
		VP30RT (VP15TF)	150 (120-180)
K Cast iron Ductile cast iron	—	VP15TF	180 (150-220)
S Titanium alloy	—	MP9120	50 ( 30- 70)
N Aluminium alloy	Si<5%	HT110	500 (200-800)
	Si>5%	HT110	100 ( 50-300)
H Hardened steel	40-55HRC	VP15TF	80 ( 50-120)

1. Wet cutting is recommended for titanium alloys.



# AQX

## CUTTING CONDITIONS FOR SHOULDER MILLING



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

A3 is the depth of cut for the full dual insert 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 a single insert, not forming full dual insert configuration. Therefore, 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 damage. At large depth of cut operations, applying the following depth of cut (t), at which the edge is full dual insert at the border of cut is recommended to prevent damage to the cutting edge.

DC Ø (mm)	ap
Ø 16, 17	12 – 14
Ø 20, 21	14 – 17
Ø 25, 26	17 – 22
Ø 32, 33	22 – 28

DC Ø (mm)	ap
Ø 35	25 – 32
Ø 40	28 – 35
Ø 50	35 – 45

Material	Properties	Ø 16, 17			Ø 20, 21			Ø 25, 26		
		ap	ae	f	ap	ae	f	ap	ae	f
P Mild steel	≤180HB	<4.5	<8	0.25	<6	<10	0.3	<7.5	<12.5	0.35
		4.5–12	<5	0.16	6–14	<7	0.25	7.5–17	<8	0.28
		12–17	<3	0.1	14–22	<4	0.18	17–27	<5	0.2
M Carbon steel Alloy steel	180–350HB	<4.5	<8	0.2	<6	<10	0.25	<7.5	<12.5	0.3
		4.5–12	<4	0.14	6–14	<6	0.2	7.5–17	<7	0.25
		12–17	<2	0.08	14–22	<3	0.16	17–27	<4	0.18
M Stainless steel	<270HB	<4.5	<8	0.2	<6	<10	0.25	<7.5	<12.5	0.3
		4.5–12	<4	0.14	6–14	<6	0.2	7.5–17	<7	0.25
		12–17	<2	0.08	14–22	<3	0.16	17–27	<4	0.18
K Cast iron Ductile cast iron		<4.5	<8	0.25	<6	<10	0.3	<7.5	<12.5	0.35
		4.5–12	<5	0.16	6–14	<7	0.25	7.5–17	<8	0.28
		12–17	<3	0.1	14–22	<4	0.18	17–27	<5	0.2
S Titanium alloy		<4.5	<11	0.3	<6	<14	0.35	<7.5	<12.5	0.4
		4.5–12	<8	0.21	6–14	<10	0.3	7.5–17	<7	0.33
		12–17	<5	0.15	14–22	<6	0.23	17–27	<4	0.25
N Aluminium alloy		<4.5	<8	0.14	<6	<10	0.18	<7.5	<17.5	0.21
		4.5–12	<4	0.1	6–14	<6	0.14	7.5–17	<12.5	0.18
		12–17	<2	0.06	14–22	<3	0.11	17–27	<7.5	0.13
H Hardened steel	40–55HRC	<4.5	<5	0.16	<6	<6	0.2	<7.5	<7	0.22
		4.5–12	<3	0.1	6–14	<4	0.16	7.5–17	<4	0.18
		12–17	<1	0.06	14–22	<2	0.12	17–27	<2	0.14

# AQX

## CUTTING CONDITIONS FOR SHOULDER MILLING

Material	Properties	Ø 32, 33			Ø 35			Ø 40			Ø 50		
		ap	ae	f	ap	ae	f	ap	ae	f	ap	ae	f
P Mild steel	≤180HB	<9.5	<16	0.4	<11	<17.5	0.45	<12	<20	0.5	<15	<25	0.6
		9.5–22	<11	0.32	11–25	<12	0.35	12–28	<13	0.4	15–35	<16	0.5
		22–35	<6	0.25	25–40	<6.5	0.28	28–44	<7	0.3	35–55	<10	0.35
P Carbon steel Alloy steel	180–350HB	<9.5	<16	0.35	<11	<17.5	0.37	<12	<20	0.4	<15	<25	0.5
		9.5–22	<10	0.28	11–25	<11	0.3	12–28	<12	0.32	15–35	<14	0.4
		22–35	<5	0.2	25–40	<5.5	0.22	28–44	<6	0.25	35–55	<8	0.3
M Stainless steel	<270HB	<9.5	<16	0.35	<11	<17.5	0.37	<12	<20	0.4	<15	<25	0.5
		9.5–22	<10	0.28	11–25	<12	0.3	12–28	<12	0.32	15–35	<14	0.4
		22–35	<5	0.2	25–40	<6.5	0.22	28–44	<6	0.25	35–55	<8	0.3
K Cast iron Ductile cast iron		<9.5	<16	0.4	<11	<17.5	0.45	<12	<20	0.5	<15	<25	0.6
		9.5–22	<11	0.32	11–25	<12	0.35	12–28	<13	0.4	15–35	<16	0.5
		22–35	<6	0.25	25–40	<6.5	0.28	28–44	<7	0.3	35–55	<10	0.35
S Titanium alloy		<9.5	<16	0.45	<11	<17.5	0.5	<12	<20	0.55	<15	<25	0.65
		9.5–22	<10	0.37	11–25	<12	0.4	12–28	<12	0.45	15–35	<14	0.55
		22–35	<5	0.3	25–40	<6.5	0.32	28–44	<6	0.35	35–55	<8	0.4
N Aluminium alloy		<9.5	<23	0.25	<11	<24.5	0.26	<12	<28	0.28	<15	<35	0.35
		9.5–22	<16	0.2	11–25	<17.5	0.21	12–28	<20	0.22	15–35	<25	0.28
		22–35	<10	0.14	25–40	<10.5	0.15	28–44	<12	0.18	35–55	<15	0.21
H Hardened steel	40–55HRC	<9.5	<8	0.25	<11	<9	0.28	<12	<10	0.3	<15	<14	0.35
		9.5–22	<5	0.2	11–25	<5.5	0.22	12–28	<6	0.24	15–35	<8	0.3
		22–35	<2	0.16	25–40	<2	0.17	28–44	<2	0.18	35–55	<4	0.22

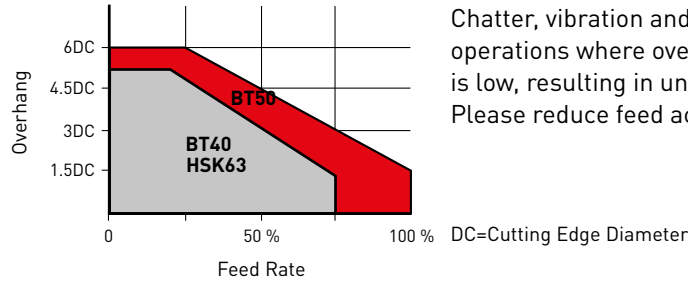
1. Please pay special attention on the depth of cut when using the short edge type.
2. When using the G1 breaker (VP15TF), please reduce the feed rate by 20%.



# AQX

## RECOMMENDED CUTTING CONDITIONS

### CUTTING CONDITIONS FOR SLOTTING



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

Material	Properties	Ø 16, 17		Ø 20, 21		Ø 25, 26	
		ap	f	ap	f	ap	f
P Mild steel	<180HB	<4.5	0.16	<6	0.18	<7.5	0.2
		4.5-12	0.1	6-14	0.14	7.5-17	0.16
		12-17	0.07	14-22	0.1	17-27	0.12
M Carbon steel Alloy steel	180-350HB	<4.5	0.14	<6	0.16	<7.5	0.18
		4.5-12	0.09	6-14	0.12	7.5-17	0.14
		12-17	0.05	14-22	0.1	17-27	0.1
M Stainless steel	<270HB	<4.5	0.14	<6	0.16	<7.5	0.18
		4.5-12	0.09	6-14	0.12	7.5-17	0.4
		12-17	0.05	14-22	0.1	17-27	0.1
K Cast iron	<350MPa	<4.5	0.16	<6	0.18	<7.5	0.2
		4.5-12	0.1	6-14	0.14	7.5-17	0.16
		12-17	0.07	14-22	0.1	17-27	0.12
S Titanium alloy		<4.5	0.18	<6	0.2	<7.5	0.22
		4.5-12	0.12	6-14	0.16	7.5-17	0.18
		12-17	0.09	14-22	0.12	17-27	0.14
N Aluminium alloy		<4.5	0.1	<6	0.12	<7.5	0.15
		4.5-12	0.05	6-14	0.08	7.5-17	0.1
		12-17	0.03	14-22	0.05	17-27	0.08
H Hardened steel	40-55HRC	<4.5	0.1	<6	0.12	<7.5	0.14
		4.5-12	0.07	6-14	0.1	7.5-17	0.12

# AQX

## RECOMMENDED CUTTING CONDITIONS

### CUTTING CONDITIONS FOR SLOTTING

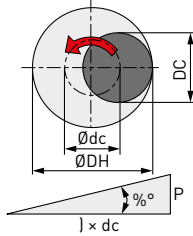
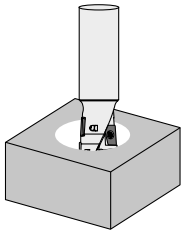
Material	Properties	Ø 32, 33		Ø 35		Ø 40		Ø 50	
		ap	f	ap	f	ap	f	ap	f
P Mild steel	<180HB	<9.5	0.25	<11	0.27	<12	0.3	<15	0.35
		9.5-22	0.2	11-25	0.22	12-28	0.25	15-35	0.3
		22-35	0.14	25-40	0.16	28-44	0.18	35-55	0.22
P Carbon steel Alloy steel	180-350HB	<9.5	0.2	<11	0.22	<12	0.25	<15	0.3
		9.5-22	0.16	11-25	0.18	12-28	0.2	15-35	0.25
		22-35	0.12	25-40	0.13	28-44	0.14	35-55	0.16
M Stainless steel	<270HB	<9.5	0.2	<11	0.22	<12	0.25	<15	0.3
		9.5-22	0.16	11-25	0.18	12-28	0.2	15-35	0.25
		22-35	0.12	25-40	0.13	28-44	0.14	35-55	0.16
K Cast iron	<350MPa	<9.5	0.25	<11	0.27	<12	0.3	<15	0.35
		9.5-22	0.2	11-25	0.22	12-28	0.25	15-35	0.3
		22-35	0.14	25-40	0.16	28-44	0.18	35-55	0.22
S Titanium alloy		<9.5	0.27	<11	0.3	<12	0.32	<15	0.37
		9.5-22	0.22	11-25	0.25	12-28	0.27	15-35	0.32
		22-35	0.16	25-40	0.18	28-44	0.2	35-55	0.25
N Aluminium alloy		<9.5	0.18	<11	0.2	<12	0.23	<15	0.25
		9.5-22	0.12	11-25	0.15	12-28	0.2	15-35	0.23
		22-35	0.1	25-40	0.12	28-44	0.15	35-55	0.18
H Hardened steel	40-55HRC	<9.5	0.16	<11	0.17	<12	0.18	<15	0.22
		9.5-22	0.12	11-25	0.13	12-28	0.14	15-35	0.16

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

# AQX

## RECOMMENDED CUTTING CONDITIONS

### FOR HELICAL CUTTING



- How to derive a locus of the centre of the tool.
- Depth of cut per pass.
- Min. machined hole diameter for helical cutting : 1.2DC
- Max. machined hole diameter for helical cutting: 1.8DC
- For chip discharge, please always apply air blow.  
(When machining aluminium, please use coolant.)
- When using G1 breaker (VP15TF), please reduce the feed rate by 20 %.

$\emptyset dc$	=	$\emptyset DH$	-	DC
Locus of the centre of the tool		Desired hole diameter		Cutting edge diameter
$P = \pi \times dc \times \tan \alpha^\circ$				
<small>*<math>\alpha^\circ &lt; 3^\circ</math></small>				

Material	Properties	Ø 16, 17				Ø 20, 21				Ø 25, 26			
		DH	APMX	f	P	DH	APMX	f	P	DH	APMX	f	P
P Mild steel	<180HB	20	8	0.16	0.44	24	10	0.18	0.44	30	12.5	0.2	0.55
		25	12	0.14	0.99	30	15	0.16	1.1	38	19	0.18	1.43
		29	16	0.12	1.43	36	20	0.14	1.76	45	25	0.16	2.2
Carbon steel Alloy steel	180-350HB	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	0.1	1.07	36	20	0.12	1.32	45	25	0.14	1.65
M Stainless steel	<270HB	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	0.1	0.71	36	10	0.12	0.88	45	12.5	0.14	1.1
K Cast iron	<350MPa	20	10	0.16	0.55	24	14	0.18	0.55	30	18	0.2	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
S Titanium alloy		20	10	0.18	0.44	24	14	0.2	0.44	30	18	0.22	0.55
		25	13	0.16	0.99	30	17	0.18	1.1	38	21	0.2	1.43
		29	16	0.14	1.43	36	20	0.16	1.76	45	25	0.18	2.2
N Aluminium alloy		20	3	0.1	0.22	24	4	0.11	0.22	30	5	0.13	0.27
		25	5	0.08	0.49	30	7	0.1	0.55	38	9	0.11	0.71
		29	8	0.07	0.71	36	10	0.08	0.88	45	12.5	0.1	1.1
H Hardened steel	40-55HRC	20	3	0.1	0.22	24	4	0.12	0.22	30	5	0.14	0.27
		25	5	0.08	0.49	30	7	0.1	0.55	38	9	0.12	0.71
		29	8	0.06	0.71	36	10	0.08	0.88	45	12.5	0.1	1.1

# AQX

## RECOMMENDED CUTTING CONDITIONS

### FOR HELICAL CUTTING

Material	Properties	Ø 32, 33				Ø 35				Ø 40				Ø 50				
		DH	APMX	f	P	DH	APMX	f	P	DH	APMX	f	P	DH	APMX	f	P	
P	Mild steel	<180HB	38	16	0.25	0.66	42	18	0.28	0.77	48	20	0.3	0.88	60	25	0.35	1.1
			48	24	0.22	1.76	53	27	0.24	1.97	60	30	0.26	2.19	75	38	0.3	2.74
			58	32	0.2	2.85	63	35	0.21	3.07	72	40	0.22	3.51	90	50	0.26	4.39
	Carbon steel Alloy steel	180-350HB	38	16	0.2	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	0.2	2.63	90	50	0.24	3.29
M	Stainless steel	<270HB	38	6	0.2	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	1.1	75	18	0.26	1.37
			58	16	0.16	1.43	63	18	0.18	1.53	72	20	0.2	1.75	90	25	0.274	2.19
K	Cast iron	<350MPa	38	22	0.25	0.82	42	25	0.28	0.95	48	28	0.3	1.1	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	0.3	3.43
			58	32	0.2	3.57	63	35	0.21	3.84	72	40	0.22	4.39	90	50	0.26	5.49
S	Titanium alloy		38	22	0.27	0.66	42	25	0.3	0.77	48	28	0.32	0.88	60	35	0.37	1.1
			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
N	Aluminium alloy		38	6	0.14	0.33	42	7	0.15	0.38	48	8	0.18	0.44	60	10	0.2	0.55
			48	11	0.13	0.88	53	13	0.14	0.99	60	14	0.15	1.1	75	18	0.18	1.37
			58	16	0.11	1.43	63	18	0.13	1.53	72	20	0.14	1.75	90	25	0.17	2.19
H	Hardened steel	40-55HRC	38	6	0.16	0.33	42	7	0.17	0.38	48	8	0.18	0.44	60	10	0.2	0.55
			48	11	0.14	0.88	53	13	0.15	0.99	60	14	0.16	1.1	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

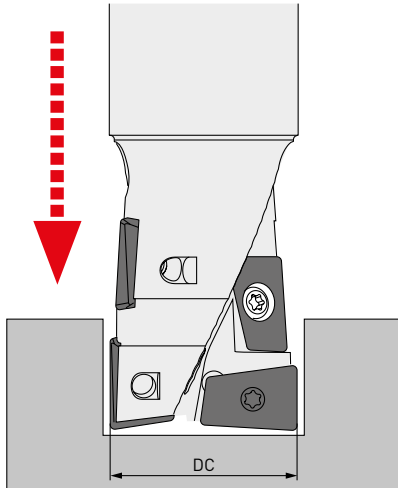
1. Helical grooving is strongly recommended for machining tempered steel.
2. When using G1 breaker (VP15TF), please reduce the feed rate by 20%.

# AQX

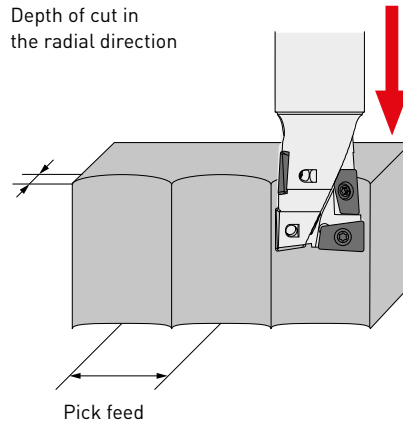
## RECOMMENDED CUTTING CONDITIONS

### FOR DRILLING AND PLUNGING

#### DRILLING



#### 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 for plunging operations.

Depth of cut in the radial direction	< 0.4DC
Pick feed	< 0.5DC

- The recommended drilling depth is less than 0.5 DC.
- Use step feed when drilling (0.25 – 0.5 mm) to ensure that the chips are effectively broken.
- Use internal or external coolant to ensure efficient chip disposal.
- The chips generated can dispel in any direction, ensure that adequate safety precautions are taken.

Material	Properties	Ø 16, 17		Ø 20, 21		Ø 25, 26		Ø 32, 33, 35		Ø 40		Ø 50		
		fz	Step	fz	Step	fz	Step	fz	Step	fz	Step	fz	Step	
P	Mild steel	<180HB	0.035	0.2	0.045	0.3	0.05	0.3	0.055	0.3	0.06	0.3	0.065	0.3
	Carbon steel Alloy steel		0.03	0.2	0.04	0.3	0.045	0.3	0.05	0.3	0.055	0.3	0.06	0.3
M	Stainless steel	<270HB	0.03	0.15	0.04	0.25	0.045	0.25	0.05	0.25	0.055	0.25	0.06	0.25
K	Cast iron	<350MPa	0.04	0.4	0.05	0.5	0.06	0.5	0.065	0.5	0.07	0.5	0.075	0.5
N	Aluminium alloy		0.04	0.2	0.05	0.3	0.06	0.3	0.065	0.3	0.07	0.3	0.075	0.3
H	Hardened steel	40–55HRC	0.02	0.15	0.03	0.25	0.035	0.25	0.04	0.25	0.045	0.25	0.05	0.25

1. Helical grooving is strongly recommended for machining tempered steel.
2. When using G1 breaker (VP15TF), please reduce the feed rate by 20 %.

---

# AQX

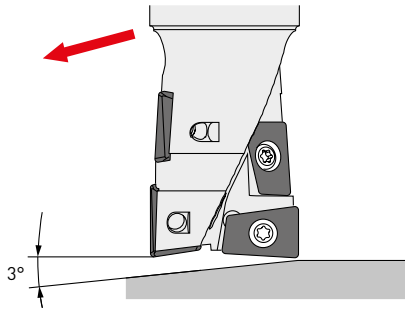
---

## RECOMMENDED CUTTING CONDITIONS

---

FOR DRILLING AND PLUNGING

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

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

**GERMANY**

MMC HARTMETALL GMBH  
Comeniusstr. 2 . 40670 Meerbusch  
Phone +49 2159 91890 . Fax +49 2159 918966  
Email admin@mmchg.de

**U.K.**

MMC HARDMETAL U.K. LTD.  
Mitsubishi House . Galena Close . Tamworth . Staffs. B77 4AS  
Phone +44 1827 312312 . Fax +44 1827 312314  
Email sales@mitsubishicarbide.co.uk

**SPAIN**

mitsubishi MATERIALS ESPAÑA, S.A.  
Calle Emperador 2 . 46136 Museros/Valencia  
Phone +34 96 1441711 . Fax +34 96 1443786  
Email comercial@mmevalencia.es

**FRANCE**

MMC METAL FRANCE S.A.R.L.  
6, Rue Jacques Monod . 91400 Orsay  
Phone +33 1 69 35 53 53 . Fax +33 1 69 35 53 50  
Email mmfsales@mmc-metal-france.fr

**POLAND**

MMC HARDMETAL POLAND SP. Z O.O  
Al. Armii Krajowej 61 . 50-541 Wrocław  
Phone +48 71335 1620 . Fax +48 71335 1621  
Email sales@mitsubishicarbide.com.pl

**RUSSIA**

MMC HARDMETAL OOO LTD.  
Electrozavodskaya St. 24 . build. 3 . Moscow . 107023  
Phone +7 495 725 58 85 . Fax +7 495 981 39 79  
Email info@mmc-carbide.ru

**ITALY**

MMC ITALIA S.R.L.  
Viale Certosa 144 . 20156 Milano  
Phone +39 0293 77031 . Fax +39 0293 589093  
Email info@mmc-italia.it

**TURKEY**

MMC HARTMETALL GMBH ALMANYA - İZMİR MERKEZ ŞUBESİ  
Adalet Mahallesi Anadolu Caddesi No: 41-1 . 15001 35530 Bayraklı /İzmir  
Phone +90 232 5015000 . Fax +90 232 5015007  
Email info@mmchg.com.tr

[www.mitsubishicarbide.com](http://www.mitsubishicarbide.com) | [www.mmc-hardmetal.com](http://www.mmc-hardmetal.com)


DISTRIBUTED BY:

□

□

└

└

Order Code: B021E 

Published: 2018.04 (0), printed in Germany