

AQX

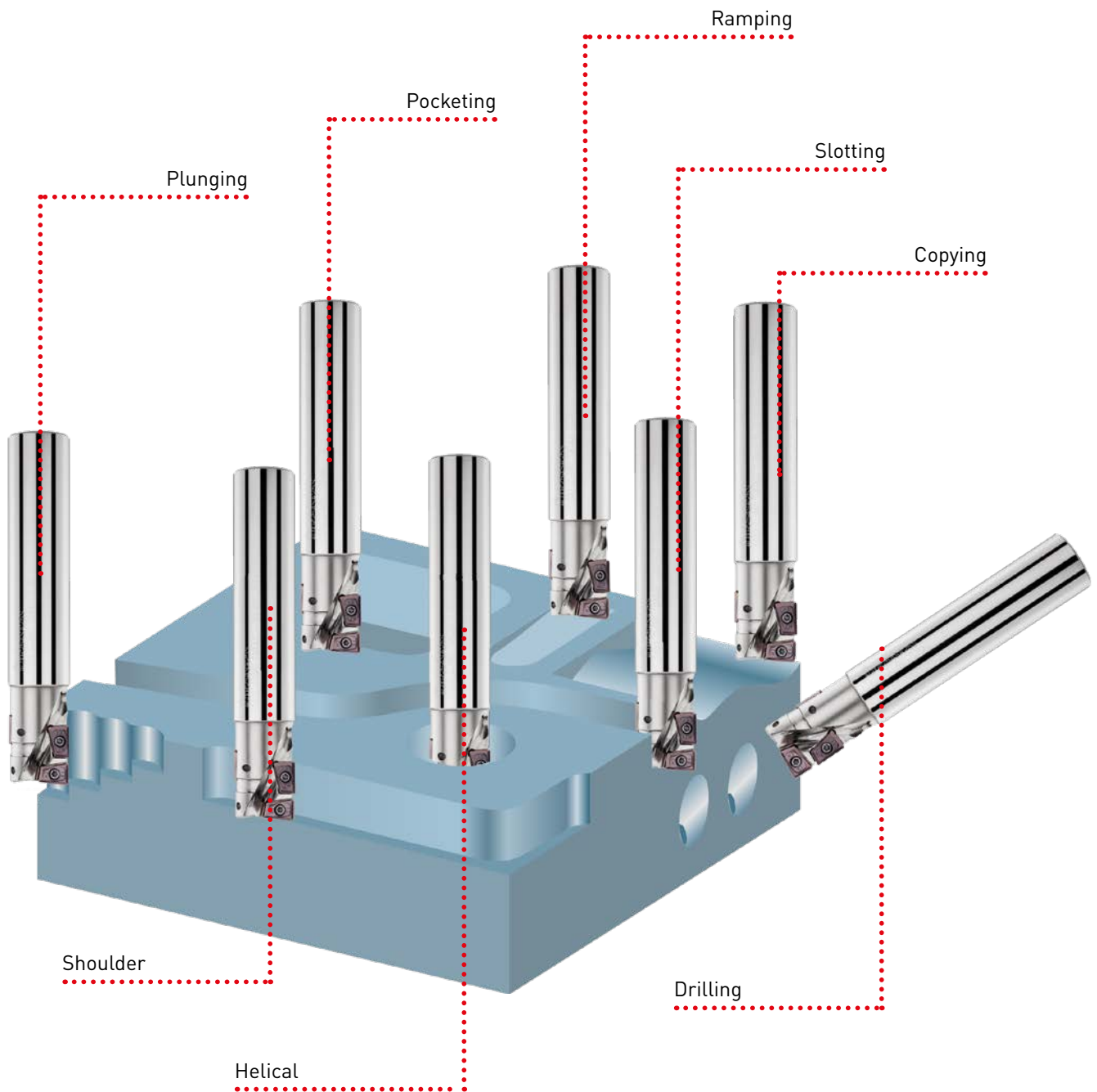
MULTI-FUNCTIONAL INDEXABLE INSERT END MILL



 MITSUBISHI MATERIALS

AQX

MULTI-FUNCTIONAL INDEXABLE INSERT END MILL

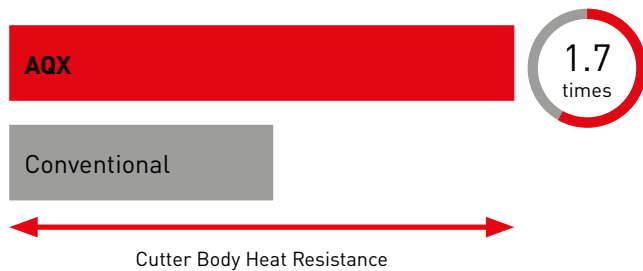


AQX

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.



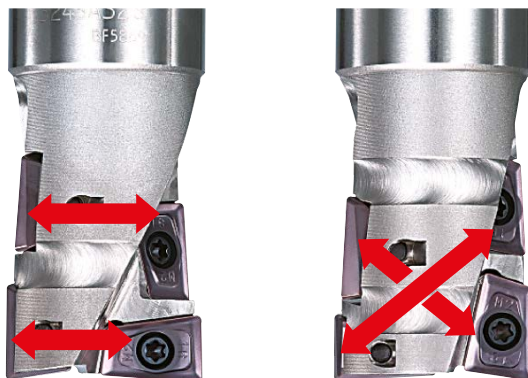
2 INSERT BOTTOM CUTTING EDGE

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



ONE INSERT TYPE

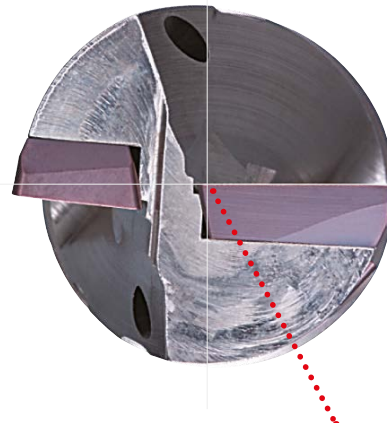
Tool management is simplified by using only one type of insert for all 4 cutting edges. By rotating the inserts it's possible to use all 4 corners.



Insert Rotation

CENTRE CUTTING EDGE

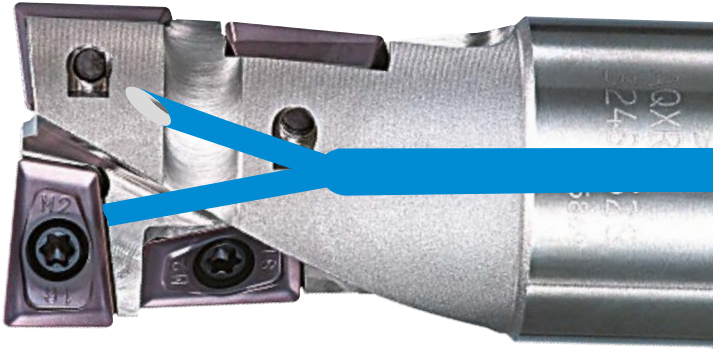
The AQX is designed with a centre cutting edge, making it possible to sink, helical mill and pocket machine without a pre-drilled hole.



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

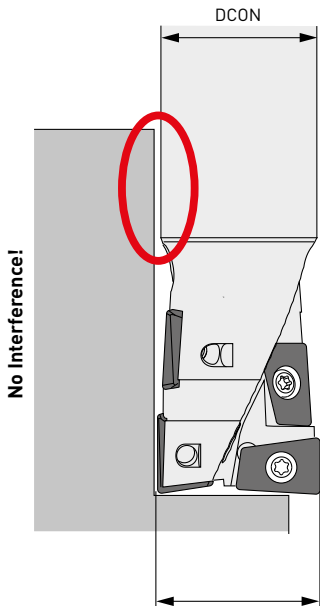
An economical short edge type body is available with 2 inserts for short depth of cut applications.



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



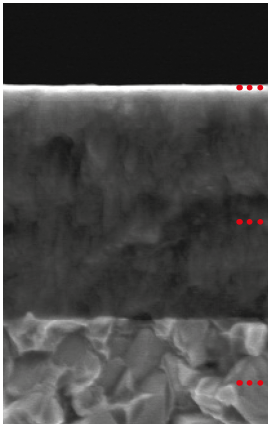
MP6100



MP7100



MP9100



Excellent welding resistance due to low coefficient of friction

PVD accumulated coating prevents abnormal damage

Special cemented carbide substrate

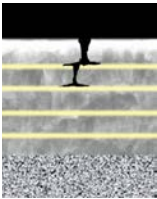
TOUGH-Σ TECHNOLOGY

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

PVD ACCUMULATED COATING

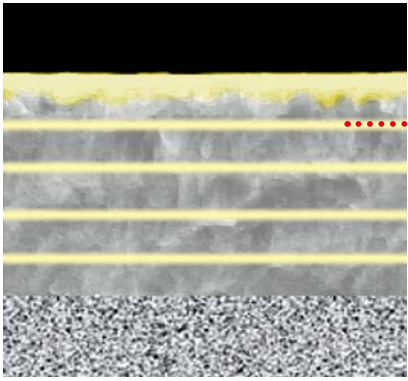
Base Layer with high compressed (Al,Ti,Cr)N

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

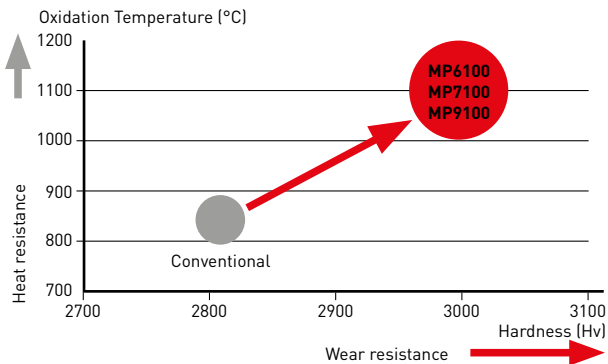


Graphical Representation

•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		
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

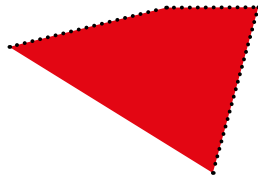
INSERT GRADES FOR A WIDE RANGE OF MATERIALS

P	PVD			M	PVD			K	PVD		
P10				M10				K10			
P20	MP6120	VP15TF		M20	MP7130			K20	VP15TF		
P30			MP6130	M30		MP7140	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			

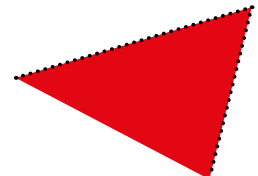
WIDE RANGE OF INSERTS

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.

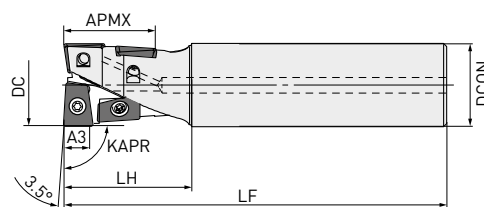
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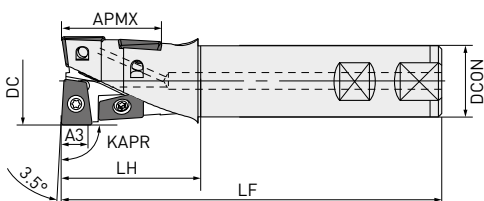
MULTI FUNCTIONAL MILLING



1



2



Right hand tool holder only.

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

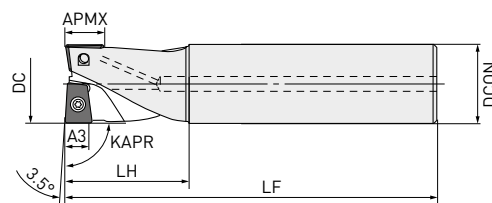
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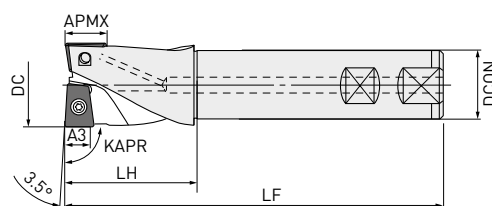
MULTI FUNCTIONAL MILLING



1



2



Right hand tool holder only.

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

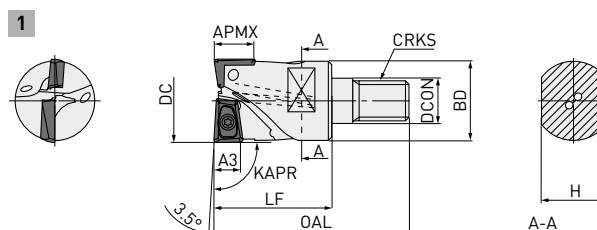
*1 Dimension A3 represents the depth of cut when the cutting edge consists of 2 inserts.

AQX



MULTI FUNCTIONAL MILLING – SCREW-IN

P M K S N H



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				
AQXR20	TS25		1 TKY08F	
AQXR21				
AQXR25	TS33		2 TKY08D	
AQXR26				
AQXR32	TS407		2 TKY15D	
AQXR33				
AQXR35				
AQXR40	TS55		2 TKY25D	
AQXR50	TS6S		3 TKY30T	

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

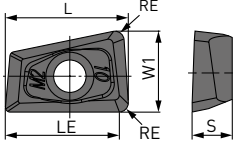
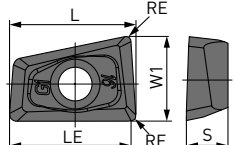
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INSERTS

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	MP6120	MP6130	MP7130	MP7140	MP9120	VP15TF	VP30RT	HTi10	L	LE	W1	S	RE	Geometry
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

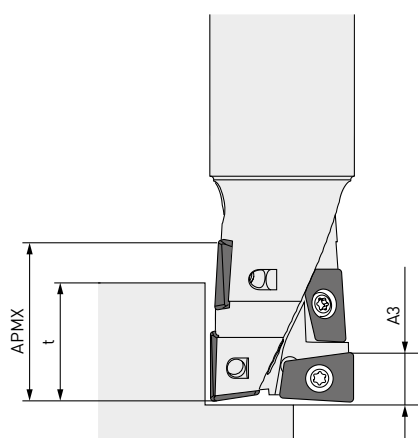
Material	Properties	Grade	Vc
P	Mild steel <180HB	MP6120	200 (170-240)
		VP15TF	180 (150-220)
		MP6130	160 (130-200)
	Carbon steel Alloy steel 180-350HB	MP6120	180 (140-220)
		VP15TF	160 (120-200)
M	Stainless steel <270HB	MP6130	140 (100-180)
		MP7130	170 (120-200)
		MP7140	160 (100-180)
K	Cast iron Ductile cast iron —	VP30RT (VP15TF)	150 (120-180)
		VP15TF	180 (150-220)
S	Titanium alloy —	MP9120	50 (30- 70)
N	Aluminium alloy Si<5% Si>5%	HTI10	500 (200-800)
		HTI10	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

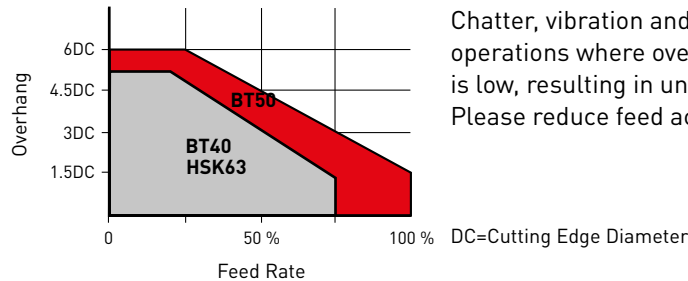
Material		Properties	Ø 32, 33			Ø 35			Ø 40			Ø 50		
			ap	ae	f	ap	ae	f	ap	ae	f	ap	ae	f
P	Mild steel	≤180HB	<9.5	<16	0.4	<11	<17.5	0.45	<12	<20	0.5	<15	<25	0.6
			9.5–22	<11	0.32	11–25	<12	0.35	12–28	<13	0.4	15–35	<16	0.5
			22–35	<6	0.25	25–40	<6.5	0.28	28–44	<7	0.3	35–55	<10	0.35
	Carbon steel Alloy 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
	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

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RECOMMENDED CUTTING CONDITIONS

CUTTING CONDITIONS FOR SLOTTING

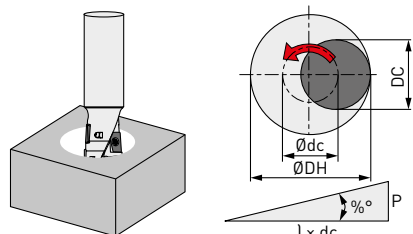
Material		Properties		Ø 32, 33		Ø 35		Ø 40		Ø 50	
				ap	f	ap	f	ap	f	ap	f
P	Mild steel	<180HB	<9.5	0.25	<11	0.27	<12	0.3	<15	0.35	
			9.5–22	0.2	11–25	0.22	12–28	0.25	15–35	0.3	
			22–35	0.14	25–40	0.16	28–44	0.18	35–55	0.22	
	Carbon steel Alloy steel	180–350HB	<9.5	0.2	<11	0.22	<12	0.25	<15	0.3	
			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 %.

$\varnothing dc$	=	$\varnothing DH$	-	DC
Locus of the centre of the tool		Desired hole diameter		Cutting edge diameter
$P = \pi \times dc \times \tan \alpha^\circ$				
* $\alpha^\circ < 3^\circ$				

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

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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

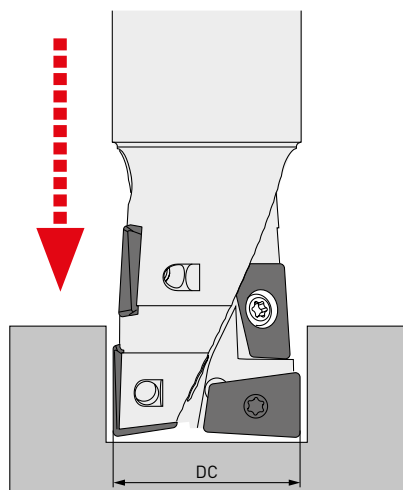
1. Helical grooving is strongly recommended for machining tempered steel.
2. When using G1 breaker (VP15TF), please reduce the feed rate by 20%.

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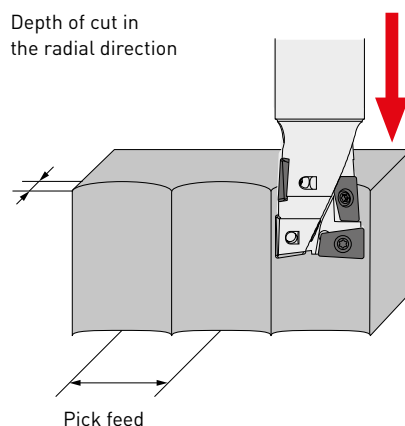
RECOMMENDED CUTTING CONDITIONS

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

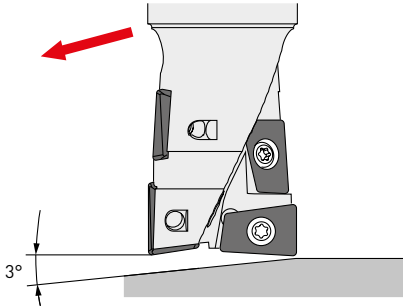
1. Helical grooving is strongly recommended for machining tempered steel.
2. When using G1 breaker (VP15TF), please reduce the feed rate by 20 %.

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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%.

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