MillLine

DOREC

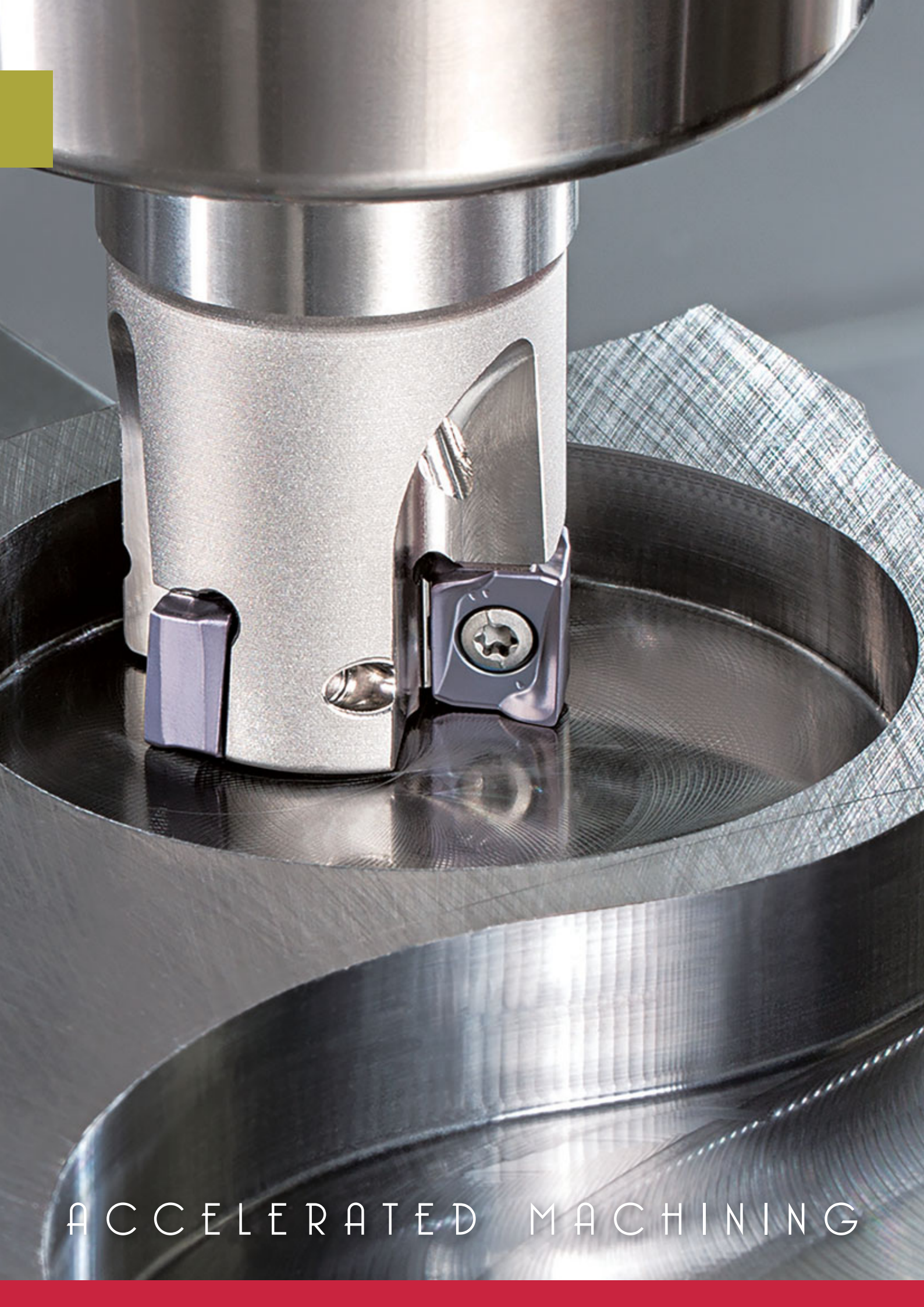
www.tungaloy.com

Tungaloy Report No. 390-G

Strong, Free-cutting Edges **Guarantee Maximum Machining Efficiency and Stability**

INDUSTRY 4.0

FEED the SPEED!


ACCELERATED MACHINING

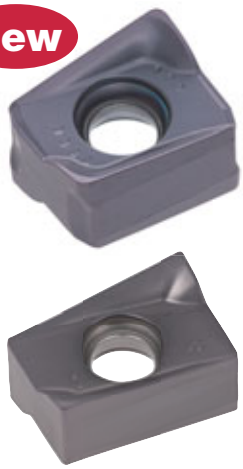
DOREC TUNGALOY

TUNG FORCE MILL
ACCELERATED MACHINING

Optimized cutting edge integrity for **maximum productivity and tool reliability**

Inserts for Best Economy and Efficiency!

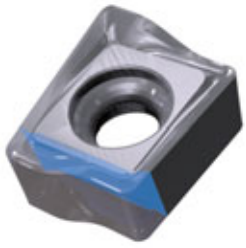
Broad range of economical inserts



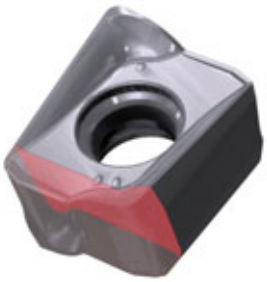
Innovative multi-functional geometry enables 3D milling applications

Universal geometry for superior surface finish

■ Superior cutting edge integrity



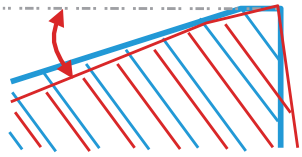
Common negative insert for shoulder milling



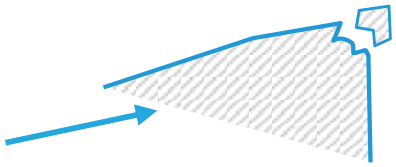
Obtuse cutting edge

DOREC

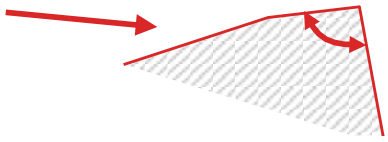
Common insert profile



Higher rake angle!



Where negative inserts fail …



Obtuse cutting edge does not fracture!

■ Higher feed-per-tooth capability

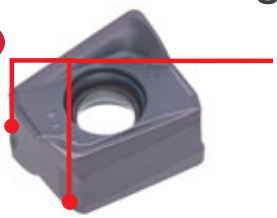
Feed per tooth: *fz* (mm/t)

	0.1	0.15	0.2	0.25	0.3	0.35	0.4
Competitor	◎	◎	◎	x : Tool damage			
DOREC	◎	◎	◎	◎	◎	○	○

Cutter	: TPQ11R050M22.0-06 (DC = 50 mm, z = 6)
Insert	: LQMU110708PXER-MJ AH3135
Grade	: AH3135
Material	: S55C (200HB)
Cutting Speed	: 200 m/min
Cutting depth	**: 4 mm**
Cutting width	: 42.5 mm
Coolant	: Dry
Machine	: Vertical M/C, 22 kW

Optimized insert geometry

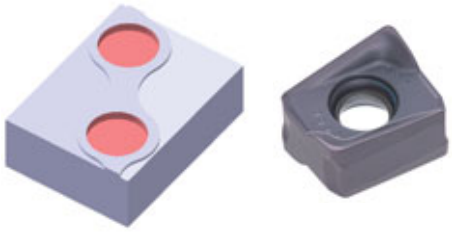
New



Unique clearance design enables 3D milling

Better machining efficiency by high-feed circular ramping

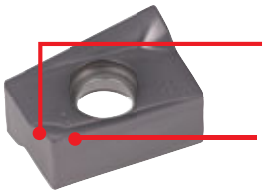
Comparison of M.R.R.



Circular ramping
Material: S55C / C55 (200HB)
Machine: Ver MC, BT50

Cutting conditions	DOREC	Competitor
Cutter	**EPQ11R032M32.0-03** (DC = 32 mm, z = 3)	DC = 32 mm, z = 3
Insert	**LQMU110708PXER-MJ** AH3135	2-edged inserts P30 equivalent
Cutting speed: *Vc* (m/min)	200	
Depth of cut: *ap* (mm)	2 (pitch of a helix)	
Feed per tooth: *fz* (mm/t)	0.4	0.2
Metal removal rate: Q (cc/min)	152.8	76.4
Width of cut: ae (mm)	ø62 mm, Hole making	

Universal insert geometry for superior surface finish



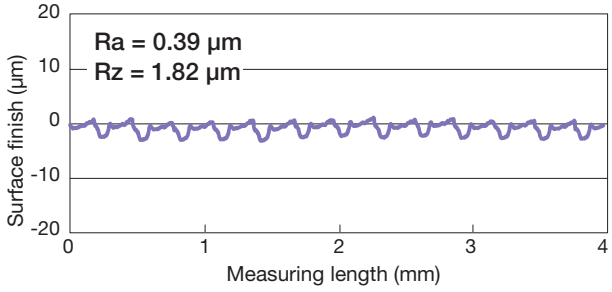
Wiper edge for high surface finish quality

Free cutting geometry

Free-cutting geometry and superior surface finish

Provides free cutting as positive inserts and wiper effect

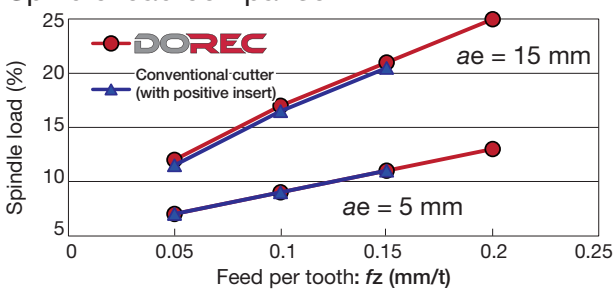
Surface finish



Superior surface finish quality achieved by economical inserts!

Cutter	: TPQ18R050M22.0E03 (DC = 50 mm, z = 3)
Insert	: LQMU1808008PNER-MJ
Grade	: AH725
Workpiece material	: S55C / C55 (200HB)
Cutting speed	: *Vc* = 150 m/min
Feed per tooth	: *fz* = 0.1 mm/t
Depth of cut	: *ap* = 10 mm
Width of cut	: *ae* = 50 mm
Coolant	: Wet
Machine	: Vertical M/C, BT50

Spindle load comparison

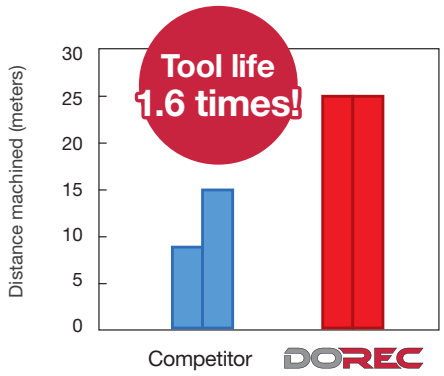


Similar load levels as a conventional tool!

Cutter	: EPQ18R040M32.0W03 (DC == 40 mm, z = 3)
Insert	: LQMU180808PNER-MJ
Workpiece material	: S55C / C55 (200HB)
Cutting speed	: *Vc* = 150 m/min
Depth of cut	: *ap* = 16 mm
Coolant	: Wet
Machine	: Vertical M/C, BT50

CUTTING PERFORMANCE

Tool life comparison: steel machining

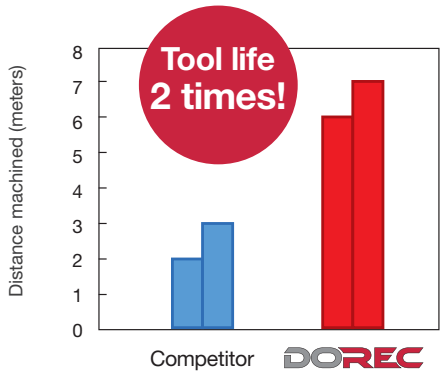


P

Cutter	: TPQ11R050M22.0-06 (DC = 50 mm, z = 6)
Insert	: LQMU110708PXER-MJ
Grade	: AH3135
Workpiece material	: S55C (200HB)
Cutting speed	: *Vc* = 150 m/min
Feed per tooth	: *fz* = 0.2 mm/t
Cutting depth	: *a*p = 5.0 mm
Cutting width	: *a*e = 30 mm
Coolant	: Dry
Number of inserts	: 1 insert
Machine	: Vertical M/C, 22 kW

A combination of strong cutting edge geometry and high wear resistant AH3135, treated by PremiumTec, yielded longer tool life and superior machining stability over the competitor's.

Tool life comparison: stainless steel machining



M

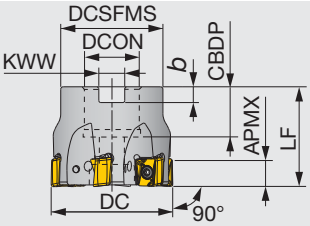
Cutter	: TPQ11R050M22.0-06 (DC = 50 mm, z = 6)
Insert	: LQMU110708PXER-MJ
Grade	: AH3135
Workpiece material	: SUS304 (180HB)
Cutting speed	: *Vc* = 150 m/min
Feed per tooth	: *fz* = 0.2 mm/t
Cutting depth	: *a*p = 5.0 mm
Cutting width	: *a*e = 30 mm
Coolant	: Dry
Number of inserts	: 1 insert
Machine	: Vertical M/C, 22 kW

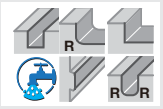
Free cutting action with reduced built-up edge and thermal cracks. Superior cutting edge integrity eliminated notch wear, delivering more stable and longer tool life over the competitor's.

TPQ11,18

Square shoulder milling cutter, bore type, with rectangular double-sided LQMU inserts

A.R. = +4° ~ +5°, R.R. = +13° ~ +15°





Right hand (R) shown.

Designation	APMX	DC	z	DCSFMS	LF	DCON	CBDP	KWW	*b*	Kg	Air hole	Insert
TPQ11R040M16.0E04	9	40	4	35	40	16	20	8.4	5.6	0.2	with	LQMU1107...
TPQ11R050M22.0E06	9	50	6	41	40	22	20	10.4	6.3	0.4	with	LQMU1107...
TPQ11R063M22.0E07	9	63	7	47	40	22	20	10.4	6.3	0.5	with	LQMU1107...
TPQ11R080M25.4-10	9	80	10	55	50	25.4	26	9.5	6	1.1	with	LQMU1107...
TPQ11R080M27.0E10	9	80	10	58	50	27	26	12.4	7	1	with	LQMU1107...
TPQ11R100M31.7-12	9	100	12	66	50	31.75	32	12.95	8	1.6	with	LQMU1107...
TPQ11R100M32.0E12	9	100	12	66	50	32	32	14.4	8	1.6	with	LQMU1107...
TPQ18R050M22.0E03	14	50	3	47	40	22	20	10.4	6.3	0.4	with	LQMU1808...
TPQ18R063M25.4-04	16	63	4	55	50	25.4	26	9.5	6	0.7	with	LQMU1808...
TPQ18R063M27.0E04	16	63	4	58	50	27	26	12.4	7	0.5	with	LQMU1808...
TPQ18R080M25.4-05	16	80	5	55	50	25.4	26	9.5	6	0.9	with	LQMU1808...
TPQ18R080M27.0E05	16	80	5	58	50	27	26	12.4	7	0.9	with	LQMU1808...
TPQ18R100M31.7-06	16	100	6	70	50	31.75	32	12.95	8	1.4	with	LQMU1808...
TPQ18R100M32.0E06	16	100	6	66	50	32	32	14.4	8	1.4	with	LQMU1808...
TPQ18R125M38.1-08	16	125	8	80	63	38.1	38	15.9	10	2.9	with	LQMU1808...
TPQ18R125M40.0E08	16	125	8	82	63	40	38	16.4	9	2.9	with	LQMU1808...
TPQ18R160M50.8-09	16	160	9	100	63	50.8	38	19	11	4.1	without	LQMU1808...
TPQ18R160M40.0E09	16	160	9	100	63	40	38	16.4	9	4.1	without	LQMU1808...

SPARE PARTS

Designation	Clamping screw	Grip	Grip 1	Torx bit	Center bolt
TPQ11R040M...	CSTB-3.5L115	SW6-SD	-	BLDT10/S7	CM8×30H
TPQ11R050M...	CSTB-3.5L115	SW6-SD	-	BLDT10/S7	CM10×30H
TPQ11R063M...	CSTB-3.5L115	SW6-SD	-	BLDT10/S7	CM10×30H
TPQ11R080M...	CSTB-3.5L115	SW6-SD	-	BLDT10/S7	CM12×30H
TPQ11R100M...	CSTB-3.5L115	SW6-SD	-	BLDT10/S7	TMBA-M16H
TPQ18R050M...	SR14-591	-	H-TB	BT20M	CM10×30H
TPQ18R063M...	SR14-591	-	H-TB	BT20M	CM12×30H
TPQ18R080M...	SR14-591	-	H-TB	BT20M	CM12×30H
TPQ18R100M...	SR14-591	-	H-TB	BT20M	TMBA-M16H
TPQ18R125M...	SR14-591	-	H-TB	BT20M	TMBA-M20H
TPQ18R160M...	SR14-591	-	H-TB	BT20M	-

EPQ11,18

Square shoulder milling cutter, shank type, with rectangular double-sided LQMU inserts

A.R. = +4° ~ +5°, R.R. = +13° ~ +15°

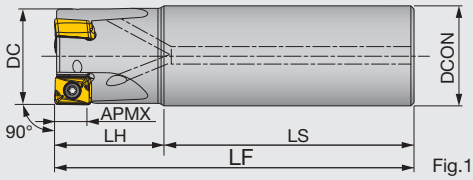


Fig.1

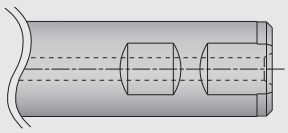
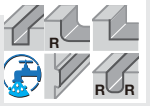


Fig.2



Right hand (R) shown.

Designation	APMX	DC	z	DCON	LS	LH	LF	Kg	Air hole	Insert	Shank style
EPQ11R025M25.0-02	9	25	2	25	70	30	100	0.3	with	LQMU1107...	Fig.1
EPQ11R032M32.0-03	9	32	3	32	80	35	115	0.7	with	LQMU1107...	Fig.1
EPQ11R040M32.0-04	9	40	4	32	80	35	115	0.8	with	LQMU1107...	Fig.1
EPQ11R050M32.0-05	9	50	5	32	80	40	120	0.9	with	LQMU1107...	Fig.1
EPQ11R063M32.0-06	9	63	6	32	80	40	120	1.1	with	LQMU1107...	Fig.1
EPQ11R080M32.0-07	9	80	7	32	80	40	120	1.4	with	LQMU1107...	Fig.1
EPQ18R040M32.0W03	14	40	3	32	75	35	110	0.7	with	LQMU1808...	Fig.2
EPQ18R050M32.0W04	14	50	4	32	75	40	115	0.9	with	LQMU1808...	Fig.2

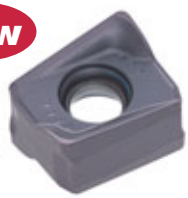
SPARE PARTS

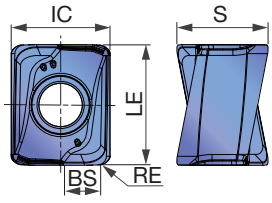
Designation	Clamping screw	Grip	Grip 1	Torx bit	Wrench
EPQ11...	CSTB-3.5L115	SW6-SD	-	BLDT10/S7	T-10D
EPQ18...	SR14-591	-	H-TB	BT20M	T-20D

INSERTS

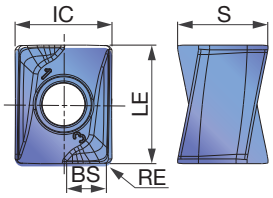
LQMU11-PXER-MJ

New





LQMU11/18-PNER-MJ



P	Steel	☆		★	★	
M	Stainless		★	☆	★	
K	Cast iron	★		☆		
N	Non-ferrous					
S	Superalloys	★		★	☆	
H	Hard materials					

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated				LE	S	IC	BS	Cutter
			AH120	AH140	AH725	AH3135					
LQMU110704PNER-MJ	0.4	9	●	●	●		11	8.3	9	1.5	EPQ11R, TPQ11R
LQMU110708PNER-MJ	0.8	9	●	●	●		11	8.3	9	1.1	EPQ11R, TPQ11R
New LQMU110708PXER-MJ	0.8	9	●			●	11	8.3	9	1.1	EPQ11R, TPQ11R
LQMU110716PNER-MJ	1.6	9	●	●	●		11	8.3	9	0.3	EPQ11R, TPQ11R
LQMU110720PNER-MJ	2	9	●				11	8.3	9	-	EPQ11R, TPQ11R
LQMU180804PNER-MJ	0.4	16	●	●	●		17.5	10.9	11.5	2.0	EPQ18R, TPQ18R
LQMU180808PNER-MJ	0.8	16	●	●	●		17.5	10.9	11.5	1.6	EPQ18R, TPQ18R
LQMU180816PNER-MJ	1.6	16	●	●	●		17.5	10.9	11.5	0.8	EPQ18R, TPQ18R
LQMU180824PNER-MJ	2.4	16	●	●	●		17.5	10.9	11.5	-	EPQ18R, TPQ18R

●: Line up

STANDARD CUTTING CONDITIONS

LQMU11-PXER-MJ

ISO	Workpiece material		Hardness	Grade	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	Low carbon steel S15C, etc. C15E, etc.		- 200HB	AH3135	100 - 250	0.1 - 0.25*
P	Alloy steel S55C, etc. C55, etc.		- 300HB	AH3135	100 - 230	0.1 - 0.2*
P	Prehardened steel NAK80, PX5, etc.		30 - 40HRC	AH3135	100 - 230	0.1 - 0.2*
M	Stainless steel SUS304, etc. X5CrNi18-9, etc.		-	AH3135	90 - 180	0.1 - 0.25*
K	Grey cast iron FC250, etc. 250, etc.		150 - 250HB	AH120	140 - 250	0.1 - 0.25*
K	Ductile cast iron FCD400, etc. 450-10S, etc.		150 - 250HB	AH120	110 - 200	0.1 - 0.25*
S	Titanium alloys Ti-6Al-4V, etc.		-	AH120	30 - 60	0.08 - 0.2*
S	Superalloys Inconel 718, etc.		-	AH120	20 - 50	0.06 - 0.1*
H	Hardened steel	SKD61, etc.	40 - 50HRC	AH120	45 - 70	0.08 - 0.15*
H		SKD11, etc.	50 - 60HRC	AH120	40 - 65	0.06 - 0.1*

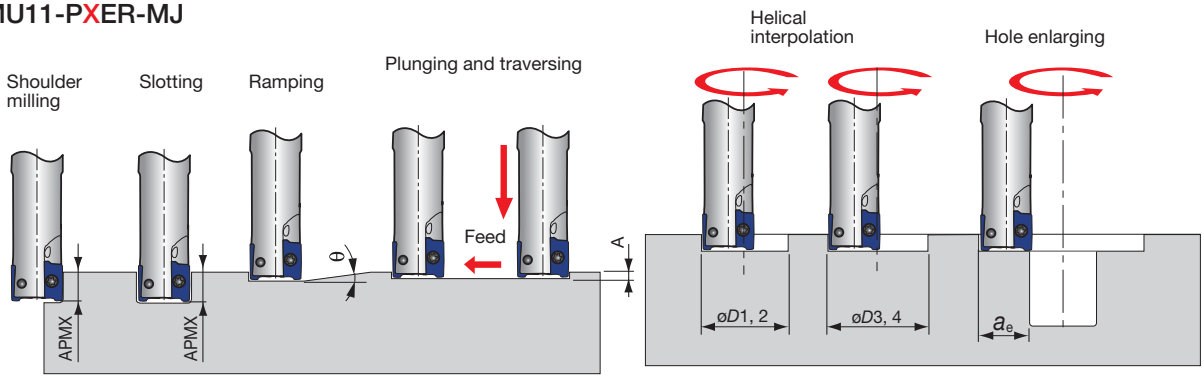
LQMU11/18-PNER-MJ

ISO	Workpiece material	Hardness HB	Grade	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	Low carbon steel S15C, etc. C15E, etc.	- 200	AH725	100 - 250	0.1 - 0.25*
P	High carbon steel S45C, S55C, etc. C45, C55, etc.	200 - 300	AH725	100 - 230	0.1 - 0.2*
P	Alloy steel SCM440, SCr415, etc. 42CrMo4, etc.	150 - 300	AH725	100 - 230	0.1 - 0.2*
P	Tool steel D2, etc. X153CrMoV12, etc.	- 300	AH725	100 - 180	0.1 - 0.2*
M	Stainless steel SUS304, etc. X5CrNi18-9, etc.	-	AH140	90 - 180	0.1 - 0.25*
K	Grey cast iron FC250, etc. 250, etc.	150 - 250	AH120	140 - 250	0.1 - 0.25*
K	Ductile cast iron FCD400, etc. 450-10S, etc.	150 - 250	AH120	110 - 200	0.1 - 0.25*
S	Superalloys Inconel 718, Ti-6Al-4V, etc.	-	AH725	20 - 50	0.08 - 0.2*

* When using LQMU11 inserts, see page 13 for proper feed per tooth setting.
· For applications with poor chip evacuation, use air gun to remove chips from the machining area to avoid chip re-cutting and part damage.
· To machine cast surface with unstable cutting depths or interruptions, it is recommended to lower the feed rate (*fz*) to the lowest parameter in the recommended range.
· Rigidity of the machine and/or workpiece and the spindle power capability greatly influence the cutting conditions. For applications with large cutting width/depth and/or long tool overhang, start with a *Vc* and *fz* in the lower range of the recommended cutting parameters and monitor the machine stability.

APPLICATION RANGE

New **LQMU11-PXER-MJ**



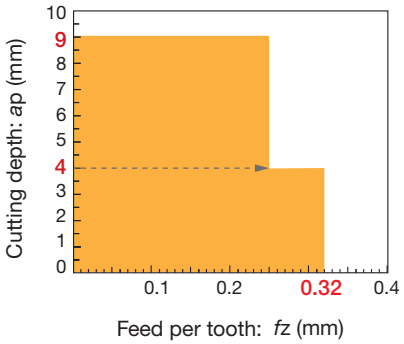
Designation	DC	Max. depth of cut APMX	Max. ramping angle θ	Max. plunging A	Min. machining øD1	Max. machining øD2*	Max. machining øD3	Max. machining øD4*	RE	Max. cutting width in enlarging ae
EPQ11R025…	25	9	1.8°	0.6	35	46.8	49	48.5	0.8	24.1
EPQ11R032…	32	9	1.3°	0.6	48	60.8	63	62.5	0.8	31.1
TPQ11R040…	40	9	0.9°	0.6	64	76.8	79	78.5	0.8	39.1
TPQ11R050…	50	9	0.7°	0.6	84	96.8	99	98.5	0.8	49.1
TPQ11R063…	63	9	0.5°	0.6	110	122.8	125	124.5	0.8	62.1
TPQ11R080…	80	9	0.4°	0.6	144	156.8	159	158.5	0.8	79.1
TPQ11R100…	100	9	0.3°	0.6	184	196.8	199	198.5	0.8	99.1

*For a flat bottom

NOTE WHEN USING LQMU11 INSERTS

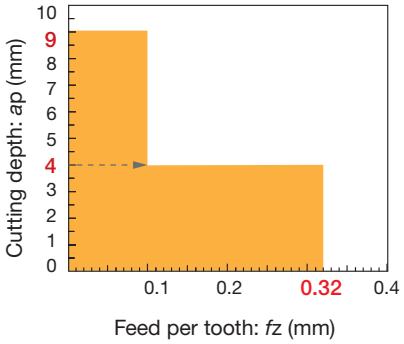
Maximum feed rate per tooth varies depending on the cutting depth and width.
Use proper feed rate as described below.
Use caution. Tool may damage if the parameters are not properly set.

Applicable feed rate (for ae < 10% of tool diameter)



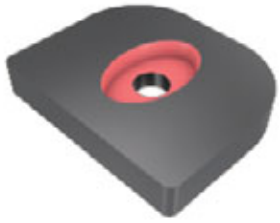
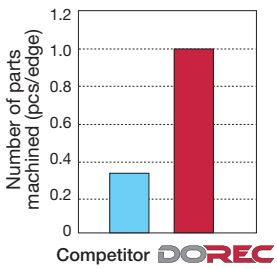
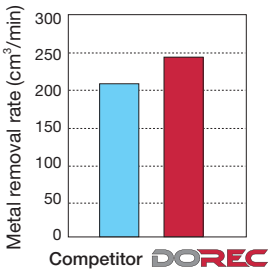
Cutter	: TPQ11R050M22.0-06 (DC = 50 mm, z = 6)
Insert	: LQMU110708PXER-MJ
Grade	: AH3135
Workpiece material	: S55C (200HB)
Cutting Speed	: *Vc* = 200 m/min
Cutting width	: *ae* = 5 mm
Coolant	: Dry
Machine	: Vertical M/C, 22 kW

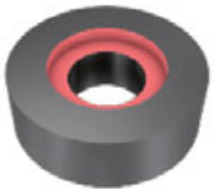
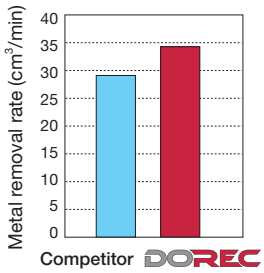
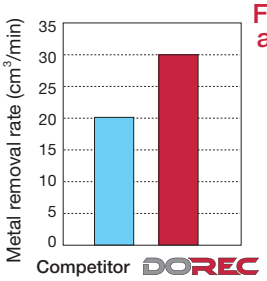
Applicable feed rate (for ae > 10% of tool diameter)

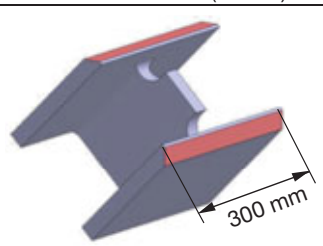
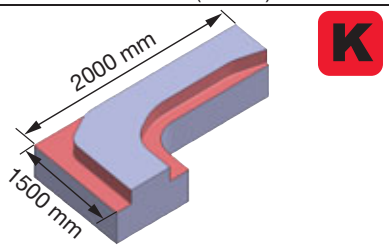
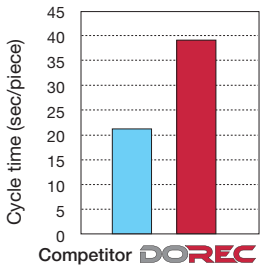
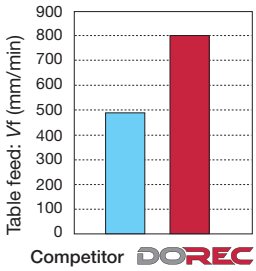


Cutter	: TPQ11R050M22.0-06 (DC = 50 mm, z = 6)
Insert	: LQMU110708PXER-MJ
Grade	: AH3125
Workpiece material	: S55C (200HB)
Cutting Speed	: *Vc* = 200 m/min
Cutting width	: *ae* = 42.5 mm
Coolant	: Dry
Machine	: Vertical M/C, 22 kW

PRACTICAL EXAMPLES

		Workpiece type	Flange sheet	Machine parts
		Milling cutter	TPQ11R080M27.0E10 (ø80, z = 10)	TPQ11R050M22.0E06 (ø50, z = 6)
		Insert	LQMU110708PXER-MJ	LQMU110708PXER-MJ
		Grade	AH3135	AH3135
		Workpiece material	Martensitic stainless steel  M	S55C / C55 P
Cutting conditions		Cutting speed: *Vc* (m/min)	180	180
		Feed per tooth: *fz* (mm/t)	0.15	0.15
		Feed speed: *Vf* (mm/min)	1074	1035
		Depth of cut: *ap* (mm)	1.0 (at 1.0 mm helix pitch)	9 (competitor's *ap* = 8)
		Width of cut: *ae* (mm)	50	26
		Application	Hole enlargement by helical interpolation	Shoulder milling
		Coolant	Dry	External supply
		Machine	Vertical M/C, BT50	Vertical M/C, BT50
		Results	 Strong cutting edge **Tool life 3 times!** Competitor's positive round inserts repetitively fractured. DoRec insert's multifunctional geometry provided stable machining thanks to its strong cutting edge geometry.	 Free cutting action **Improved productivity 1.1 times!** Overloaded cutting force and vibration were causing the competitor's inserts unpredictable tool life. DoRec insert's multifunctional geometry is optimized for chatter stability, ensuring reliable machining.

Workpiece type		Base plate	Eccentric countersink
Milling cutter		TPQ11R040M16.0E04 (ø40, z = 4)	EPQ11R032M32.0-03 (ø32, z = 3)
Insert		LQMU110708PXER-MJ	LQMU110708PXER-MJ
Grade		AH120	AH3135
Workpiece material		SS400 / E275A P	SUS304  M
Cutting conditions	Cutting speed: ***Vc*** **(m/min)**	176	150
	Feed per tooth: ***fz*** **(mm/t)**	0.15 (Competitor: *fz* = 0.12)	0.45 (Competitor:*fz* = 0.3)
	Feed speed: ***Vf*** **(mm/min)**	860 (Competitor: *Vf* = 720)	2000 (Competitor:*Vf* = 1350)
	Depth of cut: ***ap*** **(mm)**	4 (0.38°ramp approach)	1.0 (at 1.0 mm helix pitch)
	Width of cut: ***ae*** **(mm)**	10	15
	Application	Hole enlargement, helical interpolation	Hole enlargement, helical interpolation
	Coolant	External supply	External supply
	Machine	Vertical M/C, BT50	Vertical M/C, BT40
Results		 Superior cutting edge integrity Productivity up 120%! Competitor's inserts fractured at high feed rates. DoRec inserts enabled stable machining at higher feed rates thanks to its unique insert geometry.	 Free-cutting action and superior edge integrity Productivity up 150%! Competitor's inserts fractured at high feed rates, and repetitive notch wears shortened the tool life. DoRec inserts enabled stable machining at higher feed rates thanks to its superior cutting edge integrity, extending tool life 1.3x .

	Workpiece type	Machine part	Press mold
	Milling cutter	EPQ11R032M32.0-03	TPQ18R080M25.4-05
	Insert	LQMU110708PNER-MJ	LQMU180816PNER-MJ
	Grade	AH725	AH120
	Workpiece material	SS400 / E275A (150HB)	FC250 / GG25 / 250 (180HB)
			
Cutting conditions	Cutting speed: *Vc* (m/min)	200	200
Cutting conditions	Feed per tooth: *fz* (mm/t)	0.2	0.2
Cutting conditions	Feed speed: *Vf* (mm/min)	1194	800
Cutting conditions	Depth of cut: *ap* (mm)	8	12
Cutting conditions	Width of cut: *ae* (mm)	4	20 - 60
Cutting conditions	Application	Side milling	Shoulder milling
Cutting conditions	Coolant	Dry	Dry
Cutting conditions	Machine	Vertical M/C, BT50	Vertical M/C, BT50
	Results	 Superior cutting edge integrity **Improved productivity 1.8 times!** Competitor's inserts repeatedly fractured. DoRec inserts enabled machining at higher feed rates thanks to its superior edge integrity.	 Superior cutting edge integrity **Productivity up 160%!** Superior edge integrity enabled machining at higher feed rates, improving cycle time.

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