Tungaloy
Member IMC Group

Tungaloy Report No. 429-E

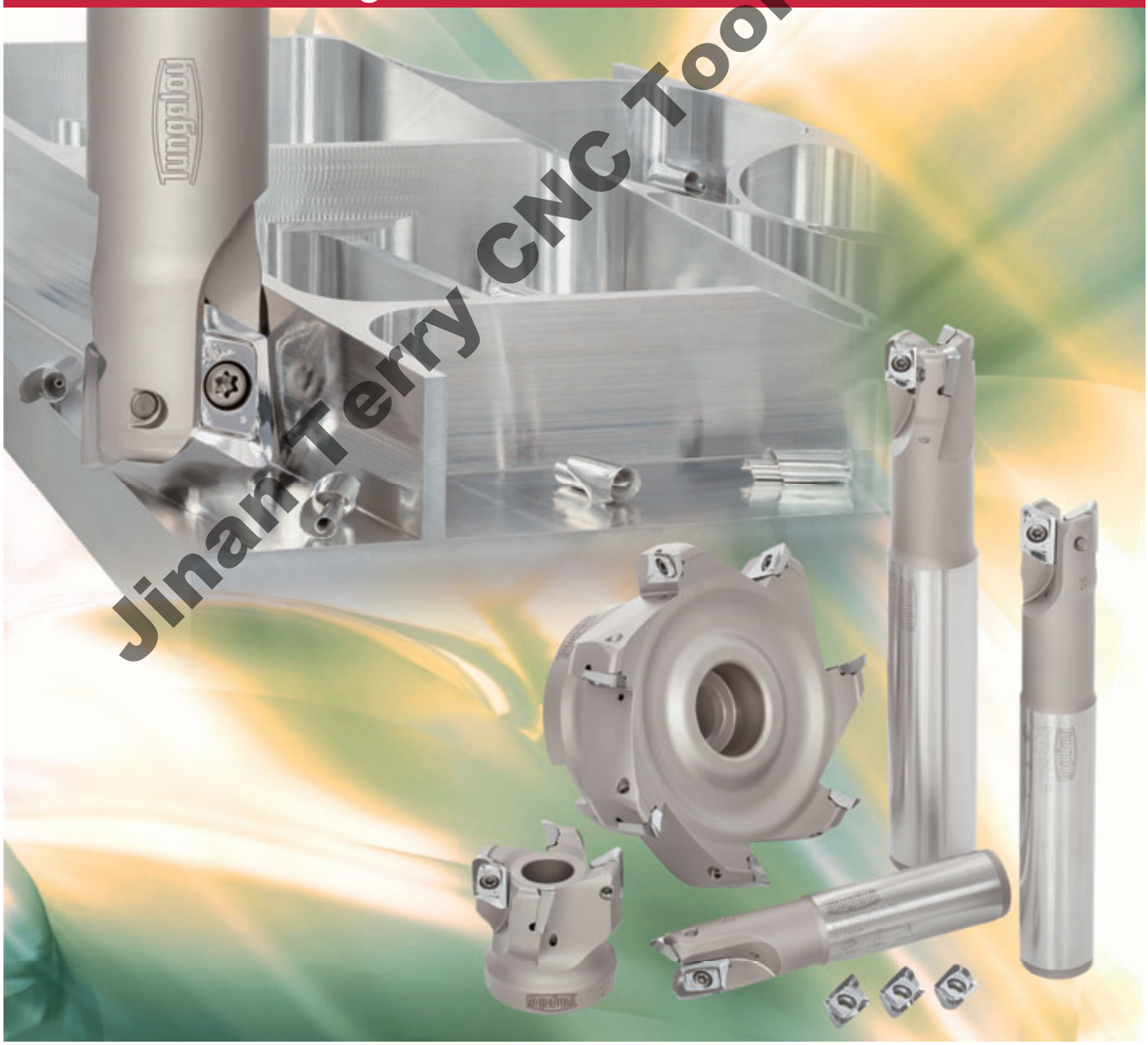
MILLLINE High speed milling cutter

TUNG-ALUMILL

NEW

TPV / EPV16 type

Exceptional productivity for aluminium and non-ferrous material machining

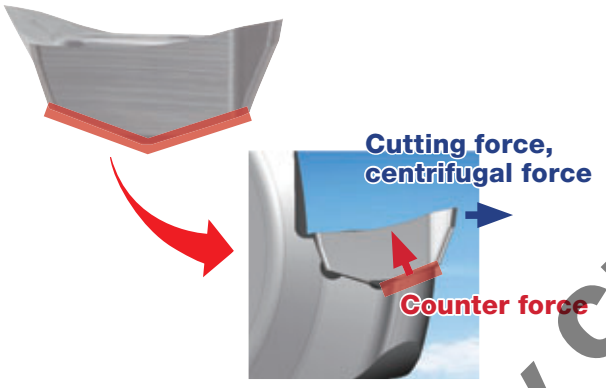


Outstanding productivity in dema applications such as high helical straight ramping and step milling!

Features

- **Exceptional productivity in aluminium and non-ferrous material machining at high cutting speeds (*Vc*) of up to 5000 m/min.**

■ V-shaped bottom insert



- **No insert movement during high ramp machining due to v-bottom clamping, also ensuring no shear forces on the screw.**

■ FE Analysis

V-shaped design reduces stress on screw

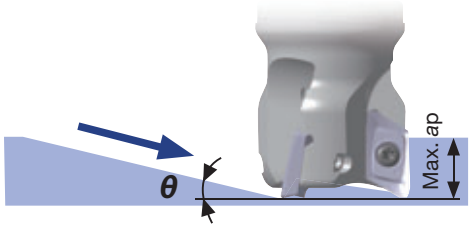
Cutters	TUNG-ALUMILL V shaped design	General type
Insert movement (down cutting)	3.0 µm, Cutting force	10.5 µm, Cutting force
Stress of screw	100%	120%

Milling cutter : EPV16R032M32.0-02 (ø32, z = 2)
Insert : XVCT160508R-AJ TH10
Work material : Aluminium alloy
Cutting speed : *Vc* = 2000 m/min
Feed per tooth : *fz* = 0.15 mm/t
Depth of cut : *ap* = 5 mm
Width of cut : *ae* = 10 mm

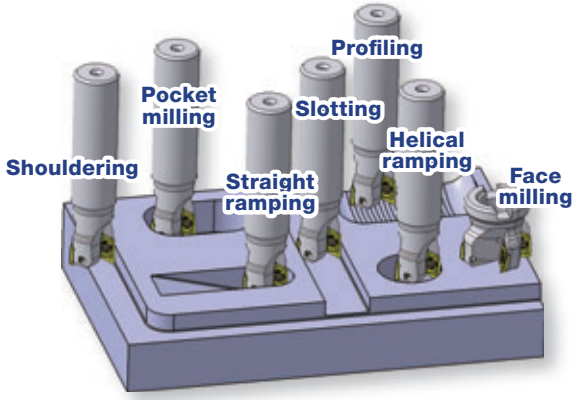
- **High positive rake and higher cutting edge clearance allows higher ramping capabilities.**

■ Comparison of max ramping angle

Tool diameter øDc: ø40 mm	TUNG-ALUMILL	Competitor		
		A	B	C
Max. ramping angle θ	11.5°	11°	9°	9°



- **Can be applied to a wide range of machining**

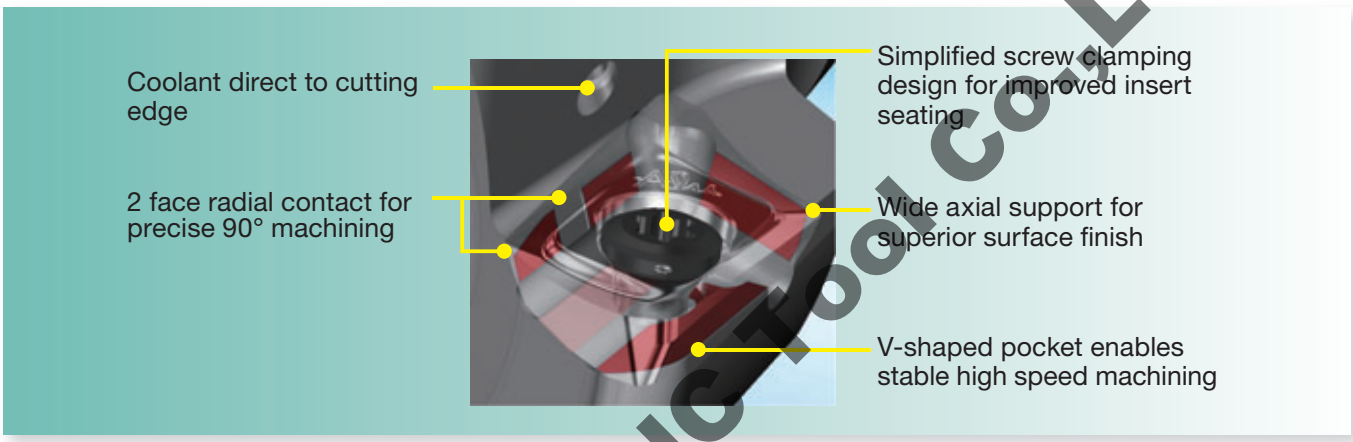


■ Target application

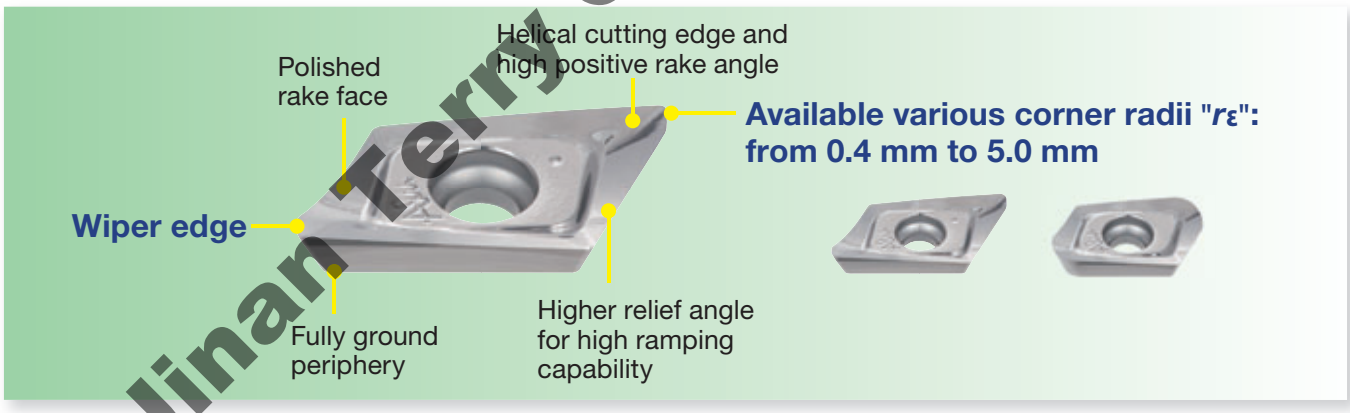
· Where productivity needs to be increased while maintaining accurate machining and high surface quality.
· Components that require high precision such as aerospace frame part.

nding ramping,

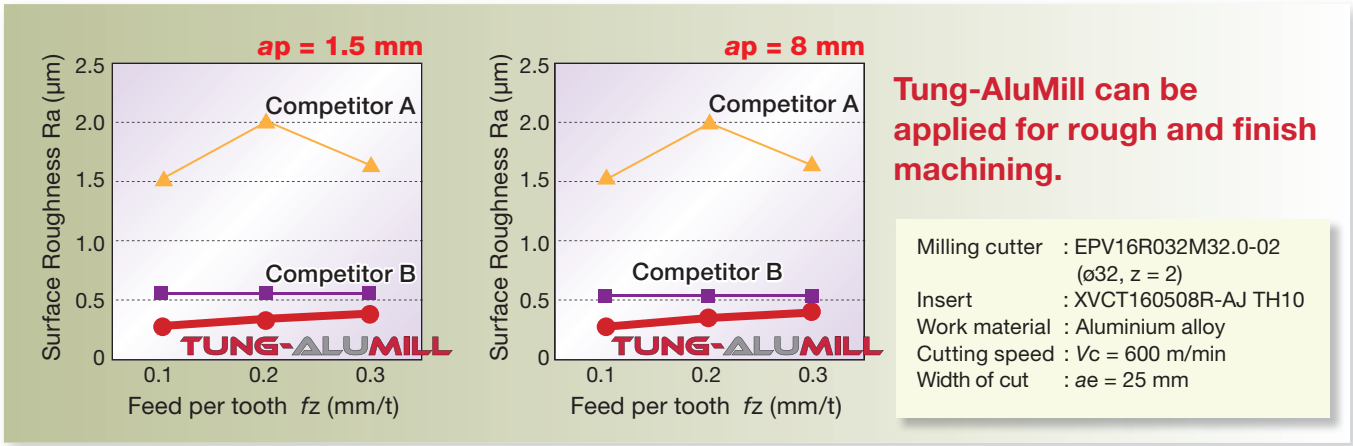
Secure, stable pocket design with unique v-shaped bottom on cutters



Inserts with excellent sharpness and high work material adhesion resistance



■ Comparison of surface roughness

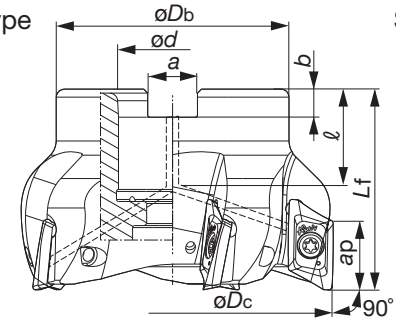


Tung-AluMill can be applied for rough and finish machining.

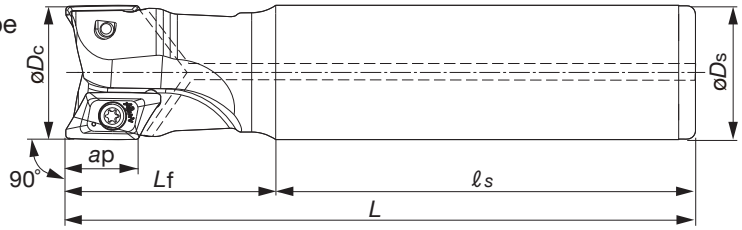
Milling cutter	: EPV16R032M32.0-02 (ø32, z = 2)
Insert	: XVCT160508R-AJ TH10
Work material	: Aluminium alloy
Cutting speed	: *Vc* = 600 m/min
Width of cut	: *ae* = 25 mm

Milling cutter

Bore type



Shank type



T/EPV16: Max. *ap* = 13 - 16 mm

Replacement parts

Descriptions		Parts Cat. No.		
		EPV16R025…	EPV16R032/040…	TPV16R…
Clamping screw		TS40085I/HG	TS40093I/HG	TS40093I/HG
Wrench	Bit	BT15S		
	Grip	H-TBS		

Bore type

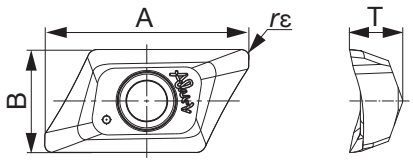
Cat. No.	Stock	No. of inserts	Dimensions (mm)							Weight (kg)	Air hole	Max. RPM (min^{-1})	Center bolt	Inserts
			øDc	øDb	ød	ℓ	Lf	b	a					
TPV16R040M16.0E03	●	3	40	38	16	20	50	5.6	8.4	0.229	with	30,000	SHM8X1.25X35-C	XVCT 1605...
TPV16R050M22.0E04	●	4	50	45	22	22	50	6.3	10.4	0.327		27,000	SHM10X1.5X30-C	
TPV16R063M22.0E05	●	5	63	47	22	22	50	6.3	10.4	0.535		24,000	SHM10X1.5X30-C	
TPV16R080M27.0E05	●	5	80	58	27	28	50	7	12.4	0.861		21,000	LHM12X1.75X30-C	
TPV16R100M32.0E06	●	6	100	66	32	26	63	8	14.4	1.547		19,000	SHM16X2X35-C	
TPV16R125M40.0E07	●	7	125	85	40	32	63	9	16.4	2.526		17,000	SHM20X2.5X40-C	

Shank type

Type	Cat. No.	Stock	No. of inserts	Dimensions (mm)					Weight (kg)	Air hole	Max. RPM (min^{-1})	Inserts
				øDc	øDs	ℓ s	Lf	L				
Coarse pitch	EPV16R025M25.0-02	●	2	25	25	70	55	125	0.373	with	38,000	XVCT 1605...
	EPV16R032M32.0-02	●	2	32	32	100	50	150	0.765		34,000	
	EPV16R032M32.0-03	●	3	32	32	100	50	150	0.76		34,000	
	EPV16R040M32.0-03	●	3	40	32	120	50	170	0.942		30,000	
Long shank	EPV16R025M25.0-02L	●	2	25	25	100	70	170	0.532	with	38,000	
	EPV16R032M32.0-02L	●	2	32	32	120	80	200	1.034		34,000	
	EPV16R032M32.0-03L	●	3	32	32	120	80	200	1.029		34,000	
	EPV16R040M32.0-03L	●	3	40	32	195	55	250	1.426		30,000	

* When using inserts with corner radius $r\varepsilon \geq 3.2$ mm, standard cutter body has to be modified with "R". "R" = $r\varepsilon$ - 0.3 mm

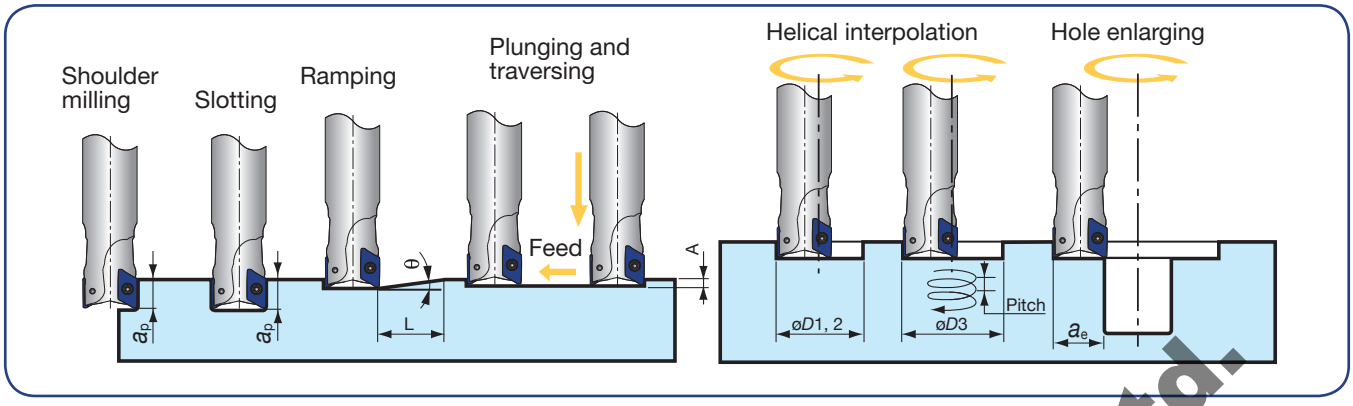
Inserts



Cat. No.	Accuracy	Honing	Grades	Dimensions (mm)					Cutter
			TH10	A	B	T	r_ε	Max. *ap*	
XVCT160504R-AJ	C	without	●	22.24	11.23	5.9	0.4	16	E/TPV16R
XVCT160508R-AJ	C		●	22.24	11.23	5.9	0.8	16	
XVCT160512R-AJ	C		●	21.74	11.23	5.8	1.2	15.5	
XVCT160516R-AJ	C		●	21.22	11.23	5.75	1.6	15	
XVCT160520R-AJ	C		●	20.78	11.23	5.75	2.0	14.5	
XVCT160530R-AJ	C		●	19.49	11.23	5.6	3.0	14	
XVCT160532R-AJ	C		●	19.24	11.23	5.6	3.2	14	
XVCT160540R-AJ	C		●	18.4	11.23	5.5	4.0	13	
XVCT160550R-AJ	C		●	18.35	11.23	5.4	5.0	13	

● : Stocked items

Machining applications



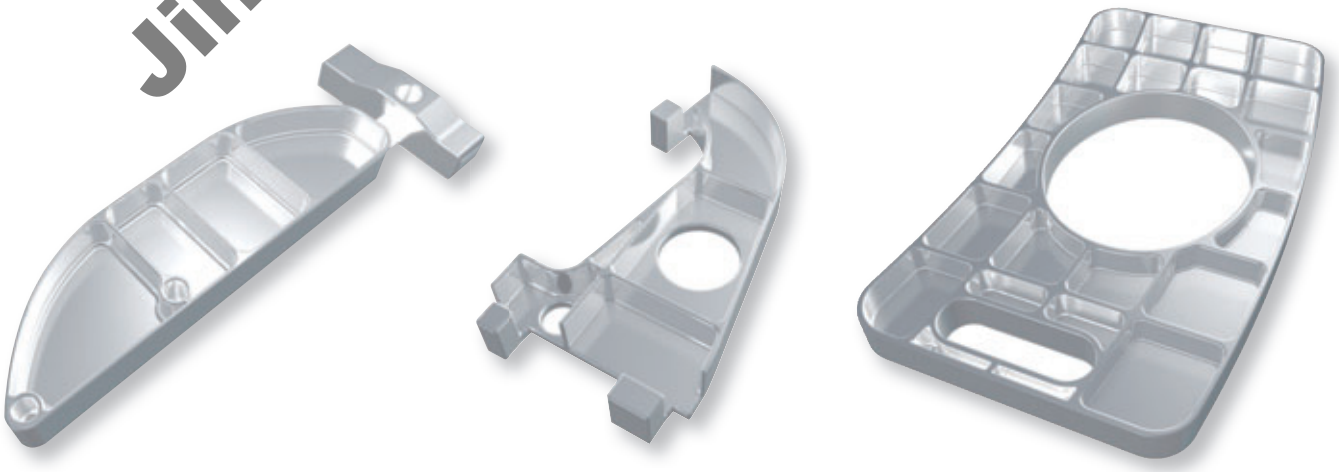
Cat. No.	Tool ø øDc (mm)	Corner radius rε (mm)	Max. depth of cut ap (mm)	Straight ramp down		Step down	Helical ramp down				Hole enlarging
				Max. ramping angle θ	Min. length L (mm)	Max. plunging A (mm)	Min. machining øD1 (mm)	Min. pitch/rev P (mm)	Max. machining øD2 (mm)	Max. pitch/rev P (mm)	Max. width ae (mm)
EPV16R025...	ø25	0.4, 0.8	16	22°	40	4.2	29.1	4.4	50	13.6	22.5
		1.2	15.5	22°	40	4.2	29.1	4.4	50	13.6	
		1.6	15	22°	38	3.7	29.1	4.4	50	13.2	
		2.0	14.5	22°	38	3.7	29.1	4.4	50	13.2	
		3.0, 3.2	14	21°	38	2.5	29.1	4.2	50	12.3	
		4.0, 5.0	13	18.5°	40	2.3	29.1	3.7	50	12.3	
EPV16R032...	ø32	0.4, 0.8	16	16.5°	54	4	43.1	8.8	64	13.6	28.8
		1.2	15.5	16.5°	54	4	43.1	8.8	64	13.6	
		1.6	15	16°	54	3.5	43.1	8.5	64	13.2	
		2.0	14.5	16°	54	3.5	43.1	8.5	64	13.2	
		3.0, 3.2	14	15°	54	3	43.1	7.9	64	12.3	
		4.0, 5.0	13	13.5°	56	2.5	43.1	7.1	64	12.3	
T/EPV16R040...	ø40	0.4, 0.8	16	11.5°	79	4	59.1	10.4	80	13.6	36
		1.2	15.5	11.5°	79	4	59.1	10.4	80	13.6	
		1.6	15	11°	80	3.5	59.1	9.9	80	13.2	
		2.0	14.5	11°	80	3.5	59.1	9.9	80	13.2	
		3.0, 3.2	14	10°	82	3	59.1	9	80	12.3	
		4.0, 5.0	13	8.5°	90	2.5	59.1	7.6	80	12.3	
TPV16R050...	ø50	0.4, 0.8	16	9.5°	96	4	79.1	13	100	13.6	45
		1.2	15.5	9.5°	96	4	79.1	13	100	13.6	
		1.6	15	9°	98	3.5	79.1	12.3	100	13.2	
		2.0	14.5	9°	98	3.5	79.1	12.3	100	13.2	
		3.0, 3.2	14	8°	103	3	79.1	10.9	100	12.3	
		4.0, 5.0	13	7°	110	2.5	79.1	9.5	100	12.3	
TPV16R063...	ø63	0.4, 0.8	16	7°	130	4	105.1	13.6	126	13.6	56.7
		1.2	15.5	7°	130	4	105.1	13.6	126	13.6	
		1.6	15	6.5°	136	3.5	105.1	12.8	126	13.2	
		2.0	14.5	6.5°	136	3.5	105.1	12.8	126	13.2	
		3.0, 3.2	14	6°	136	3	105.1	11.8	126	12.3	
		4.0, 5.0	13	5.5°	140	2.5	105.1	10.8	126	12.3	
TPV16R080...	ø80	0.4, 0.8	16	5°	183	4	139.1	13.6	160	13.6	72
		1.2	15.5	5°	183	4	139.1	13.6	160	13.6	
		1.6	15	4.5°	197	3.5	139.1	12.4	160	13.2	
		2.0	14.5	4.5°	197	3.5	139.1	12.4	160	13.2	
		3.0, 3.2	14	4°	207	3	139.1	11	160	12.3	
		4.0, 5.0	13	3.5°	221	2.5	139.1	9.6	160	12.3	
TPV16R100...	ø100	0.4, 0.8	16	3.5°	262	4	179.1	12.9	200	13.6	90
		1.2	15.5	3.5°	262	4	179.1	12.9	200	13.6	
		1.6	15	3°	296	3.5	179.1	11.1	200	13.2	
		2.0	14.5	3°	296	3.5	179.1	11.1	200	13.2	
		3.0, 3.2	14	2.5°	332	3	179.1	9.2	200	12.3	
		4.0, 5.0	13	2.5°	309	2.5	179.1	9.2	200	11.6	
TPV16R125...	ø125	0.4, 0.8	16	2.5°	367	4	229.1	12.1	125	13.6	112.5
		1.2	15.5	2.5°	367	4	229.1	12.1	125	13.6	
		1.6	15	2°	444	3.5	229.1	9.7	125	13.2	
		2.0	14.5	2°	444	3.5	229.1	9.7	125	13.2	
		3.0, 3.2	14	1.5°	554	3	229.1	7.3	125	8.7	
		4.0, 5.0	13	1.5°	516	2.5	229.1	7.3	125	8.7	

Standard cutting conditions

Workpiece materials	Hardness HB	Grades	Chipbreaker	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)	
Aluminium alloy	60	TH10	AJ	300 - 5000	0.15 - 0.35	
	100			200 - 2000	0.10 - 0.25	
Cast aluminium alloy (Si ≤ 12%)	75			200 - 2000	0.15 - 0.30	
	90			200 - 1500	0.10 - 0.25	
Cast aluminium alloy (Si > 12%)	130			200 - 1000	0.07 - 0.15	
Copper alloys (Pb > 1%)	110			200 - 800	0.07 - 0.15	
Copper alloys	90			300 - 1000	0.10 - 0.15	
	100			300 - 800	0.10 - 0.15	
Duroplastics, fiber plastics	-			100 - 500	0.10 - 0.15	
Hard rubber	-			100 - 300	0.10 - 0.15	

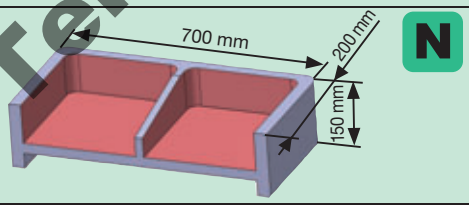
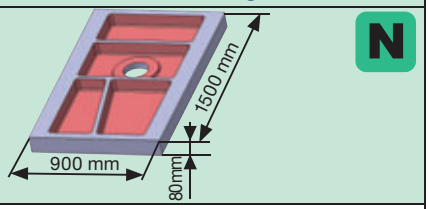
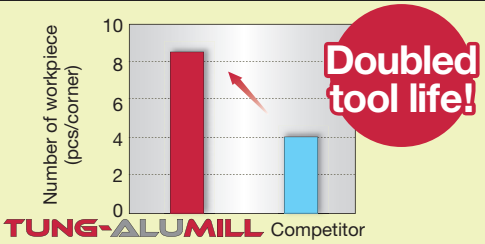
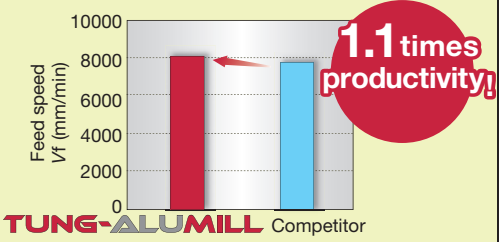
Safety guidelines

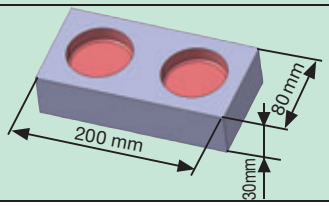
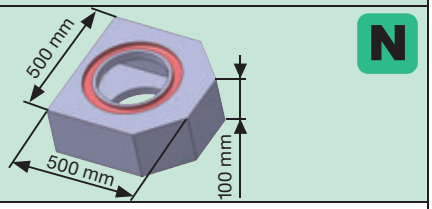
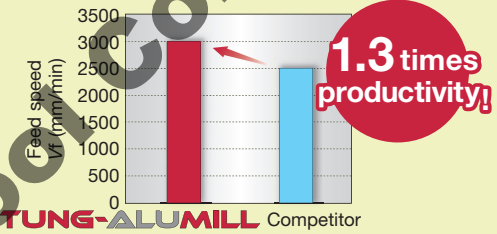
1. Use only original inserts and cutters including components.
2. Insert pocket must be cleaned before clamping insert.
3. Clamp torque of screw: 4.5 N·m.
4. For safety reasons, it is recommended to use a new screw after every insert change.
5. Maximum RPM values are determined based on the burst test, using RPM beyond maximum values may cause insert breakage, machine damage and personal injury.
6. XVCT insert has sharp cutting edge, always wear gloves for protection from injury when handling.



Tool dia.: øDc (mm), Number of revolutions: n (min-1), Feed speed: Vf (mm/min), Depth of cut: ap = 2.0 mm, No. of inserts: z																	
ø25		ø32				ø40		ø50		ø63		ø80		ø100		ø125	
z = 2		z = 2		z = 3		z = 3		z = 4		z = 5		z = 5		z = 6		z = 7	
n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf
19100	9600	14900	7500	14900	11200	11900	8900	9500	9500	7600	9500	6000	7500	4800	7200	3800	6700
Vc = 1500m/min, fz = 0.25 mm/t																	
12700	5100	9900	4000	9900	5900	8000	4800	6400	5100	5100	5100	4000	4000	3200	3800	2500	3500
Vc = 1000 m/min, fz = 0.2 mm/t																	
12700	5100	9900	4000	9900	5900	8000	4800	6400	5100	5100	5100	4000	4000	3200	3800	2500	3500
Vc = 1000 m/min, fz = 0.2 mm/t																	
10200	3100	8000	2400	8000	3600	6400	2900	5100	3100	4000	3000	3200	2400	2500	2300	2000	2100
Vc = 800 m/min, fz = 0.15 mm/t																	
7600	1500	6000	1200	6000	1800	4800	1400	3800	1500	3000	1500	2400	1200	1900	1100	1500	1100
Vc = 600 m/min, fz = 0.1 mm/t																	
6400	1300	5000	1000	5000	1500	4000	1200	3200	1300	2500	1300	2000	1000	1600	1000	1300	900
Vc = 500 m/min, fz = 0.1 mm/t																	
7600	1800	6000	1400	6000	2200	4800	1700	3800	1800	3000	1800	2400	1400	1900	1400	1500	1300
Vc = 600 m/min, fz = 0.12 mm/t																	
6400	1500	5000	1200	5000	1800	4000	1400	3200	1500	2500	1500	2000	1200	1600	1200	1300	1100
Vc = 500 m/min, fz = 0.12 mm/t																	
3800	900	3000	700	3000	1100	2400	900	1900	900	1500	900	1200	700	1000	700	800	700
Vc = 300 m/min, fz = 0.12 mm/t																	
2500	600	2000	500	2000	700	1600	600	1300	600	1000	600	800	500	600	400	500	400
Vc = 200 m/min, fz = 0.12 mm/t																	

Practical examples

Workpiece type		Airplane part	Airplane part
Cutter		TPV16R050M22.0E04 (ø50, z = 4)	EPV16R032M32.0-03 (ø32, z = 3)
Insert		XVCT160504R-AJ	XVCT160530R-AJ
Grade		TH10	TH10
Workpiece material		A7050 / AlZn5.5MgCu 	A7050 / AlZn5.5MgCu 
Cutting conditions	Cutting speed: Vc (m/min)	2200	900
	Feed per tooth: fz (mm/t)	0.17	0.3
	Depth of cut: ap (mm)	5.2	30
	Width of cut: ae (mm)	35	25
	Method of machining	Pocket milling	Pocket milling
	Coolant	Wet	Wet
	Machine	Vertical M/C, BT50	Vertical M/C, BT50
Results		 Excellent sharpness drastically reduces cutting force, achieving longer tool life.	 Lower cutting force allows higher feed machining, providing higher productivity.

Workpiece type		Robot component	Robot component
Cutter		EPV16R025M25.0-02 (ø25, z = 2)	TPV16R050M22.0E04 (ø50, z = 4)
Insert		XVCT160504R-AJ	XVCT160504R-AJ
Grade		TH10	TH10
Workpiece material		A6061 / AlMg1AiCu	Aluminium alloy
			
Cutting conditions	Cutting speed: *Vc* (m/min)	780	1000
	Feed per tooth: *fz* (mm/t)	0.15	0.2
	Depth of cut: *ap* (mm)	10.0	6
	Width of cut: *ae* (mm)	25	45
	Method of machining	Pocket milling	Slot milling
	Coolant	Wet	Wet
	Machine	Vertical M/C, BT40	Vertical M/C, BT50
Results		 Due to rigid clamping, excellent surface finish can be achieved even with higher feed rates.	 High density insert cutter can also be used in appliction, because of lower cutting forces, achieving higher productivity.

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