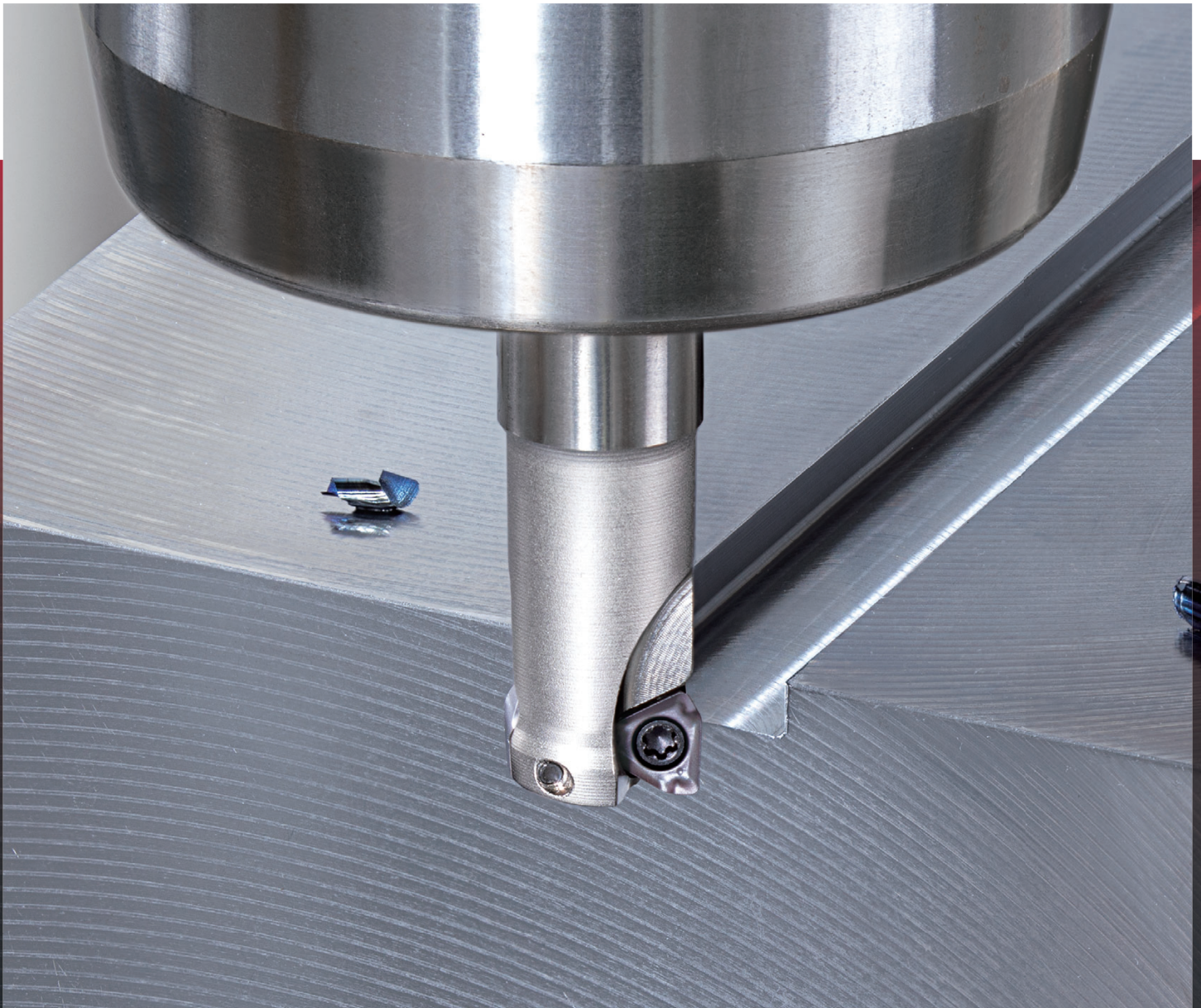


Shoulder milling cutter

TUNG-TRI

Tungaloy Report No. 421S2-G

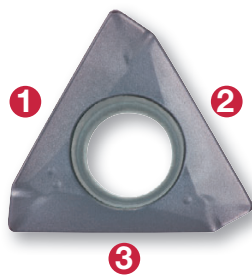
Economical shoulder mill series with
3 cutting-edged inserts now offering
small-diameter cutters from $\varnothing 8$ mm



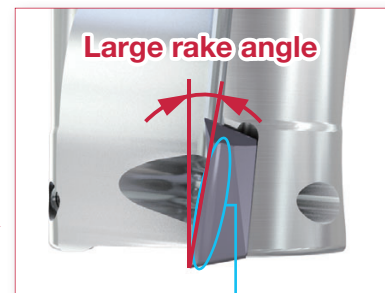


Extremely cost-efficient square shoulder mill series unveils cutters in a smaller diameter than ever before

■ 3 cutting-edged insert provides economy and low cutting forces



Gradual engagement of helical cutting edge provides low cutting forces in all applications



Uniquely designed flank face prevents chattering and chipping.

■ Four variations of insert sizes

APMX = Max. depth of cut

New

APMX:
3.5 mm

Size 04

ø8 - ø25 mm

Cutter: EPA04

APMX:
6 mm

Size 06

ø12 - ø50 mm

Cutter: TPA06,
EPA06,
HPA06-M

APMX:
10 mm

Size 10

ø25 - ø100 mm

Cutter: TPA10,
TLA10,
EPA10,
HPA10-M

APMX:
15 mm

Size 15

ø40 - ø160 mm

Cutter: TPA15,
TLA15-M,
TLA15-S,
TLA15-BT,
EPA15

■ Close-pitch design for high productivity

■ The number of teeth for tool diameters

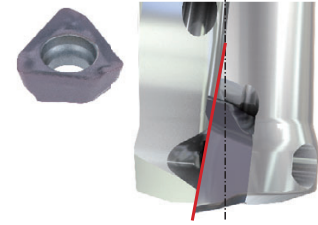
Size 04

Tool dia.	ø8 mm	ø10 mm	ø12 mm	ø16 mm	ø20 mm	ø25 mm
Standard cutter body	1	2	2 or 3	3 or 4	4 or 5	5 or 6
Long shank body (-L)	-	2	2	3	4	4

New Size 04 insert enables high productivity machining with small-diameter cutter

Lighter cutting and better chip control for broader application range

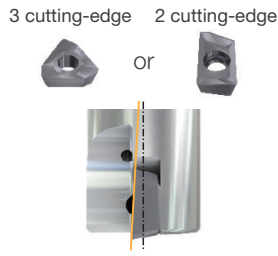
TUNG-TRI 04



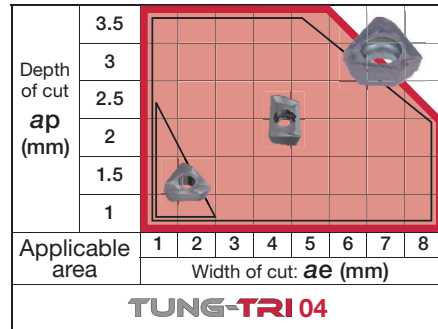
12° rake

Light cutting geometry with high rake angle

Competitors



3° - 8° rake



Cutter : EPA04R010M10.0-02 (ø10 mm, z = 2)
 Insert : TOMT040204PXER-MM AH3225
 Workpiece : S55C / C55
 Cutting speed : Vc = 200 m/min
 Feed per tooth : fz = 0.07 mm/t

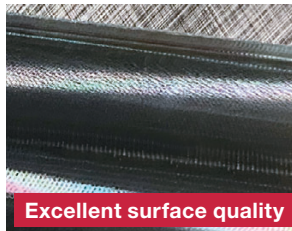
Coolant : Air blast
 Overhang length : 20 mm
 Machine : Vertical M/C, HSK63A
 Criteria : Chattering

Large wiper radius provides improved surface quality



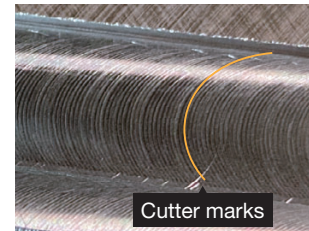
Large radius wiper

TUNG-TRI 04



Excellent surface quality

Competitor

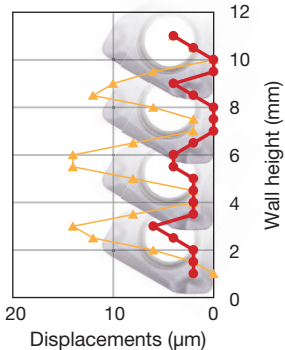


Cutter marks

Cutter : EPA04R025M25.0-06 (ø25 mm, z = 6)
 Insert : TOMT040204PXER-MM AH3225
 Workpiece : S50C / C50
 Cutting speed : Vc = 200 m/min
 Feed per tooth : fz = 0.07 mm/t

Depth of cut : ap = 1 mm
 Width of cut : ae = 20 mm
 Coolant : Air blast
 Overhang length : 35 mm
 Machine : Vertical M/C, BT40

Excellent vertical wall surface accuracy



Cutter : EPA04R010M10.0-02 (ø10 mm, z = 2)
 Insert : TOMT040204PXER-MM AH3225
 Workpiece : S55C / C55
 Cutting speed : Vc = 200 m/min
 Feed per tooth : fz = 0.07 mm/t
 Depth of cut : ap = 3 mm x 4 pass
 Width of cut : ae = 0.5 mm
 Coolant : Air blast
 Overhang length : 20 mm
 Machine : Vertical M/C, HSK63A

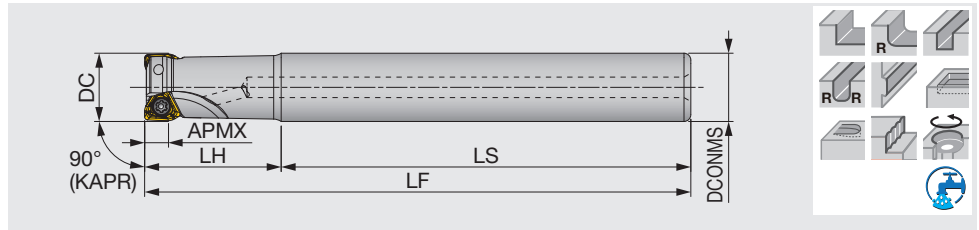
● **TUNG-TRI 04**
 ★ Competitor's insert (with 2 cutting-edge)



EPA04

High precision square shoulder endmill, shank type, with screw clamp system, for triangular inserts

GAMP = +12.1°~ +12.2°, GAMF = -14.2°~ -18.3°



Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPA04R008M08.0-01	3.5	8	1	8	48	12	60	0.02	with	TOMT04...
EPA04R010M10.0-02	3.5	10	2	10	60	20	80	0.04	with	TOMT04...
EPA04R010M10.0-02L	3.5	10	2	10	65	35	100	0.05	with	TOMT04...
EPA04R012M12.0-02	3.5	12	2	12	60	20	80	0.06	with	TOMT04...
EPA04R012M12.0-03	3.5	12	3	12	60	20	80	0.06	with	TOMT04...
EPA04R012M12.0-02L	3.5	12	2	12	85	35	120	0.09	with	TOMT04...
EPA04R016M16.0-03	3.5	16	3	16	70	20	90	0.12	with	TOMT04...
EPA04R016M16.0-04	3.5	16	4	16	70	20	90	0.12	with	TOMT04...
EPA04R016M16.0-03L	3.5	16	3	16	105	35	140	0.19	with	TOMT04...
EPA04R020M20.0-04	3.5	20	4	20	70	30	100	0.21	with	TOMT04...
EPA04R020M20.0-05	3.5	20	5	20	70	30	100	0.21	with	TOMT04...
EPA04R020M20.0-04L	3.5	20	4	20	165	35	200	0.44	with	TOMT04...
EPA04R025M25.0-05	3.5	25	5	25	80	35	115	0.39	with	TOMT04...
EPA04R025M25.0-06	3.5	25	6	25	80	35	115	0.39	with	TOMT04...
EPA04R025M25.0-04L	3.5	25	4	25	160	40	200	0.7	with	TOMT04...

SPARE PARTS

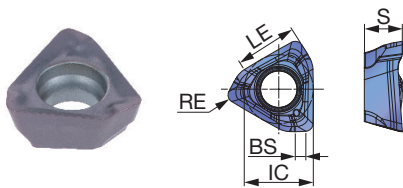


Designation	Clamping screw	Wrench
EPA04R008M08.0-01	CSPB-1.8L3.3	IP-6DB
EPA04R010 - 025...	CSPB-1.8L3.6	IP-6DB

*Recommended clamping torque (N·m): CSPB-1.8L3.3/CSPB-1.8L3.6 = 0.5

INSERTS

TOMT-MM



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

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated							LE	IC	S	BS
			AH3225	AH120	AH8015								
TOMT040204PXER-MM	0.4	3.5	●	●	●					3.6	4	2.2	0.6
TOMT040208PXER-MM	0.8	3.5	●	●	●					3.6	4	2.2	0.2

● : Line up

GRADES

AH3225 **P M S**

- Nano multi-layer coating technology with three major properties for optimal cutting edge integrity
- Increased resistance to wear, fracture, oxidation, built-up edge, and delamination

AH120 **P K**

- PVD grade with a well-balanced wear and fracture resistance
- Ideal for general machining of steel and stainless steel

AH8015 **H S**

- Incorporates a hard coating layer and carbide substrate
- Strong resistance to wear, heat, and built-up edge, ideal for machining hard or difficult materials

STANDARD CUTTING CONDITIONS

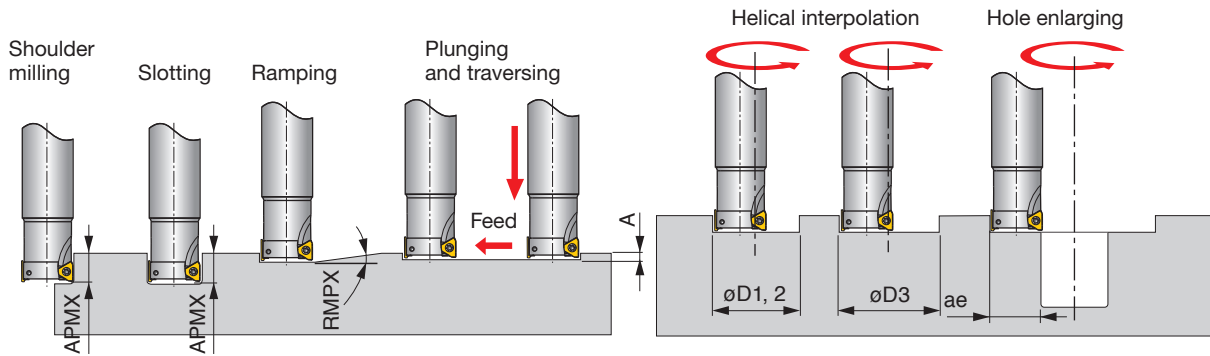
EPA04

ISO	Workpiece materials	Hardness	Grades	Cutting speed Vc (m/min)	Feed per tooth fz (mm/t)
P	Low carbon steel SS400, S15C, etc. E275A, C15E4, etc.	- 200 HB	AH3225	100 - 250	0.05 - 0.12
	Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.	- 300 HB	AH3225	100 - 230	0.05 - 0.12
	Prehardend steel NAK80, PX5, etc.	30 - 40 HRC	AH3225	100 - 180	0.05 - 0.1
M	Stainless steel SUS304, etc. X5CrNi18-9, etc.	-	AH3225	90 - 200	0.05 - 0.1
K	Grey cast iron FC250, etc. 250, etc., GG25, etc.	150 - 250 HB	AH120	100 - 300	0.05 - 0.12
	Ductile cast iron FCD450, etc. 450-10S, etc., GGG45, etc.	150 - 250 HB	AH120	100 - 200	0.05 - 0.12
S	Titanium alloys Ti-6Al-4V, etc.	-	AH3225	20 - 60	0.04 - 0.07
	Heat-resistant alloys Inconel 718, etc.	-	AH8015	20 - 40	0.04 - 0.07
H	Hardened steel	SKD61, etc. X40CrMoV5-1, etc.	AH8015	50 - 150	0.04 - 0.07
		SKD11, etc. X153CrMoV12, etc.	AH8015	40 - 70	0.04 - 0.07

- Remove excessive chip accumulation with an air blast.
- For the operation with depth of cut which varies (ex. casting skin) and machining of workpiece materials with interrupted surface, the feed per tooth (fz) should be set to the lower recommended value shown in the above table.

- Cutting conditions may be limited depending on machine power, workpiece rigidity, and spindle output. When the cutting width, depth, or overhang length is large, set Vc and fz to the lower recommended values and check the machine power and vibration.

APPLICATION RANGE


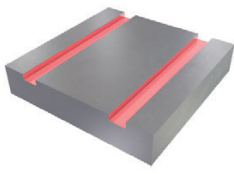
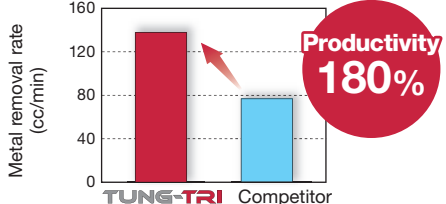
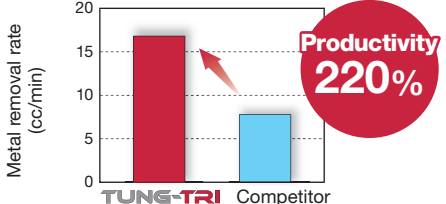


Designation	DC	Max. depth of cut APMX	Max. ramping angle RMPX	Max. plunging depth A	Min. machining depth øD1	Max. machining diameter		Max. cutting width in enlarging ae
						øD2	øD3*	
EPA04R008...	8	3.5	0.3°	0.02	12.8	15.6	13.6	7.5
EPA04R010...	10	3.5	0.2°	0.02	16.8	19.6	17.6	9.5
EPA04R012...	12	3.5	0.15°	0.02	20.8	23.6	21.6	11.5
EPA04R016...	16	3.5	0.1°	0.02	28.8	31.6	29.6	15.5
EPA04R020...	20	3.5	0.1°	0.02	36.8	39.6	37.6	19.5
EPA04R025...	25	3.5	0.1°	0.02	46.8	49.6	47.6	24.5

* Flat bottom hole

Note: Corner RE for dimensions of øD1, øD2 and øD3: RE = 0.4

PRACTICAL EXAMPLES

Workpiece type		Rotator shaft	Machine part	
Cutter		EPA04R025M25.0-06 (ø25 mm, z = 6)	EPA04R010M10.0-03 (ø10 mm, z = 2)	
Insert		TOMT040204PXER-MM	TOMT040204PXER-MM	
Grade		AH3225	AH3225	
Workpiece material		SNCM439 / 40CrNiMoA	S50C / C50	
		 P	 P	
Cutting conditions	Cutting speed: Vc (m/min)	200	110	
	Feed per tooth: fz (mm/t)	0.12	0.12	
	Feed speed: Vf (mm/min)	1833	840	
	Depth of cut : ap (mm)	3	2	
	Width of cut : ae (mm)	25	10	
	Machining	Slotting	Slotting	
	Coolant	Air blast	Air blast	
	Overhang length (mm)	35	30	
Machine		Vertical M/C, BT50	Vertical M/C, BT30	
Results	 <p>Thanks to close-pitch cutter design and large axial rake, TUNG-Tri offered high productivity, while eliminating chip packing.</p>		 <p>Tung-Tri's large axial rake enabled smooth entry to the cut and greater depth of cut without generating chatter.</p>	

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