CONTENTS

Added products

Member IMC Group Tungaloy INDUSTRY 4.0

MillLine

TUNG-TRI

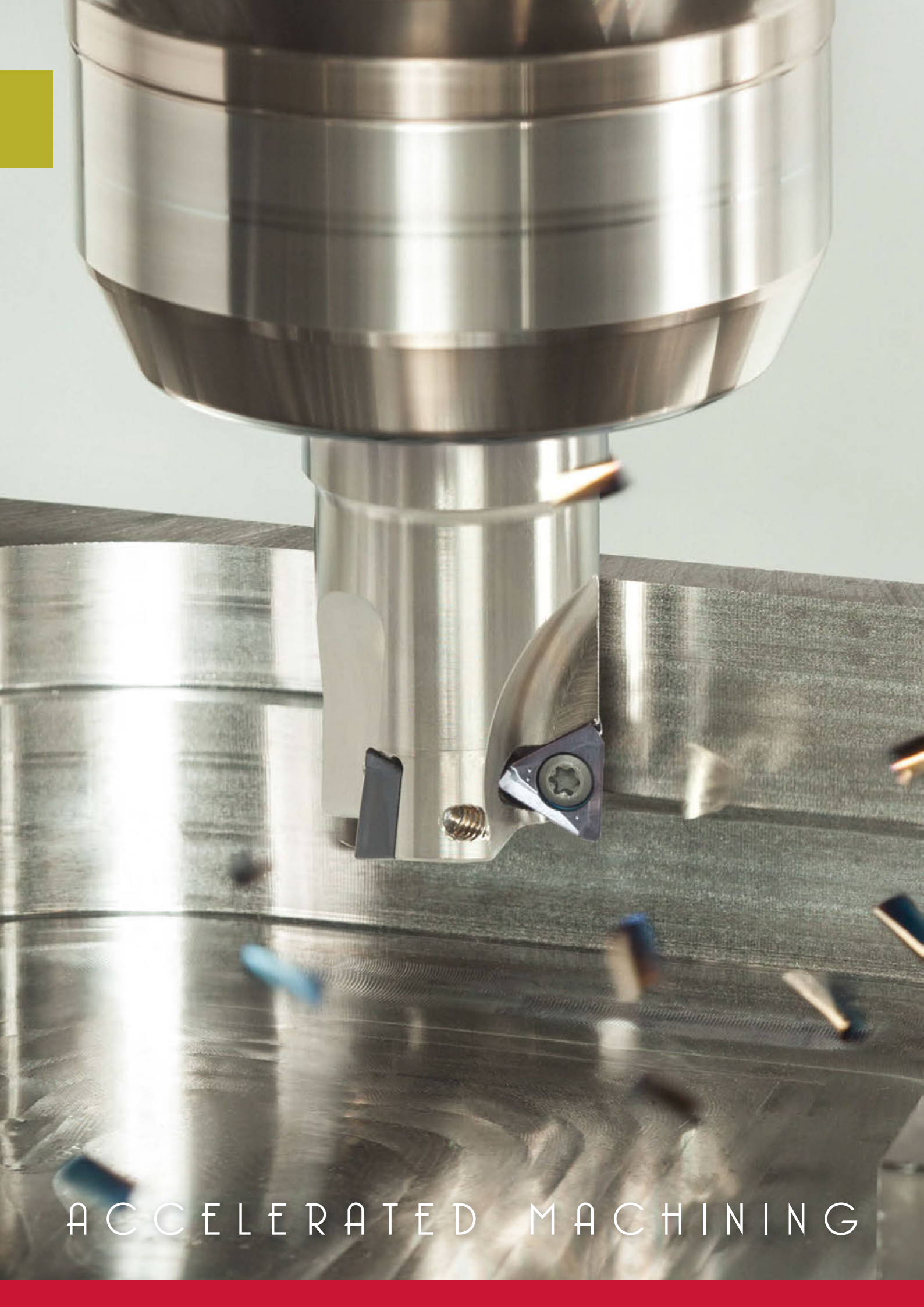
www.tungaloy.com

Tungaloy Report No. 421-G

Economical cutter with **new CVD grades** for longer tool life in high speed milling

INDUSTRY 4.0

FEED the SPEED!


ACCELERATED MACHINING

MillLine

TUNG-TRI

TUNGALOY

TUNG FORCE MILL

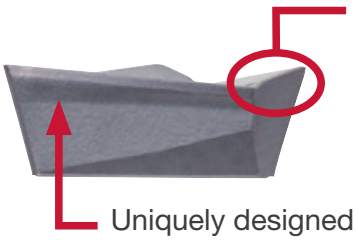
ACCELERATED MACHINING

Shoulder milling cutter with **cost-efficient inserts and outstanding chatter stability**

TUNG-TRI
TUNGALOY

Excellent cutting performance with improved profitability

Economical 3 cutting-edge inserts

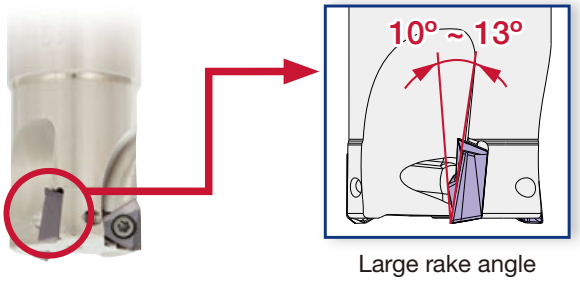


Good surface finish due to positive inclination on wiper edge

Uniquely designed flank face with built-in "margin" that prevents chattering and chipping.

Drastically reduced cutting force

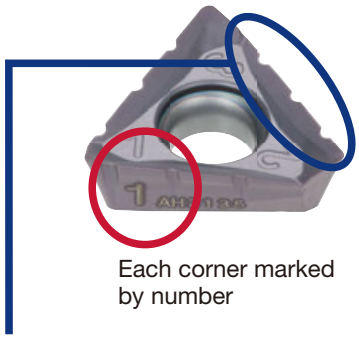
Low cutting force for all depths of cut due to helical cutting edge with large rake angle.



Large rake angle

Excellent chip formation

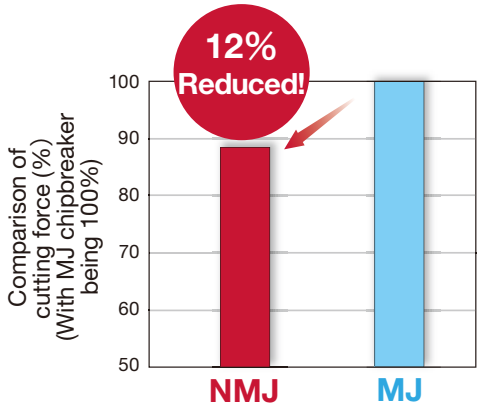
NMJ chipbreaker



Each corner marked by number

Chip splitter helps form small chips

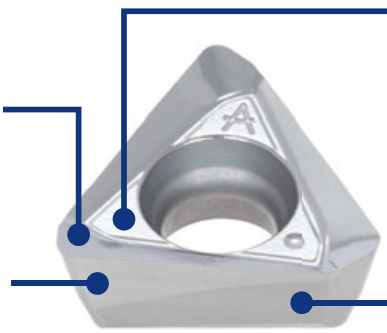
- 10% reduction in cutting force compared to MJ chipbreaker due to split chips.
- Suitable for machining with large width of cut due to split chips.



Cutter	: TPA15R080M25.4-06 (ø80 mm, z = 6)
Insert	: TOMT150608PDER-NMJ TOMT150608PDER-MJ
Grade	: AH3135
Workpiece	: SCM440 / 42CrMo4 (200HB)
Cutting speed	: *Vc* = 100 m/min
Feed per tooth	: *fz* = 0.10 mm/t
Depth of cut	: *ap* = 13 mm
Width of cut	: *ae* = 29 mm
Coolant	: Wet
Machine	: Vertical M/C, BT50

Good performance on machining

AJ chipbreaker



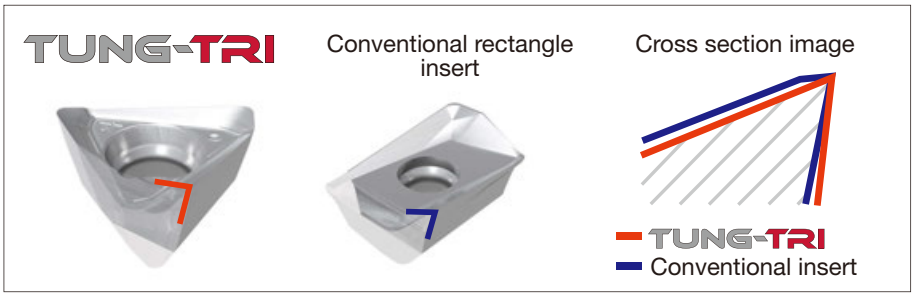
Lapping treatment
Prevent welding on the cutting edge.

Wiper with positive inclination
Good surface finish by directing chips away from wall.

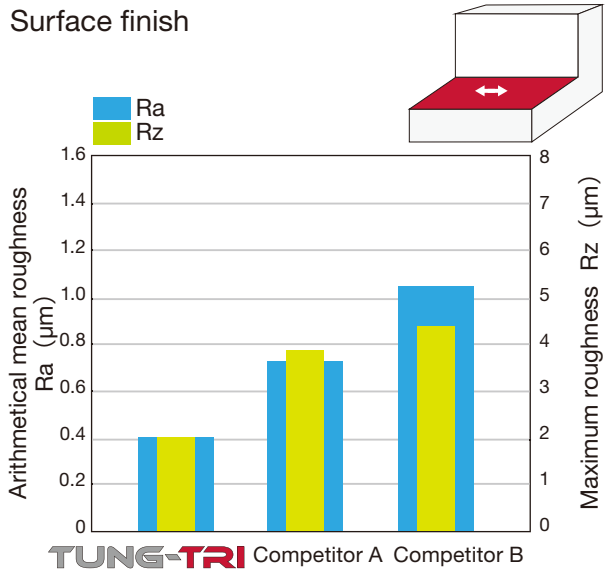
Large rake angle & high inclination cutting edge
Low cutting force and smooth cutting.

Anti-chatter design
The clearance geometry is optimized to enhance insert robustness and vibration-damping for aluminum machining.

■ Cutting edge comparison: cross sections

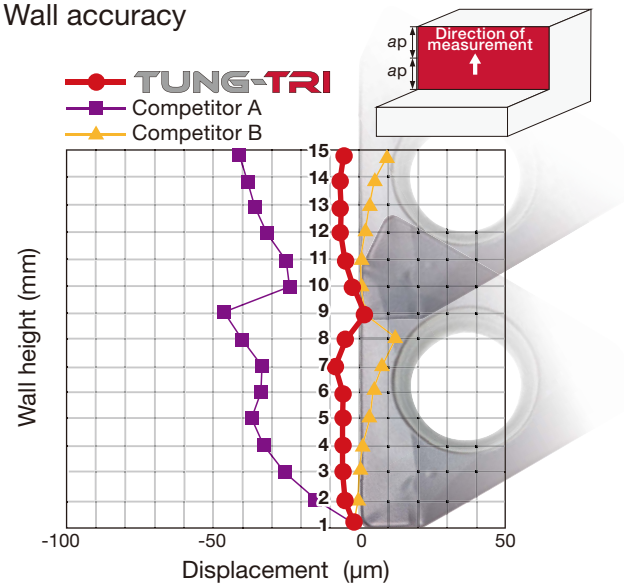


■ Surface finish



Cutter	: EPA10R032M32.0-03N
Insert	: TOGT100408PDFR-AJ
Grade	: KS05F
Workpiece	: A7075
Cutting speed	: *Vc* = 900 m/min
Feed per tooth	: *fz* = 0.10 mm/t
Depth of cut	: *ap* = 2 mm
Width of cut	: *ae* = 21 mm
Coolant	: External air
Machine	: Vertical M/C, HSK63A

■ Wall accuracy



Cutter	: EPA10R032M32.0-03N
Insert	: TOGT100408PDFR-AJ
Grade	: KS05F
Workpiece	: A7075
Cutting speed	: *Vc* = 900 m/min
Feed per tooth	: *fz* = 0.10 mm/t
Depth of cut	: *ap* = 8 mm x 2 pass
Width of cut	: *ae* = 5 mm
Coolant	: External air
Machine	: Vertical M/C, HSK63A

New coated grade offers long tool life

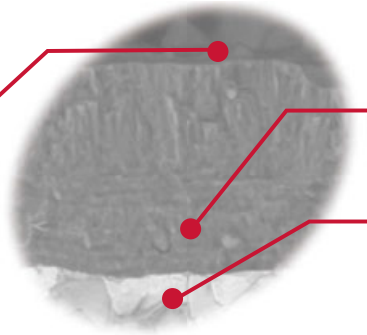
New grade for steel and stainless steel machining
Dramatically improved chipping and fracture resistance

- Multi-layered coating prevents crack expansion which causes chipping and fracture.
- Exclusive carbide substrate with remarkable impact resistance and toughness.

AH3135 P Steel M Stainless

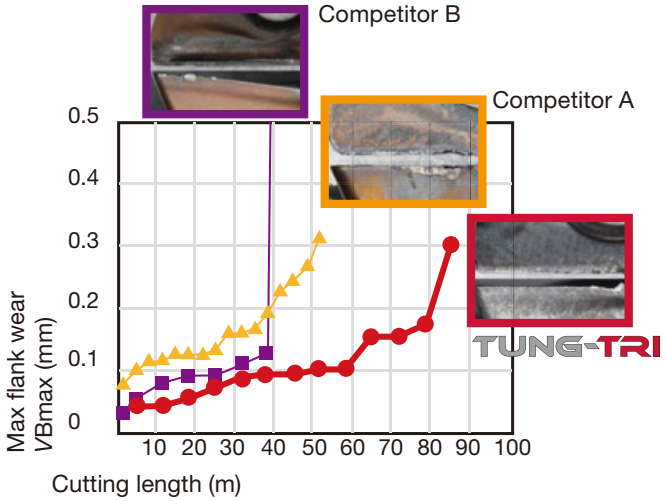
Special Surface Technology
PREMIUMTEC TUNGALOY

Smooth insert surface prevents chip adhesion



Long tool life due to high wear resistance

■ Tool life



Cutter	: EPA15R040M32.0-03N (ø40 mm, z = 3)
Insert	: TOMT150608PDER-MJ
Grade	: AH3135
Workpiece material	: S55C / C55 (200HB)
Cutting speed	: *Vc* = 200 m/min
Feed per tooth	: *fz* = 0.2 mm/t
Depth of cut	: *ap* = 9 mm
Width of cut	: *ae* = 13 mm
Coolant	: Dry
Machine	: Vertical M/C, BT50

Specification

Application	Grade	Substrate			Coating layer		Features
	Application code	Relative density	Hardness HRA	T.R.S. (GPa)	Main Composition	Thickness (μm)	
P Steel M Stainless	**AH3135** P30 - P40	14	89.5	2.8	(Ti, Al)N Multi-layer	4	**First choice for steel and stainless steel** Improved chipping and fracture resistance
K Cast Iron S Superalloys	**AH120** K15 - K30	14.5	90.8	2.8	(Ti, Al)N	3	**General purpose grade for varieties of materials** Well-balanced performance
P Steel M Stainless	**T3225** P20 - P35	14	89.5	2.8	TiCN-Al2O3	10	**The latest grade for high speed machining of steel and stainless steel** Significantly improved wear resistance
K Cast Iron	**T1215** K10 - K25	14.8	91.5	1.7	TiCN-Al2O3	10	**First choice for cast iron** Improved wear resistance
N Non-ferrous	**KS05F** N05 - N15	15	93	2.9	Uncoated	-	**For non-ferrous applications** Excellent chipping resistance and cutting edge sharpness

Rich grade lineup for every kind of material

- A total of five grades, including new CVD grade

AH3135

P Steel M Stainless

- PVD grade for high fracture resistance
- Most suitable for steel and stainless steel in general cutting parameters

AH120

P Steel K Cast Iron

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

KS05F

N Non-ferrous

- Non-coated carbide grade featuring sharp cutting edge and toughness, while reducing built-up edge formation
- Most suited for non-ferrous materials

T3225

P Steel M Stainless

- CVD grade with superior resistance to chipping and fracture
- Ideal for high speed machining of steel and stainless steel

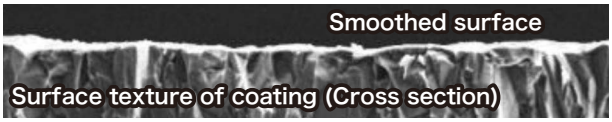
T1215

K Cast Iron

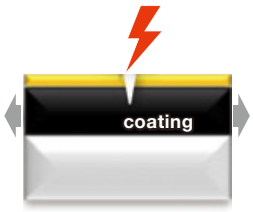
- CVD grade with superior resistance to wear and chipping
- Ideal for high speed machining of cast iron

Special Surface Technology

PREMIUMTEC TUNGALOY

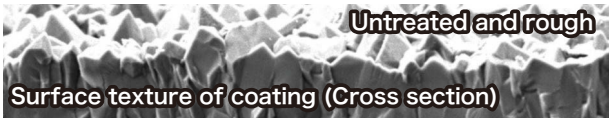


Indentation test on coating

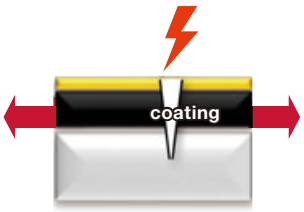


PremiumTec controls tensile residual stress and improves crack resistance.

Conventional item



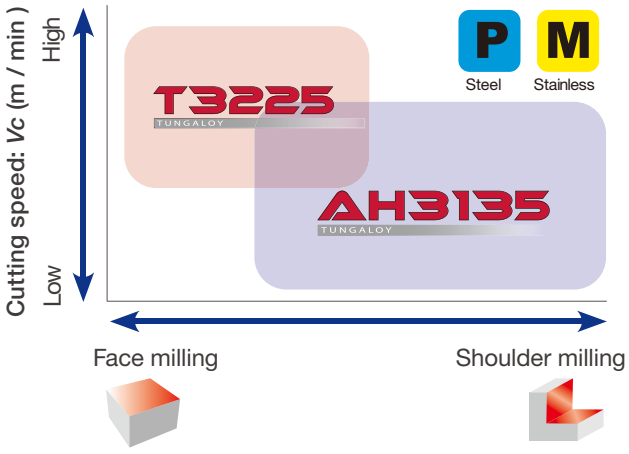
Indentation test on coating

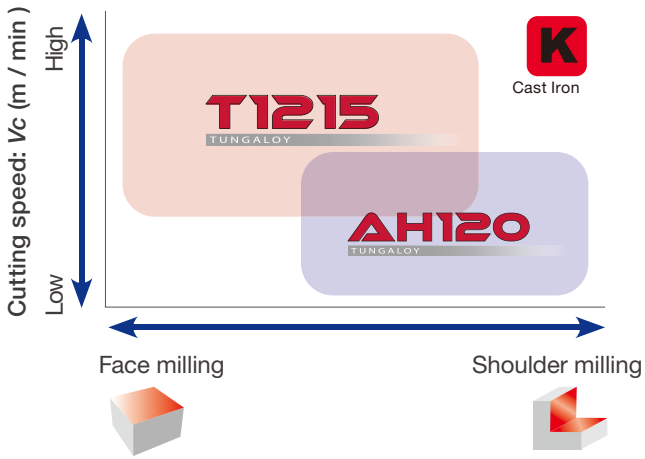


CVD coating by nature has high tensile residual stress allowing crack propagation easily.

PremiumTec technology enhances both smoothness and toughness on coating surface, improving resistance to chipping, build-up edge and fracture.

Application area



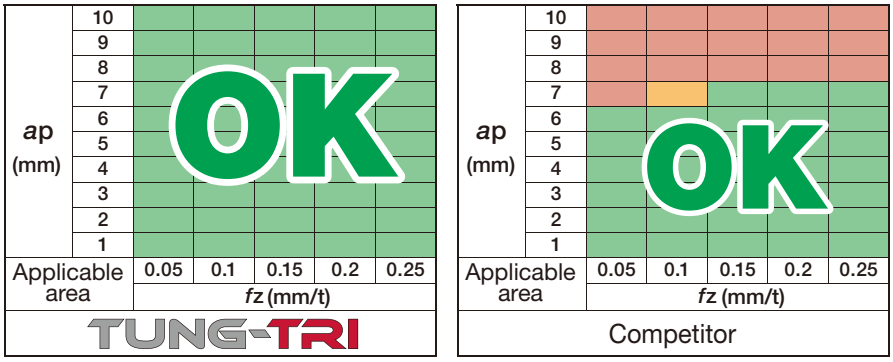


Applicable for a wide range of cutting conditions

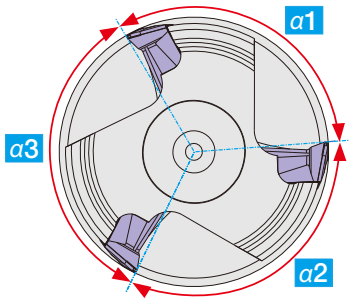
Insert positioning in irregular pitch, combined with uniquely designed flank face of inserts, prevents chattering during machining.

■ Cutting performance

OK　Chatter　Strong chatter



Irregular pitch



$\alpha 1 \neq \alpha 2 \neq \alpha 3$

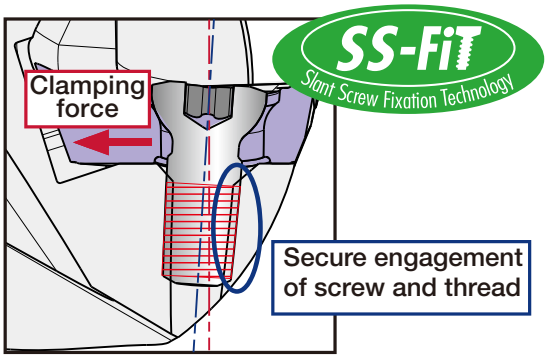
Cutter	: EPA10R032M32.0-03N (ø32 mm, z = 3)
Insert	: TOMT100404PDER-MJ
Grade	: AH3135
Workpiece	: S55C / C55 (200 HB)
Cutting speed	: *Vc* = 150 m/min
Width of cut	: *ae* = 32 mm
Machine	: Vertical M/C, BT50

High reliability

Significant increase in clamping rigidity due to large-sized screws and "SS-FiT" technology

■ Screw size

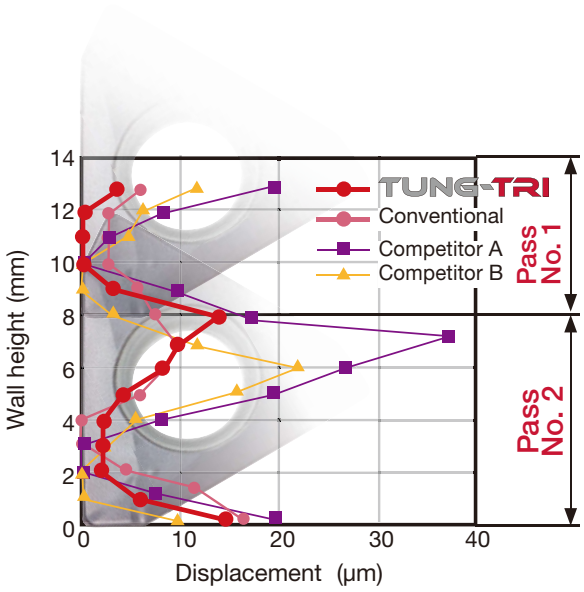
Inserts	TUNG-TRI	Competitor
TOMT06	M2.5	M1.8
TOMT10	M3.5	M2.5
TOMT15	M4.5	M4



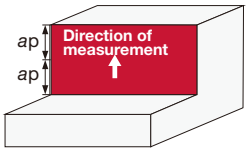
Excellent wall accuracy

High wall accuracy due to helical cutting edge with low cutting force

■ Wall accuracy



Cutter : EPA10R032M32.0-03N (ø32 mm, z = 3)
Insert : TOMT100404PDER-MJ
Grade : AH3135
Workpiece : S55C / C55 (200HB)
Cutting speed : *Vc* = 150 m/min
Feed per tooth : *fz* = 0.1 mm/t
Depth of cut : *ap* = 8 mm x 2 pass
Width of cut : *ae* = 5 mm
Machine : Vertical M/C, BT50



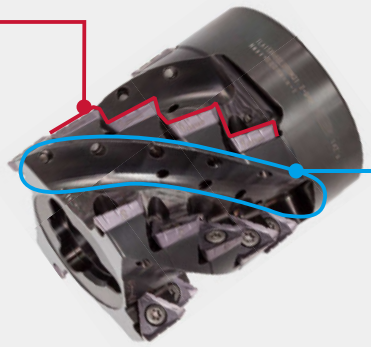
■ Result amount of displacement

TUNG-TRI : within 15 μm
Conventional : within 17 μm
Competitor A : within 22 μm
Competitor B : within 35 μm

Roughing type

Excellent chattering resistance

- Ideal insert positioning in high helix angle
- Irregular pitch

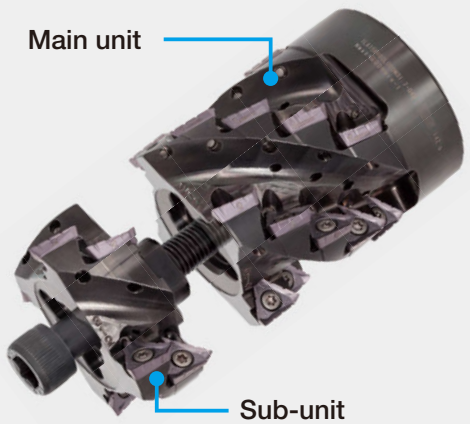


Smooth chip evacuation

- Big chip gullet that is applicable for large width of cut

Main and sub-unit system (TLA15 type)

- **Exchangeable sub-units**
  (A main unit can be used without the sub-unit.)
- **Adjustable cutting length**
  Maximum depth of cut can be increased (Up to 2 sub-units can be added on a main unit to increase depth of cut.)



Comparison of application area

- Strong resistance to chattering and low cutting force cover a wide range of applications.
- The application range is remarkably expanded with NMJ chipbreaker.

■ Cutting performance

OK Strong chatter

ae (mm)	*ae* / ø*Dc* (mm)	*fz* (mm/t) 0.05	0.1	0.15	0.2
30	38%	with NMJ chipbreaker			
20	25%	with MJ chipbreaker OK			
10	13%				
Width of cut					

TUNG-TRI

ae (mm)	*ae* / ø*Dc* (mm)	*fz* (mm/t) 0.05	0.1	0.15	0.2
30	38%				
20	25%				
10	13%		OK		
Width of cut					

Competitor

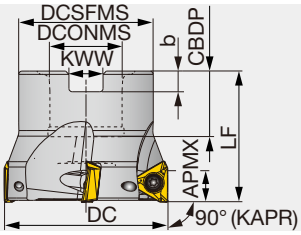
Cutter : TLA15R080L070M31.7-04M (ø80 mm, z = 4)
Insert : TOMT150608PDER-NMJ, TOMT150608PDER-MJ
Grade : AH3135
Workpiece : SCM440 / 42CrMo4 (270HB)

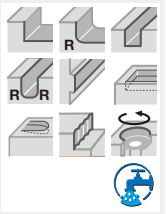
Cutting speed : *Vc* = 100 m/min
Depth of cut : *ap* = 55 mm
Coolant : Wet
Machine : Vertical M/C, BT50

TPA06

High precision square shoulder mill, with screw clamp system, for triangular inserts

GAMP = +8.5°~ +11.5°, GAMF = -5.5°~ -12.5°





Designation	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
TPA06R032M16.0E05	6	32	5	30	16	18	40	5.6	8.4	0.14	with	TOMT06...
TPA06R040M16.0E06	6	40	6	35	16	18	40	5.6	8.4	0.22	with	TOMT06...
TPA06R050M22.0E08	6	50	8	41	22	20	40	6.3	10.4	0.31	with	TOMT06...

SPARE PARTS

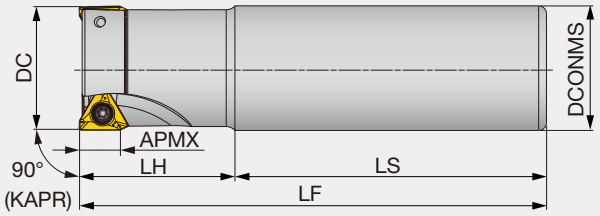
Designation	Clamping screw	Lubricant	Center bolt	Wrench
TPA06R032M16.0E05	CSTB-2.5	M-1000	FSHM8-30H	T-8D
TPA06R040M16.0E06	CSTB-2.5	M-1000	CM8X30H	T-8D
TPA06R050M22.0E08	CSTB-2.5	M-1000	CM10X30H	T-8D

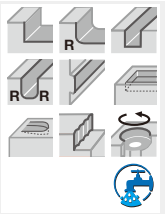
*Recommended clamping torque (N·m):CSTB-2.5=1.3

EPA06

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

GAMP = +8.5°~ +11.5°, GAMF = -5.5°~ -12.5°





Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPA06R012M16.0-01N	6	12	1	16	50	18	68	0.09	without	TOMT06...
EPA06R016M16.0-02N	6	16	2	16	60	24	84	0.12	without	TOMT06...
EPA06R016M16.0-02L	6	16	2	16	105	40	145	0.2	with	TOMT06...
EPA06R018M16.0-02N	6	18	2	16	60	24	84	0.13	without	TOMT06...
EPA06R018M16.0-02L	6	18	2	16	115	30	145	0.21	with	TOMT06...
EPA06R020M16.0-02N	6	20	2	16	60	30	90	0.14	without	TOMT06...
EPA06R020M20.0-02N	6	20	2	20	70	30	100	0.23	without	TOMT06...
EPA06R020M20.0-03N	6	20	3	20	70	30	100	0.22	without	TOMT06...
EPA06R020M20.0-02L	6	20	2	20	135	50	185	0.41	with	TOMT06...
EPA06R022M20.0-02N	6	22	2	20	70	30	100	0.23	without	TOMT06...
EPA06R022M20.0-03N	6	22	3	20	70	30	100	0.23	without	TOMT06...
EPA06R022M20.0-02L	6	22	2	20	145	40	185	0.42	with	TOMT06...
EPA06R025M25.0-03N	6	25	3	25	80	35	115	0.41	without	TOMT06...
EPA06R025M25.0-04N	6	25	4	25	80	35	115	0.41	without	TOMT06...
EPA06R025M25.0-02L	6	25	2	25	150	70	220	0.78	with	TOMT06...
EPA06R028M25.0-03N	6	28	3	25	80	35	115	0.42	without	TOMT06...
EPA06R028M25.0-04N	6	28	4	25	80	35	115	0.42	without	TOMT06...
EPA06R028M25.0-02L	6	28	2	25	180	40	220	0.8	with	TOMT06...

SPARE PARTS

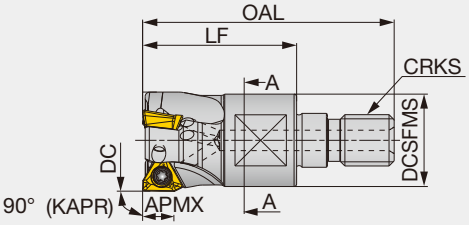
Designation	Clamping screw	Lubricant	Wrench
EPA06R012 - 018M...	CSTB-2.5S	M-1000	T-8D
EPA06R020 - 028M...	CSTB-2.5	M-1000	T-8D

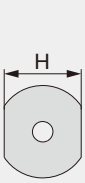
*Recommended clamping torque (N·m):CSTB-2.5S/CSTB-2.5=1.3

HPA06-M

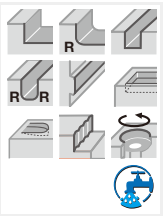
High precision square shoulder endmill, modular type, for triangular inserts (TungFlex)

GAMP = +8.5°~ +11.5°, GAMF = -12.5°~ -5.5°





A-A cross section



Designation	APMX	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Air hole	Insert
HPA06R016MM08-02	6	16	2	42	25	10	13	M8	0.03	with	TOMT06...
HPA06R020MM10-03	6	20	3	49	30	15	18	M10	0.06	with	TOMT06...
HPA06R025MM12-04	6	25	4	57	35	17	21	M12	0.1	with	TOMT06...
HPA06R032MM16-05	6	32	5	63	40	22	29	M16	0.20	with	TOMT06...

• Please see the page 17 for TungFlex modular shank.

SPARE PARTS



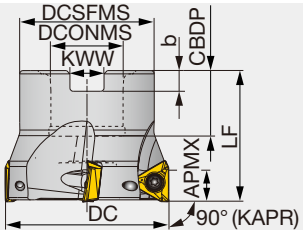
Designation	Clamping screw	Lubricant	Wrench
HPA06R016MM08-02	CSTB-2.5S	M-1000	T-8D
HPA06R020 - 032MM...	CSTB-2.5	M-1000	T-8D

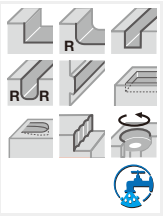
*Recommended clamping torque (N·m):CSTB-2.5S/CSTB-2.5=1.3

TPA10

High precision square shoulder mill, with screw clamp system, for triangular inserts

GAMP = +9.5°~ +11°, GAMF = -4.5°~ -0.5°





Designation	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
TPA10R040M16.0E04	10	40	4	35	16	18	40	5.6	8.4	0.2	with	TO*T10...
TPA10R050M22.0E04	10	50	4	41	22	20	40	6.3	10.4	0.31	with	TO*T10...
TPA10R063M22.0E06	10	63	6	41	22	20	40	6.3	10.4	0.51	with	TO*T10...
TPA10R080M25.4-07	10	80	7	58	25.4	26	50	6	9.5	1.04	with	TO*T10...
TPA10R080M27.0E07	10	80	7	58	27	22	50	7	12.4	1.04	with	TO*T10...
TPA10R100M31.7-08	10	100	8	70	31.75	32	63	8	12.7	2.02	with	TO*T10...
TPA10R100M32.0E08	10	100	8	60	32	28.5	50	8	14.4	2.02	with	TO*T10...

SPARE PARTS





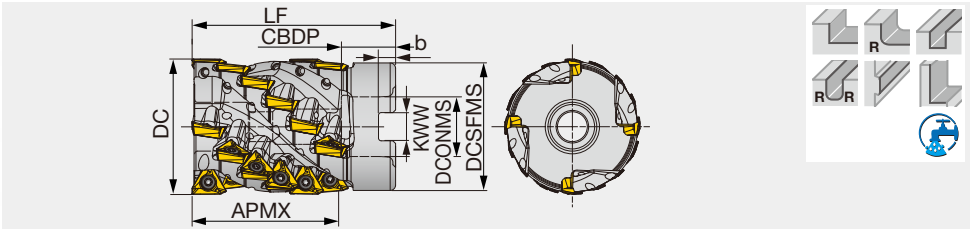
Designation	Clamping screw	Grip	Lubricant	Center bolt	Torx bit
TPA10R040M16.0E04	SR14-562/S	SW6-SD	M-1000	CM8X30H	BLDT10/S7
TPA10R050, 063M...	SR14-562/S	SW6-SD	M-1000	CM10X30H	BLDT10/S7
TPA10R080M...	SR14-562/S	SW6-SD	M-1000	CM12X30H	BLDT10/S7
TPA10R100M...	SR14-562/S	SW6-SD	M-1000	CM16X40H	BLDT10/S7

*Recommended clamping torque (N·m):SR14-562/S=3.5

TLA10

Square shoulder mill for roughing, with screw clamp system, for triangular inserts

GAMP = +9.5°~ +11°, GAMF = -4.5°~ -0.5°



Designation	APMX	DC	ZEFP	CICT	DCSFMS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
TLA10R050L054M22.0E04	54	50	4	24	47	22	20	75	6.3	10.4	0.64	with	TO*T10...
TLA10R063L054M25.4-04	54	63	4	24	60	25.4	26	80	6	9.5	1.26	with	TO*T10...
TLA10R063L054M27.0E04	54	63	4	24	60	27	22	80	7	12.4	1.25	with	TO*T10...

Note: Coolant needs to be supplied from the end of the arbor inlay. Coolant cannot be supplied from the set bolt.

SPARE PARTS

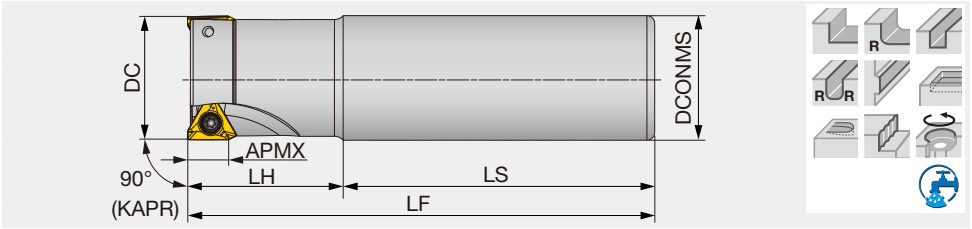
Designation	Clamping screw	Lubricant	Center bolt 1	Center bolt 2	Wrench
TLA10R050L054M22.0E04	SR14-562	M-1000	CAP-CM10X1.5X55-H	-	T-10D
TLA10R063L...	SR14-562	M-1000	-	CAP-CM12X1.75X50	T-10D

*Recommended clamping torque (N·m):SR14-562=3.5

EPA10

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

GAMP = +9.5°~ +11°, GAMF = -4.5°~ -0.5°



Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPA10R025M25.0-02N	10	25	2	25	80	35	115	0.38	without	TO*T10...
EPA10R025M25.0-02L	10	25	2	25	150	70	220	0.75	with	TO*T10...
EPA10R028M25.0-02N	10	28	2	25	80	35	115	0.39	without	TO*T10...
EPA10R028M25.0-02L	10	28	2	25	185	35	220	0.78	with	TO*T10...
EPA10R032M32.0-02N	10	32	2	32	80	40	120	0.66	without	TO*T10...
EPA10R032M32.0-03N	10	32	3	32	80	40	120	0.65	without	TO*T10...
EPA10R032M32.0-02L	10	32	2	32	175	80	255	1.46	with	TO*T10...
EPA10R035M32.0-02N	10	35	2	32	80	40	120	0.7	without	TO*T10...
EPA10R035M32.0-03N	10	35	3	32	80	40	120	0.68	without	TO*T10...
EPA10R035M32.0-02L	10	35	2	32	215	40	255	1.52	with	TO*T10...
EPA10R040M32.0-03N	10	40	3	32	80	40	120	0.72	without	TO*T10...
EPA10R040M32.0-04N	10	40	4	32	80	40	120	0.73	without	TO*T10...
EPA10R040M32.0-02L	10	40	2	32	205	50	255	1.57	with	TO*T10...

SPARE PARTS

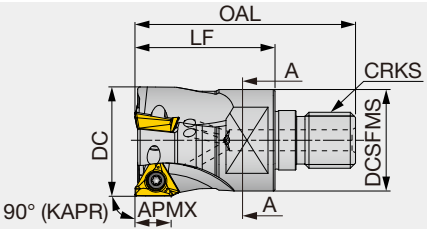
Designation	Clamping screw	Grip	Lubricant	Torx bit
EPA10...	SR14-562/S	SW6-SD	M-1000	BLDT10/S7

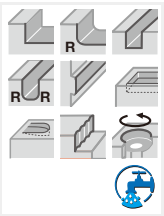
*Recommended clamping torque (N·m):SR14-562/S=3.5

HPA10-M

High precision square shoulder endmill, modular type, for triangular inserts (TungFlex)

GAMP = +9.5°~ +11°, GAMF = -4.5°~ -0.5°





Designation	APMX	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Air hole	Insert
HPA10R025MM12-02	10	25	2	57	35	17	21	M12	0.08	with	TO*T10...
HPA10R032MM16-03	10	32	3	63	40	22	29	M16	0.18	with	TO*T10...

• Please see the page **17** for TungFlex modular shank.

SPARE PARTS



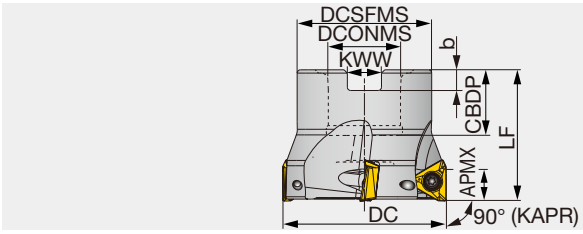

Designation	Clamping screw	Grip	Lubricant	Torx bit
HPA10...	SR14-562/S	SW6-SD	M-1000	BLDT10/S7

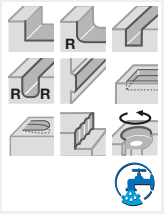
*Recommended clamping torque (N·m):SR14-562/S=3.5

TPA15

High precision square shoulder mill, with screw clamp system, for triangular inserts

GAMP = +12°~ +13.5°, GAMF = -6°~ -3.5°





Designation	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
TPA15R050M22.0E04	15	50	4	41	22	20	40	6.3	10.4	0.27	with	TOMT15...
TPA15R063M22.0E05	15	63	5	41	22	20	40	6.3	10.4	0.41	with	TOMT15...
TPA15R080M25.4-06	15	80	6	46	25.4	26	50	6	9.5	0.83	with	TOMT15...
TPA15R080M27.0E06	15	80	6	50	27	22	50	7	12.4	0.86	with	TOMT15...
TPA15R100M31.7-07	15	100	7	60	31.75	32	50	8	12.7	1.3	with	TOMT15...
TPA15R100M32.0E07	15	100	7	60	32	28.5	50	8	14.4	1.27	with	TOMT15...
TPA15R125M38.1-08	15	125	8	80	38.1	38	63	10	15.9	2.7	with	TOMT15...
TPA15R125M40.0E08	15	125	8	71	40	32	63	9	16.4	2.47	with	TOMT15...
TPA15R160M40.0E10N	15	160	10	100	40	32	63	9	16.4	4.77	without	TOMT15...
TPA15R160M50.8-10N	15	160	10	100	50.8	46	63	11	19	4.4	without	TOMT15...

SPARE PARTS





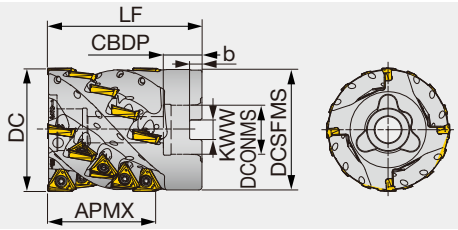

Designation	Clamping screw	Grip	Lubricant	Center bolt 1	Center bolt 2	Torx bit
TPA15R050M22.0E04	TS45120I	H-TB2W	M-1000	-	FSHM10-40H	BT20S
TPA15R063M22.0E05	TS45120I	H-TB2W	M-1000	-	CM10X30H	BT20S
TPA15R080M...	TS45120I	H-TB2W	M-1000	-	CM12X30H	BT20S
TPA15R100M...	TS45120I	H-TB2W	M-1000	TMBA-M16H	-	BT20S
TPA15R125M...	TS45120I	H-TB2W	M-1000	TMBA-M20H	-	BT20M
TPA15R160M...	TS45120I	H-TB2W	M-1000	-	-	BT20M

*Recommended clamping torque (N·m):TS45120I=5

TLA15-M

Square shoulder mill for roughing, with screw clamp system, for triangular inserts

GAMP = +12°~ +13.5°, GAMF = -6°~ -3.5°



Designation	APMX	DC	ZEFP	CICT	DCSFMS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
TLA15R080L070M31.7-04M	70	80	4	20	78	31.75	32	100	8	12.7	2.29	with	TOMT15...
TLA15R080L070M32.0E04M	70	80	4	20	78	32	25	100	8	14.4	2.38	with	TOMT15...
TLA15R100L083M38.1-05M	83	100	5	30	98	38.1	38	110	10	15.9	4.24	with	TOMT15...
TLA15R100L083M40.0E05M	83	100	5	30	98	40	32	110	9	16.4	4.26	with	TOMT15...

Note: Coolant needs to be supplied from the end of the arbor inlay. Coolant cannot be supplied from the set bolt.

SPARE PARTS





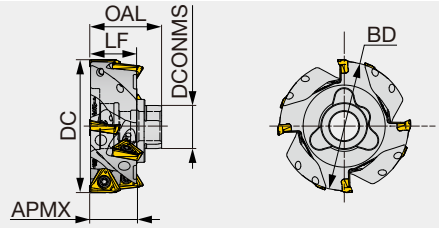
Designation	Clamping screw	Grip	Torx bit	Lubricant	Center bolt
TLA15R080...	TS45120I	H-TB2W	BT20S	M-1000	CM16X75
TLA15R100...	TS45120I	H-TB2W	BT20S	M-1000	CM20X80

*Recommended clamping torque (N·m):TS45120I=5

TLA15-S

Subunit for TLA15-M, square shoulder mill for roughing, with screw clamp system, for triangular inserts

GAMP = +12°~ +13.5°, GAMF = -6°~ -3.5°



Designation	APMX	DC	ZEFP	CICT	BD	DCONMS	OAL	LF	WT(kg)	Air hole	Insert
TLA15R080L028-04S	28	80	4	8	77.6	27	43	28.2	0.65	with	TOMT15...
TLA15R100L028-05S	28	100	5	10	97.2	33	46	28	1.05	with	TOMT15...

Note: Coolant needs to be supplied from the end of the arbor inlay. Coolant cannot be supplied from the set bolt.

SPARE PARTS




Designation	Clamping screw	Grip	Lubricant	Torx bit
TLA15...	TS45120I	H-TB2W	M-1000	BT20S

*Recommended clamping torque (N·m):TS45120I=5

CENTER BOLT

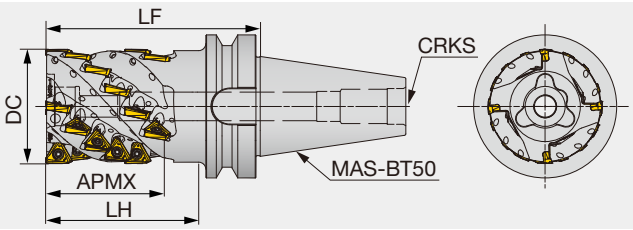
(Optional parts)


No. of subunits	1	2
TLA15R080L028-04S	CM16x120	CM16x140
TLA15R100L028-05S	CM20x120	CM20x150

TLA15-BT

Square shoulder mill for roughing, with BT tapered shank, for triangular inserts

GAMP = +12°~ +13.5°, GAMF = -6°~ -3.5°



Designation	APMX	DC	ZEFP	CICT	LF	LH	WT(kg)	Air hole	CRKS	Insert
TLA15R080L083BT50-04M	83	80	4	24	150	107	6.29	with	M24	TOMT15...
TLA15R100L097BT50-05M	97	100	5	35	165	126.5	8.92	with	M24	TOMT15...

SPARE PARTS





Designation	Clamping screw	Grip	Lubricant	Torx bit	Shell locking bolt
TLA15R080L083BT50-04M	TS45120I	H-TB2W	M-1000	BT20S	CAP-CM16×2.0×55
TLA15R100L097BT50-05M	TS45120I	H-TB2W	M-1000	BT20S	CAP-CM20×2.5×50

*Recommended clamping torque (N·m):TS45120I=5

CENTER BOLT

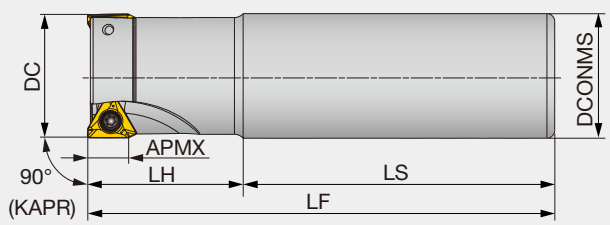
(Optional parts)

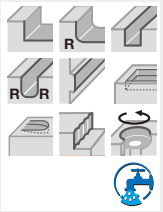

No. of subunits	1	2
TLA15R080L083BT50-04M	CAP-CM16×2.0×55	CM16x120
TLA15R100L097BT50-05M	CAP-CM20×2.5×50	CM20x80

EPA15

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

GAMP = +12°~ +13.5°, GAMF = -6°~ -3.5°





Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPA15R040M32.0-03N	15	40	3	32	80	40	120	0.73	without	TOMT15...
EPA15R040M32.0-02L	15	40	2	32	205	50	255	1.56	with	TOMT15...
EPA15R050M32.0-04N	15	50	4	32	80	40	120	0.83	without	TOMT15...
EPA15R050M42.0-02L	15	50	2	42	310	50	360	3.84	with	TOMT15...

SPARE PARTS

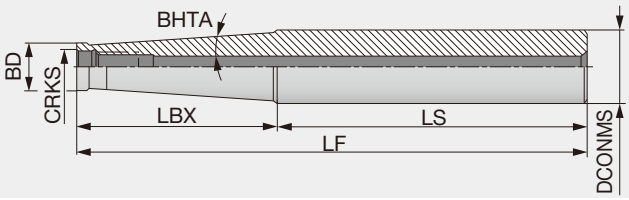



Designation	Clamping screw	Grip	Lubricant	Torx bit
EPA15...	TS45120I	H-TB2W	M-1000	BT20S

*Recommended clamping torque (N·m):TS45120I=5

TungFlex

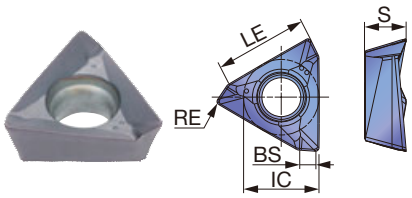
TungFlex modular shank



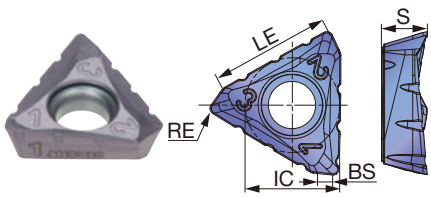
Designation	DCONMS	LF	LS	LBX	BD	CRKS	BHTA	Shank type
SM06-L60C10	10	60	40	20	9.7	M6	0°	Cylindrical
SM06-L105-C12	12	105	45	60	9.7	M6	1.2°	Cylindrical
SM06-L125-C16	16	125	65	60	9.7	M6	3.3°	Cylindrical
SM08-L73C16	16	73	48	25	13	M8	0°	Cylindrical
SM08-L128-C16	16	128	48	80	13	M8	0.9°	Cylindrical
SM08-L170-C20	20	170	103.2	66.8	13	M8	3.3°	Cylindrical
SM10-L80-C20	20	80	50	30	18	M10	0°	Cylindrical
SM10-L130-C20	20	130	50	80	18	M10	0.6°	Cylindrical
SM10-L200-C25	25	200	142.8	57.2	19	M10	3.3°	Cylindrical
SM12-L86-C25	25	86	56	30	21	M12	5.1°	Cylindrical
SM12-L200-C32	32	200	122	78	21	M12	4.4°	Cylindrical
SM16-L95-C32	32	95	60	35	29	M16	1.7°	Cylindrical
SM16-L230-C32	32	230	180	50	29	M16	1.8°	Cylindrical

INSERTS

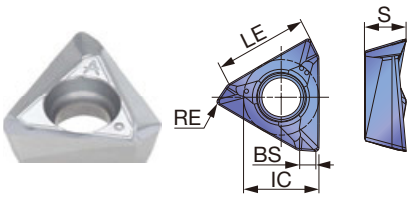
TOMT-MJ



TOMT-NMJ



TOGT-AJ



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

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated				Un-coated	LE	IC	S	BS
			AH120	AH3135	T1215	T3225	KS05F				
TOMT060302PDER-MJ	0.2	6	●	●				6.2	5.6	3.2	1.4
TOMT060304PDER-MJ	0.4	6	●	●		●		6.2	5.6	3.2	1.2
TOMT060308PDER-MJ	0.8	6	●	●	●	●		6.2	5.6	3.2	0.8
TOMT100404PDER-MJ	0.4	10	●	●		●		10.5	8.6	4.7	1.5
TOMT100408PDER-MJ	0.8	10	●	●	●	●		10.5	8.6	4.7	1.1
TOMT100416PDER-MJ	1.6	10	●	●				10.5	8.6	4.7	0.2
TOMT150604PDER-MJ	0.4	15	●	●		●		15.7	12.7	6	2.2
TOMT150608PDER-MJ	0.8	15	●	●	●	●		15.7	12.7	6	1.9
TOMT150616PDER-MJ	1.6	15	●	●				15.7	12.7	6	1.1
TOMT150620PDER-MJ	2	15	●	●				15.7	12.7	6	0.7
TOMT150608PDER-NMJ	0.8	15	●	●		●		15.7	12.7	6	1.9
TOGT100404PDFR-AJ	0.4	10					●	10.5	8.6	5.2	1.5
TOGT100408PDFR-AJ	0.8	10					●	10.5	8.6	5.1	1.1

●: Line up

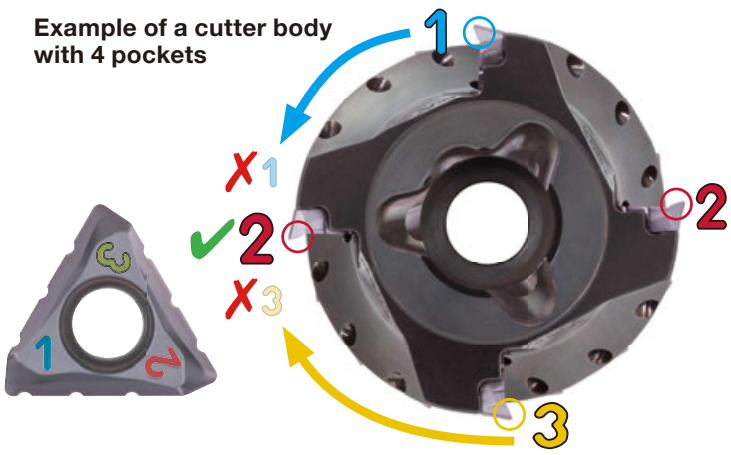
Caution for using NMJ chipbreaker

⚠ Insert with NMJ chipbreaker has a number marked on each corner.
DO NOT place the corners with the same number in adjacent flute as the cutter may be damaged.

For example, if you place the corner #1 in one flute, be sure to use #2 or #3 (and avoid #1) in the next one.

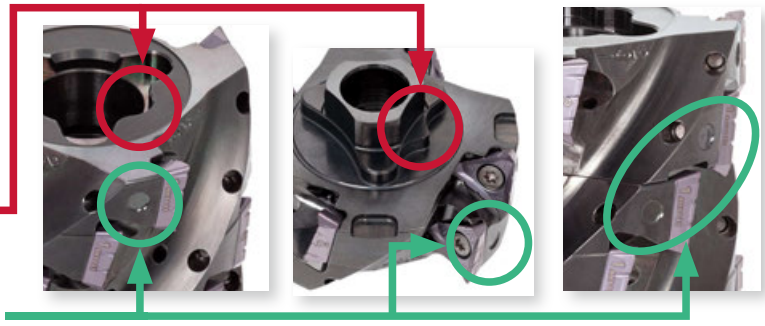
Item: TOMT150608PDER-NMJ

Example of a cutter body with 4 pockets



How to set a sub-unit

When setting a sub-unit on the main unit or another sub-unit, be sure to match the markings on the units. Sub-unit has a projection for error-proofing to avoid setting error.



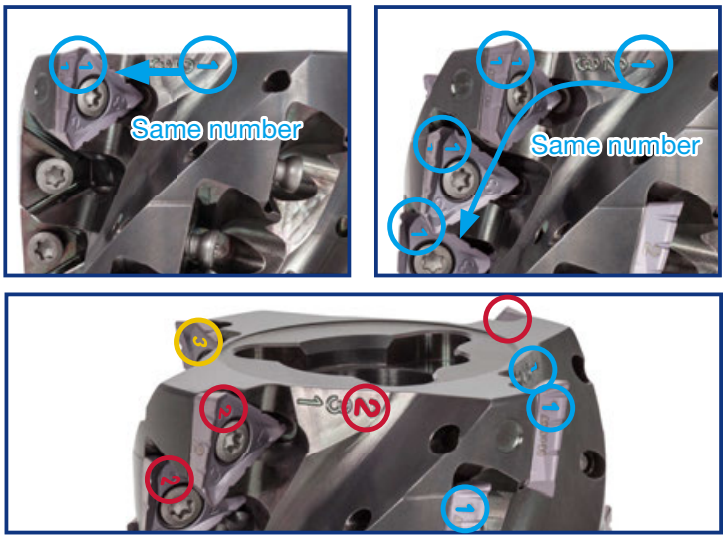
Directions for setting NMJ inserts on roughing type bodies

1. Attach the insert on the cutter body so that the number on the working cutting edge matches the first number marked on the cutter body.
(See the image on the right.)

2. Attach the remaining inserts on the same flute with the same number marked on the working cutting edge.

3. Repeat steps 1 and 2 for the other flutes.

4. Make sure the number on the working cutting edge is different from the number used on the adjacent flutes.



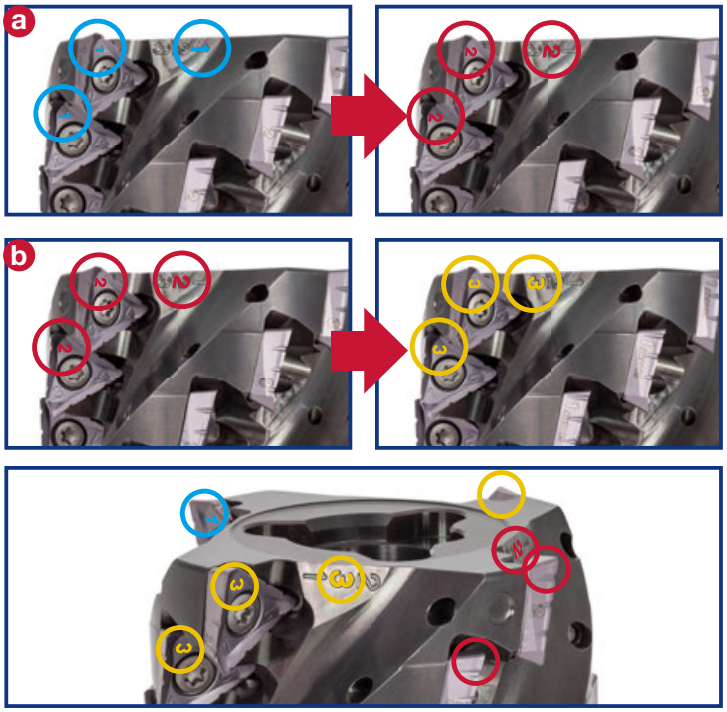
Directions for changing corners for inserts on roughing type bodies

1. a First time to change the corner rotate the insert clock-wise to match the number on the working cutting edge with the second number marked on the cutter body.
(See the image on the right.)
Ex: 1 ➡ 2
2 ➡ 3
3 ➡ 1

   b Second time to change the corner rotate the insert clock-wise to match the number on the working cutting edge with the last number marked on the cutter body.
(See the image on the right.)
Ex: 2 ➡ 3
3 ➡ 1
1 ➡ 2

2. Repeat step 1 for all inserts.

3. Make sure the number on the working cutting edge is different from the number used on the adjacent flutes.



TUNG-TRI
TUNGALOY

STANDARD CUTTING CONDITIONS

TPA/EPA/HPA

ISO	Workpiece materials	Hardness HB	Grades	Cutting speed *Vc* (m/min)			Feed per tooth: *fz* (mm/t)				
							MJ			NMJ	AJ
				T/E/HPA06	T/E/HPA10	T/EPA15	T/E/HPA06	T/E/HPA10	T/EPA15	T/EPA15	T/E/HPA10
P	Low carbon steel (SS400 / E275A, S15C / C15E4, etc.)	- 200	AH3135	100 - 220	100 - 250	100 - 250	0.05 - 0.15	0.08 - 0.2	0.08 - 0.25	0.08 - 0.15	-
	High carbon steel (S45C / C45, etc.)	200 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2	0.08 - 0.15	-
	Alloy steel (SCM440, etc. / 42CrMo4, etc.)	150 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2	0.08 - 0.15	-
	Tool steel (SKD61 / X40CrMoV5-1, etc.)	30 - 40 HRC	AH3135	100 - 120	100 -150	100 - 180	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2	0.08 - 0.15	-
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	-	AH3135	80 - 150	80 - 200	90 - 200	0.05 - 0.15	0.08 - 0.2	0.08 - 0.2	0.08 - 0.15	-
K	Grey cast iron (FC250 / GG25 / 250, etc.)	150 - 250	AH120	100 - 200	100 - 250	140 - 250	0.05 - 0.15	0.08 - 0.2	0.08 - 0.25	0.08 - 0.15	-
			T1215	150 - 250	150 - 300	200 - 300	0.05 - 0.12	0.08 - 0.15	0.08 - 0.18	-	-
	Ductile cast iron (FCD450 / GGG45 / 450-10S, etc.)	150 - 250	AH120	80 - 150	80 - 200	110 - 200	0.05 - 0.15	0.08 - 0.2	0.08 - 0.25	0.08 - 0.15	-
			T1215	100 - 200	130 - 250	150 - 250	0.05 - 0.12	0.08 - 0.15	0.08 - 0.18	-	-
N	Aluminium (Si < 13%)	-	KS05F	-	300 - 1000	-	-	-	-	-	0.08 - 0.22
	Aluminium (Si ≥ 13%)	-	KS05F	-	100 - 200	-	-	-	-	-	0.08 - 0.22
S	Titanium alloys (Ti-6Al-4V, etc.)	-	AH120	20 - 50	20 - 60	20 - 60	0.05 - 0.1	0.08 - 0.15	0.08 - 0.18	0.08 - 0.15	-
	Heat-resistant alloys (Inconel 718, etc.)	-	AH120	20 - 35	20 - 40	20 - 40	0.03 - 0.08	0.05 - 0.13	0.07 - 0.15	0.07 - 0.15	-

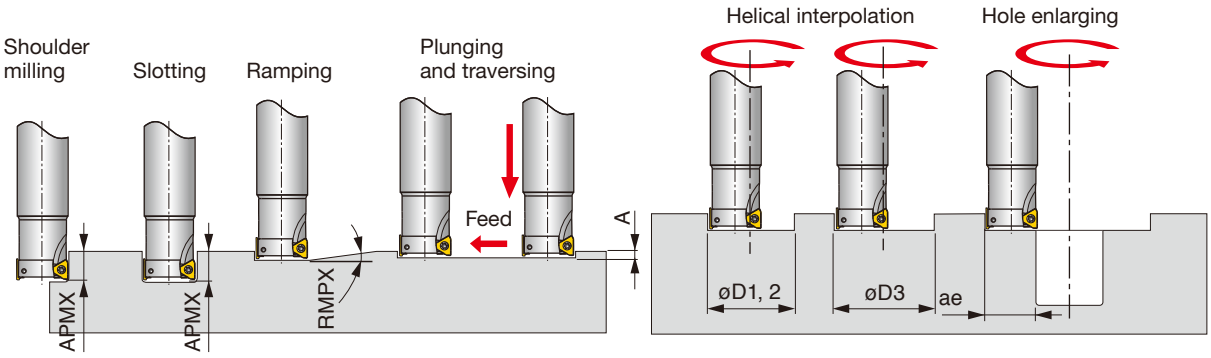
· When you use the NMJ chipbreaker, please set up the feed less than 0.15 mm/t.
· Remove excessive chip accumulation with an air blast.
· For the operation with depth of cut which varies (ex.casting skin) and machining of workpiece materials with interrupted surface, the feed per tooth (*fz*) should be set to the lower recommended value shown in the above table.
· Cutting conditions maybe 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.

TLA (Roughing type)

ISO	Workpiece materials	Hardness HB	Grades	Cutting speed *Vc* (m/min)		Feed per tooth: *fz* (mm/t)			
						MJ		NMJ	AJ
				TLA10	TLA15	TLA10	TLA15	TLA15	TLA10
P	Low carbon steel (SS400 / E275A, S15C / C15E4, etc.)	- 200	AH3135	100 - 250	100 - 250	0.08 - 0.18	0.08 - 0.22	0.08 - 0.15	-
	High carbon steel (S45C / C45, etc.)	200 - 300	AH3135	100 - 200	100 - 270	0.08 - 0.14	0.08 - 0.18	0.08 - 0.15	-
	Alloy steel (SCM440, etc. / 42CrMo4, etc.)	30 - 40 HRC	AH3135	100 - 150	100 - 180	0.08 - 0.14	0.08 - 0.18	0.08 - 0.15	-
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	-	AH3135	80 - 200	90 - 200	0.08 - 0.15	0.08 - 0.18	0.08 - 0.15	-
K	Grey cast iron (FC250 / GG25 / 250, etc.)	150 - 250	AH120	100 - 250	140 - 250	0.08 - 0.18	0.08 - 0.25	0.08 - 0.15	-
			T1215	150 - 250	150 - 250	0.08 - 0.15	0.08 - 0.18	-	-
	Ductile cast iron (FCD450 / GGG45 / 450-10S, etc.)	150 - 250	AH120	80 - 200	110 - 200	0.08 - 0.18	0.08 - 0.25	0.08 - 0.15	-
			T1215	150 - 250	150 - 250	0.08 - 0.15	0.08 - 0.18	-	-
N	Aluminium (Si < 13%)	-	KS05F	300 - 1000	-	-	-	-	0.08 - 0.22
	Aluminium (Si ≥ 13%)	-	KS05F	100 - 200	-	-	-	-	0.08 - 0.22
S	Titanium alloys (Ti-6Al-4V, etc.)	-	AH120	20 - 60	20 - 60	0.08 - 0.15	0.08 - 0.18	0.08 - 0.15	-
	Heat-resistant alloys (Inconel 718, etc.)	-	AH120	20 - 40	20 - 40	0.05 - 0.13	0.07 - 0.15	0.07 - 0.15	-

· When using NMJ chipbreaker, please set up the feed not to exceed 0.15 mm/t.

APPLICATION RANGE

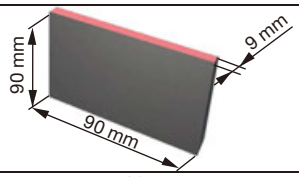
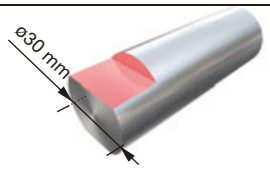
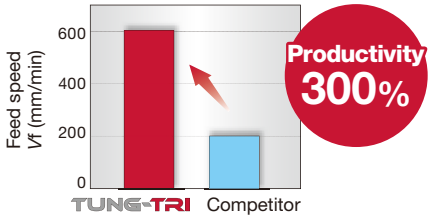


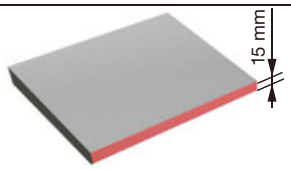
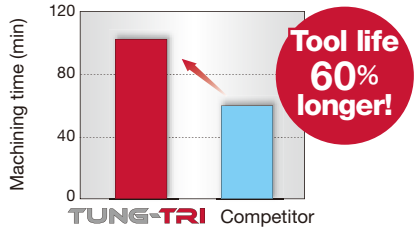
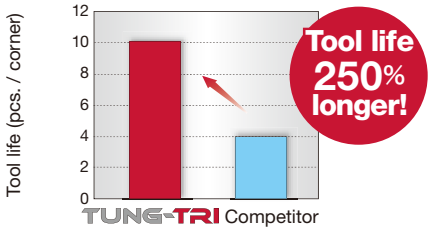
Designation	DC	Max. depth of cut APMX	Max. ramping angle RMPX	Max. plunging depth A	Min. machining depth øD1	Max. machining diameter øD2	Max. machining diameter øD3 *	Max. cutting width in enlarging ae
EPA06R012...	12	6	5°	0.6	18	23.6	21	11.5
E/HPA06R016...	16	6	4.3°	0.6	25	31.6	29	15.5
EPA06R018...	18	6	3.5°	0.6	29.5	35.6	33	17.5
E/HPA06R020...	20	6	2.8°	0.6	33.5	39.6	37	19.5
EPA06R022...	22	6	2.5°	0.6	37.5	43.6	41	21.5
E/HPA06R025...	25	6	2°	0.6	43.5	49.6	47	24.5
E/HPA10R025...	25	10	2°	0.6	42.1	49.6	47	24.5
EPA06R028...	28	6	1.8°	0.6	49.5	55.6	53	27.5
EPA10R028...	28	10	2°	0.6	48.1	55.6	53	27.5
H/TPA06R032...	32	6	1.5°	0.6	57.5	63.6	61	31.5
E/HPA10R032...	32	10	2°	0.6	56.1	63.6	61	31.5
EPA10R035...	35	10	1.7°	0.6	62.1	69.6	67	34.5
TPA06R040...	40	6	1°	0.6	73.5	79.6	77	39.5
E/TPA10R040...	40	10	1.4°	0.6	72.1	79.6	77	39.5
EPA15R040...	40	15	2.3°	0.8	68.5	79.2	75.5	39
TPA06R050...	50	6	0.7°	0.6	94	99.6	97	49.5
TPA10R050...	50	10	0.9°	0.6	92.1	99.6	97	49.5
E/TPA15R050...	50	15	1.7°	0.8	88.5	99.2	95.5	49
TPA10R063...	63	10	0.8°	0.6	118.1	125.6	123	62.5
TPA15R063...	63	15	1.4°	0.8	114.5	125.2	121.5	62
TPA10R080...	80	10	0.6°	0.6	152.1	159.6	157	79.5
TPA15R080...	80	15	1°	0.8	148.5	159.2	155.5	79
TPA10R100...	100	10	0.5°	0.6	192.1	199.6	197	99.5
TPA15R100...	100	15	0.8°	0.8	188.5	199.2	195.5	99
TPA15R125...	125	15	0.6°	0.8	238.5	249.2	245.5	124
TPA15R160...	160	15	0.5°	0.8	308.5	319.2	315.5	159

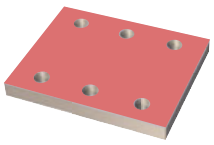
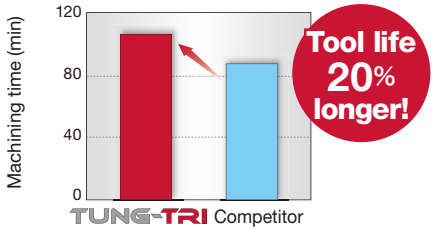
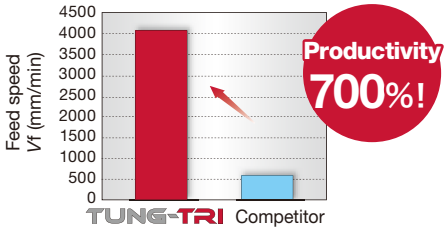
* Flat bottom hole

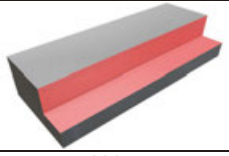
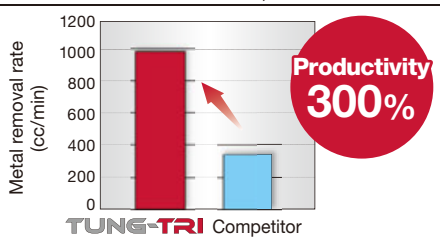
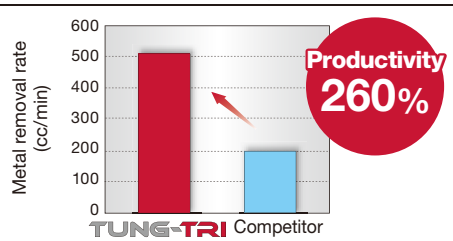
Note: Corner RE for dimensions of øD1, øD2 and øD3: RE = 0.4 for E/TPA06, E/TPA10 and RE = 0.8 for E/TPA15.

PRACTICAL EXAMPLES

	Workpiece type	Plate	Machine part
	Cutter	EPA06R020M20.0-03N (ø20 mm, z = 3)	EPA10R032M32.0-03N (ø32 mm, z = 3)
	Insert	TOMT060304PDER-MJ	TOMT100404PDER-MJ
	Grade	AH3135	AH3135
	Workpiece material	SUS304 / X5CrNi18-9	S45C / C45
		 M	 P
Cutting conditions	Cutting speed: *Vc* (m/min)	125	150
Cutting conditions	Feed per tooth: *fz* (mm/t)	0.083	0.19
Cutting conditions	Feed speed: *Vf* (mm/min)	600	836
Cutting conditions	Depth of cut : *ap* (mm)	1.5	1
Cutting conditions	Width of cut : *ae* (mm)	9	5
Cutting conditions	Machining	Face milling	Shoulder milling
Cutting conditions	Coolant	Dry	Wet (External coolant)
Cutting conditions	Machine	BT40	Turn-Mill center
	Results	 Uniquely designed cutting edge geometry delivers low cutting force and prevents chattering, resulting in highly efficient machining of steel sheet.	Conditions / Burr / Wall surface finish: TUNG-TRI — Small — Better; Competitor — Big — Worse. Due to low cutting force, Tung-Tri leaves a smaller burr and better wall surface finish compared to the competitor.

	Workpiece type	Base	Block
	Cutter	EPA10R032M32.0-03N (ø32 mm, z = 3)	TPA10R063M22.0E06 (ø63 mm, z = 6)
	Insert	TOMT100404PDER-MJ	TOMT100408PDER-MJ
	Grade	AH3135	T1215
	Workpiece material	S50C / C50	FCD700
		 P	 K
Cutting conditions	Cutting speed: *Vc* (m/min)	130	196
Cutting conditions	Feed per tooth: *fz* (mm/t)	0.1	0.15
Cutting conditions	Feed speed: *Vf* (mm/min)	390	900
Cutting conditions	Depth of cut : *ap* (mm)	1.5	2.5
Cutting conditions	Width of cut : *ae* (mm)	25	54.5
Cutting conditions	Machining	Shoulder milling	Face milling
Cutting conditions	Coolant	External air	Dry
Cutting conditions	Machine	Vertical M/C	BT40
	Results	 Due to strong wear resistance of AH3135 grade, tool life is increased by 60%.	 T1215 exhibited a superior wear resistance, extending the tool life well over to 250%.

Workpiece type		Blank	General machine part
Cutter		EPA10R040M32.0-04N (ø40 mm, z = 4)	EPA10R025M25.0-02N (ø25 mm, z = 2)
Insert		TOMT100408PDER-MJ	TOGT100408PDFR-AJ
Grade		AH3135	KS05F
Workpiece material		Titanium	AC4B
		 S	 N
Cutting conditions	Cutting speed: *Vc* (m/min)	55	457
	Feed per tooth: *fz* (mm/t)	0.1	0.3
	Feed speed: *Vf* (mm/min)	175	4072
	Depth of cut : *ap* (mm)	2.5	1.27
	Width of cut : *ae* (mm)	25	-
	Machining	Face milling	Face milling
	Coolant	Wet (External coolant)	Wet (External coolant)
	Machine	Vertical M/C, BT50	Vertical M/C, BT40
Results		 Sharp cutting edges prevent welding, which extends tool life.	 The AJ chipbreaker exhibited its high fracture resistance even in a demanding cutting condition.

Workpiece type		Molding machine part	Generator
Cutter		TLA15R080L070M31.7-04M (ø80 mm) TLA15R080L028-04S	TLA15R100L083M38.1-05M (ø100 mm, z = 5)
Insert		TOMT150608PDER-MJ	TOMT150608PDER-NMJ
Grade		AH120	AH3135
Workpiece material		FCD400 / 400-15S	S45C / C45
		 K	 P
Cutting conditions	Cutting speed: *Vc* (m/min)	180	160
	Feed per tooth: *fz* (mm/t)	0.2	0.16
	Feed speed: *Vf* (mm/min)	573.0	407
	Depth of cut : *ap* (mm)	74	50
	Width of cut : *ae* (mm)	24	25
	Machining	Contouring	Shoulder milling (Roughing)
	Coolant	Dry	Wet (External coolant)
	Machine	Vertical M/C, BT50	Vertical M/C, BT50
Results		 NMJ insert reduces cutting force, and dramatically improves efficiency.	 The serrated cutting edges of the NMJ chip-breaker significantly reduced vibration, while outputting a high MMR.

Tungaloy Corporation (Head office)
11-1 Yoshima-Kogyodanchi
Iwaki-city, Fukushima 970-1144 Japan
Phone: +81-246-36-8501
Fax: +81-246-36-8542
www.tungaloy.co.jp

Tungaloy America, Inc.
3726 N Ventura Drive
Arlington Heights,IL 60004, U.S.A.
Phone: +1-888-554-8394
Fax: +1-888-554-8392
www.tungaloy.com/us

Tungaloy Canada
432 Elgin St. Unit 3
Brantford, Ontario N3S 7P7, Canada
Phone: +1-519-758-5779
Fax: +1-519-758-5791
www.tungaloy.com/ca

Tungaloy de Mexico S.A.
C Los Arellano 113,
Parque Industrial Siglo XXI
Aguascalientes, AGS, Mexico 20290
Phone: +52-449-929-5410
Fax: +52-449-929-5411
www.tungaloy.com/mx

Tungaloy do Brasil Ltda.
Avd. Independencia N4158 Residencial Flora
13280-000 Vinhedo, São Paulo, Brasil
Phone: +55-19-38262757
Fax: +55-19-38262757
www.tungaloy.com/br

Tungaloy Germany GmbH
An der Alten Ziegelei 1
D-40789 Monheim, Germany
Phone: +49-2173-90420-0
Fax: +49-2173-90420-19
www.tungaloy.com/de

Tungaloy France S.A.S.
ZA Courtaboeuf - Le Rio
1 rue de la Terre de feu
F-91952 Courtaboeuf Cedex, France
Phone: +33-1-6486-4300
Fax: +33-1-6907-7817
www.tungaloy.com/fr

Tungaloy Italia S.r.l.
Via E. Andolfato 10
I-20126 Milano, Italy
Phone: +39-02-252012-1
Fax: +39-02-252012-65
www.tungaloy.com/it

Tungaloy Czech s.r.o.
Turanka 115
CZ-627 00 Brno, Czech Republic
Phone: +420-532 123 391
Fax: +420-532 123 392
www.tungaloy.com/cz

Tungaloy Ibérica S.L.
C/Miquel Servet, 43B, Nau 7
Pol. Ind. Bufalvent
ES-08243 Manresa (BCN), Spain
Phone: +34 93 113 1360
Fax: +34 93 876 2798
www.tungaloy.com/es

Tungaloy Scandinavia AB
Bultgatan 38
442 40 Kungälv, Sweden
Phone: +46-462119200
Fax: +46-462119207
www.tungaloy.com/se

Tungaloy Rus, LLC
Andropova avenue, h.18/7,
11 floor, office 3, 115432,
Moscow, Russia
Phone: +7-499-683-01-80
Fax: +7-499-683-01-81
www.tungaloy.com/ru

Tungaloy Polska Sp. z o.o.
Ul. Irysowa 1, 55-040 Bielany
Wrocławskie, Poland
Phone: +48 607 907 237
www.tungaloy.com/pl

Tungaloy U.K. Ltd
Gallan Park, Watling Street,
Cannock, WS110XG, UK
Phone: +44 121 4000 231
Fax: +44 121 270 9694
www.tungaloy.com/uk

Tungaloy Hungary Kft
Erzsébet királyné útja 125
H-1142 Budapest, Hungary
Phone: +36 1 781-6846
Fax: +36 1 781-6866
www.tungaloy.com/hu

Tungaloy Turkey
Serifali Mah.bayraktar Bulvari Kule Sk. No:26
34775 Umraniye / Istanbul / Turkey
Phone: +90 216 540 04 67
Fax: +90 216 540 04 87
www.tungaloy.com/tr

Tungaloy Benelux b.v.
Tjalk 70
NL-2411 NZ Bodegraven, Netherlands
Phone: +31 172 630 420
Fax: +31 172 630 429
www.tungaloy.com/nl

Tungaloy Croatia
Ulica bana Josipa Jelačića 87,
10430, Samobor, Croatia
Phone: +385 1 3326 604
Fax: +385 1 3327 683
www.tungaloy.com/hr

Tungaloy Cutting Tool (Shanghai) Co.,Ltd.
Rm No 401 No.88 Zhabei
Jiangchang No.3 Rd
Shanghai 200436, China
Phone: +86-21-3632-1880
Fax: +86-21-3621-1918
www.tungaloy.com/cn

Tungaloy Cutting Tools (Taiwan) Co.,Ltd.
9F. No.293, Zhongyang Rd,
Xinzhuang Dist, New Taipei City,
24251 Taiwan
Phone: +886-2-8521-9986
Fax: +886-2-8521-8935
www.tungaloy.com/tw

Tungaloy Cutting Tools (Thailand) Co.,Ltd.
Interlink tower 4th Fl.
1858/5-7 Bangna-Trad Road
km.5 Bangna, Bangna, Bangkok 10260
Thailand
Phone: +66-2-751-5711
Fax: +66-2-751-5715
www.tungaloy.com/th

Tungaloy Singapore (Pte.), Ltd.
62 Ubi Road 1, #06-11 Oxley BizHub 2
Singapore 408734
Phone: +65-6391-1833
Fax: +65-6299-4557
www.tungaloy.com/sg

Tungaloy Vietnam
LE04.38, Lexington Residence
67 Mai Chi Tho St., Dist. 2,
Ho Chi Minh City, Vietnam
Phone: +84-2837406660
www.tungaloy.com/sg

Tungaloy India Pvt. Ltd.
Indiabulls Finance Centre,
Unit # 902-A, 9th Floor,
Tower 1, Senapati Bapat Marg,
Elphinstone Road (West),
Mumbai -400013, India
Phone: +91-22-6124-8804
Fax: +91-22-6124-8899
www.tungaloy.com/in

Tungaloy Korea Co., Ltd
#1312, Byucksan Digital Valley 5-cha
Beotkkot-ro 244, Geumcheon-gu
153-788 Seoul, Korea
Phone: +82-2-2621-6161
Fax: +82-2-6393-8952
www.tungaloy.com/kr

Tungaloy Malaysia Sdn Bhd
50 K-2, Kelana Mall, Jalan SS6/14
Kelana Jaya, 47301
Petaling Jaya, Selangor Darul Ehsan
Malaysia
Phone: +603-7805-3222
Fax: +603-7804-8563
www.tungaloy.com/my

Tungaloy Australia Pty Ltd
Unit 68 1470 Ferntree Gully Road
Knoxfield 3180 Victoria, Australia
Phone: +61-3-9755-8147
Fax: +61-3-9755-6070
www.tungaloy.com/au

PT. Tungaloy Indonesia
Kompleks Grand Wisata Block AA-10 No.3-5
Cibitung
Bekasi 17510, Indonesia
Phone: +62-21-8261-5808
Fax: +62-21-8261-5809
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Dr. Carbide Tungaloy

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MillLine

TUNG-TRI

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Tungaloy Report No. 421S1-G

New high precision shoulder milling inserts

INDUSTRY 4.0

FEED the SPEED!

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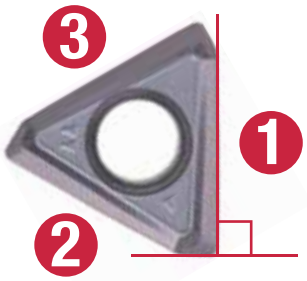
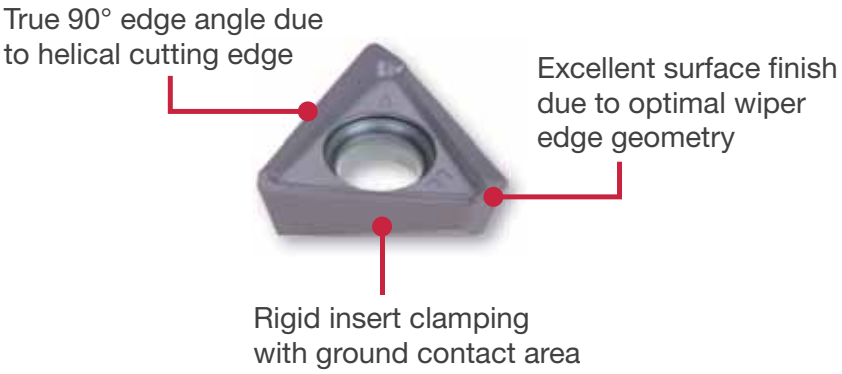
For more information

New ground E-class MJ insert offers precise square shoulder milling and excellent surface finish!

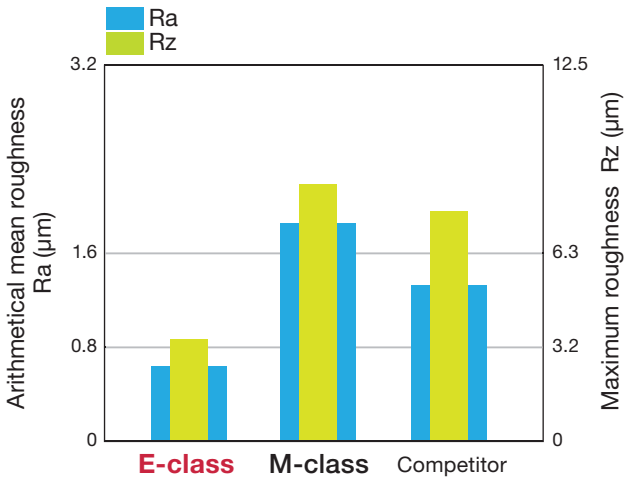
3 cutting edges perfectly perpendicular to the workpiece material

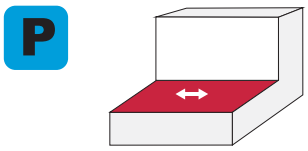




Excellent surface finish

■ Surface roughness



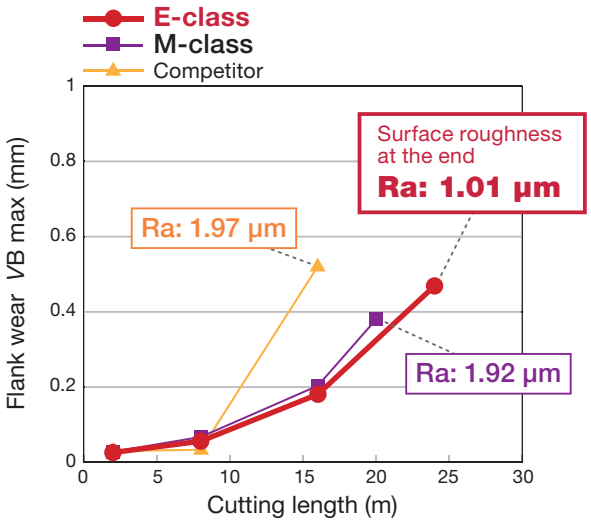


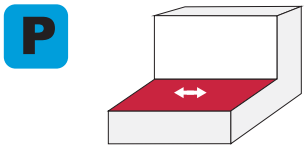
Cutter	: TPA15R100M31.7-07 (ø100 mm, z = 7)
Insert	: TOET150608PDER-MJ
Grade	: AH3135
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 250 m/min
Feed per tooth	: *fz* = 0.1 mm/t
Depth of cut	: *ap* = 3 mm
Width of cut	: *ae* = 70 mm
Coolant	: Air
Machine	: Vertical M/C, BT50

Only the E-class inserts offered Ra < 0.8 µm and Rz < 6.3 µm surface roughness due to optimal wiper edge.

Stable surface finish quality

■ Tool life and surface roughness at the end of the machining process





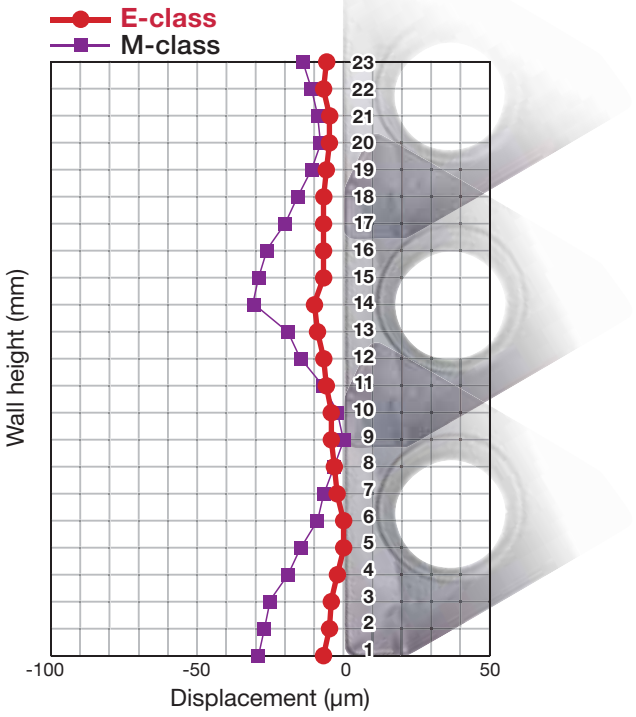
Cutter	: TPA10R080M25.4-07 (ø80 mm, z = 7)
Insert	: TOET100404PDER-MJ
Grade	: AH3135
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 250 m/min
Feed per tooth	: *fz* = 0.1 mm/t
Depth of cut	: *ap* = 2 mm
Width of cut	: *ae* = 20 mm
Coolant	: Air
Machine	: Vertical M/C, BT50

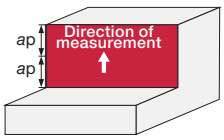
AH3135 - PVD grade for high fracture resistance
- Most suitable for steel and stainless steel in general cutting parameters

Close runout accuracy improved tool life and provided stable surface finish quality.

High wall accuracy

■ Wall accuracy in high speed machining





Cutter	: EPA15R040M32.0-03 (ø40 mm, z = 3)
Insert	: TOET150608PDER-MJ
Grade	: AH3135
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 250 m/min
Feed per tooth	: *fz* = 0.1 mm/t
Depth of cut	: *ap* = 8 mm
Width of cut	: *ae* = 5 mm
Coolant	: Air
Machine	: Vertical M/C, BT50

Helical cutting edge and secure insert clamping with the ground surface provide excellent wall accuracy even during demanding machining conditions.

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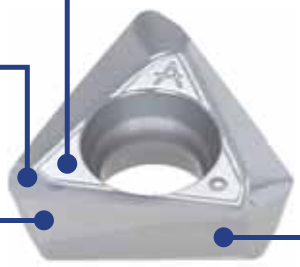
Extra sharp, tough, and precise cutting edge accelerates machining operations of non-ferrous materials!

AJ specialized chipbreaker in machining aluminium

Lapping treatment
Prevents welding on the cutting edge

Wiper edge with positive inclination
Excellent surface finish by directing chips away from the machined wall

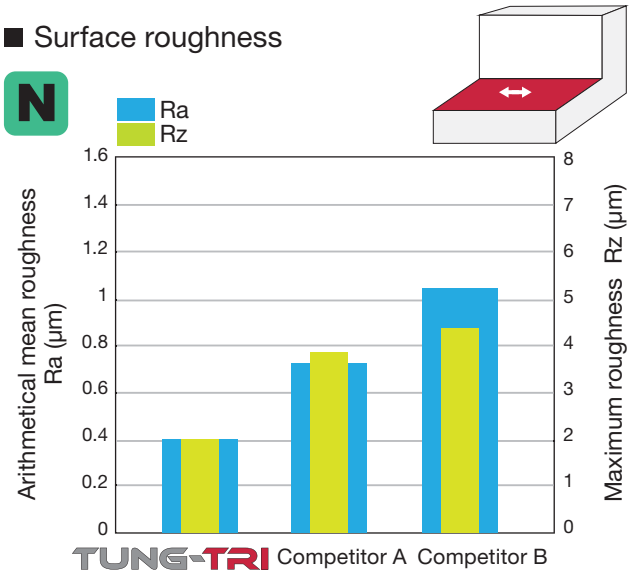


Anti-chatter design
Optimized clearance geometry to enhance insert robustness and vibration damping for machining aluminium

Cutting edge with large rake angle and high inclination
Low cutting force and smooth machining

Excellent surface finish and wall accuracy

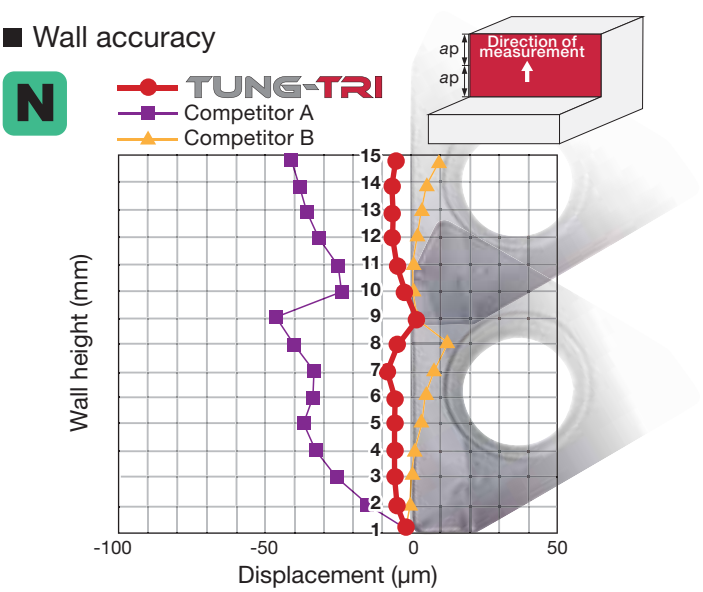
■ Surface roughness



Cutter	: EPA10R032M32.0-03N
Insert	: TOGT100408PDFR-AJ
Grade	: KS05F
Workpiece material	: A7075 (Alumigo Hard)
Cutting speed	: *Vc* = 900 m/min
Feed per tooth	: *fz* = 0.1 mm/t
Depth of cut	: *ap* = 2 mm
Width of cut	: *ae* = 21 mm
Coolant	: External air
Machine	: Vertical M/C, HSK63A

Special wiper edge geometry protects the machined workpiece material from chip re-cutting and offers excellent surface finish.

■ Wall accuracy

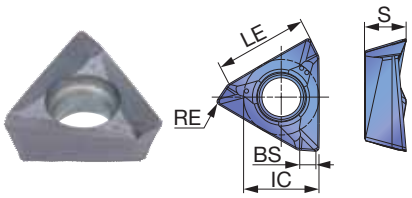


Cutter	: EPA10R032M32.0-03N
Insert	: TOGT100408PDFR-AJ
Grade	: KS05F
Workpiece material	: A7075 (Alumigo Hard)
Cutting speed	: *Vc* = 900 m/min
Feed per tooth	: *fz* = 0.1 mm/t
Depth of cut	: *ap* = 8 mm x 2 pass
Width of cut	: *ae* = 5 mm
Coolant	: External air
Machine	: Vertical M/C, HSK63A

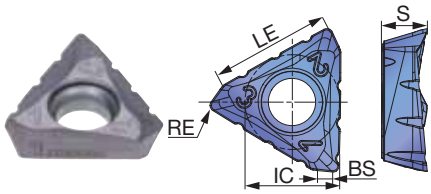
Ideal helical cutting edge design offers smooth engagement in the cut and reduces steps between the passes.

INSERTS

TOMT-MJ

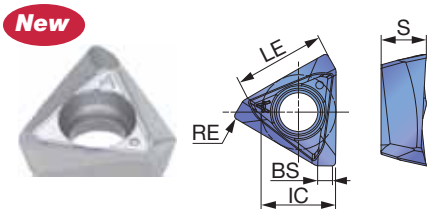


TOMT-NMJ



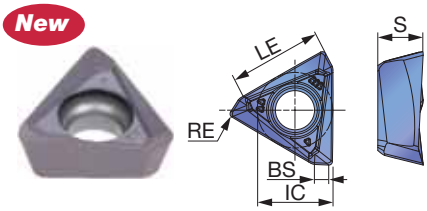
TOGT-AJ

New



TOET-MJ

New



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

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated				Un-coated	LE	IC	S	BS
			AH120	AH3135	T1215	T3225	KS05F				
TOMT060302PDER-MJ	0.2	6	●	●				6.2	5.6	3.2	1.4
TOMT060304PDER-MJ	0.4	6	●	●		●		6.2	5.6	3.2	1.2
TOMT060308PDER-MJ	0.8	6	●	●	●	●		6.2	5.6	3.2	0.8
New TOGT060304PDFR-AJ	0.4	6					●	6.2	5.6	3.3	1.2
New TOGT060308PDFR-AJ	0.8	6					●	6.2	5.6	3.3	0.8
New TOET060302PDER-MJ	0.2	6		●				6.2	5.6	3.3	1.3
New TOET060304PDER-MJ	0.4	6		●				6.2	5.6	3.3	1.1
TOMT100404PDER-MJ	0.4	10	●	●		●		10.5	8.6	4.7	1.5
TOMT100408PDER-MJ	0.8	10	●	●	●	●		10.5	8.6	4.7	1.1
TOMT100416PDER-MJ	1.6	10	●	●				10.5	8.6	4.7	0.2
TOGT100404PDFR-AJ	0.4	10					●	10.5	8.6	5.2	1.5
TOGT100408PDFR-AJ	0.8	10					●	10.5	8.6	5.1	1.1
New TOET100404PDER-MJ	0.4	10		●				10.5	8.6	5.1	1.5
New TOET100408PDER-MJ	0.8	10		●				10.5	8.6	5.1	1.1
TOMT150604PDER-MJ	0.4	15	●	●		●		15.7	12.7	6	2.2
TOMT150608PDER-MJ	0.8	15	●	●	●	●		15.7	12.7	6	1.9
TOMT150616PDER-MJ	1.6	15	●	●				15.7	12.7	6	1.1
TOMT150620PDER-MJ	2	15	●	●				15.7	12.7	6	0.7
TOMT150608PDER-NMJ	0.8	15	●	●		●		15.7	12.7	6	1.9
New TOGT150604PDFR-AJ	0.4	15					●	15.7	12.5	5.6	2.1
New TOGT150608PDFR-AJ	0.8	15					●	15.7	12.5	5.5	1.8
New TOET150604PDER-MJ	0.4	15		●				15.7	12.5	5.6	2.2
New TOET150608PDER-MJ	0.8	15		●				15.7	12.5	5.6	1.9

● : Line up
● : New product

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STANDARD CUTTING CONDITIONS

TPA/EPA/HPA

ISO	Workpiece materials	Hard-ness HB	Grades	Cutting speed *Vc* (m/min)			Feed per tooth: *fz* (mm/t)				
							MJ			NMJ	AJ
				T/E/HPA06	T/E/HPA10	T/EPA15	T/E/HPA06	T/E/HPA10	T/EPA15	T/EPA15	T/E/HPA06, T/E/HPA10, T/EPA15
P	Low carbon steel (SS400 / E275A, S15C / C15E4, etc.)	- 200	AH3135	100 - 220	100 - 250	100 - 250	0.05 - 0.15	0.08 - 0.2	0.08 - 0.25	0.08 - 0.15	-
P	High carbon steel (S45C / C45, etc.)	200 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2	0.08 - 0.15	-
P	Alloy steel (SCM440, etc. / 42CrMo4, etc.)	150 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2	0.08 - 0.15	-
P	Tool steel (SKD61 / X40CrMoV5-1, etc.)	30 - 40 HRC	AH3135	100 - 120	100 -150	100 - 180	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2	0.08 - 0.15	-
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	-	AH3135	80 - 150	80 - 200	90 - 200	0.05 - 0.15	0.08 - 0.2	0.08 - 0.2	0.08 - 0.15	-
K	Grey cast iron (FC250 / GG25 / 250, etc.)	150 - 250	AH120	100 - 200	100 - 250	140 - 250	0.05 - 0.15	0.08 - 0.2	0.08 - 0.25	0.08 - 0.15	-
K			T1215	150 - 250	150 - 300	200 - 300	0.05 - 0.12	0.08 - 0.15	0.08 - 0.18	-	-
K	Ductile cast iron (FCD450 / GGG45 / 450-10S, etc.)	150 - 250	AH120	80 - 150	80 - 200	110 - 200	0.05 - 0.15	0.08 - 0.2	0.08 - 0.25	0.08 - 0.15	-
K			T1215	100 - 200	130 - 250	150 - 250	0.05 - 0.12	0.08 - 0.15	0.08 - 0.18	-	-
N	Aluminium (Si < 13%)	-	KS05F	300 - 900	300 - 1000	300 - 1000	-	-	-	-	0.08 - 0.22
N	Aluminium (Si ≥ 13%)	-	KS05F	100 - 200	100 - 200	100 - 200	-	-	-	-	0.08 - 0.22
S	Titanium alloys (Ti-6Al-4V, etc.)	-	AH120	20 - 50	20 - 60	20 - 60	0.05 - 0.1	0.08 - 0.15	0.08 - 0.18	0.08 - 0.15	-
S	Heat-resistant alloys (Inconel 718, etc.)	-	AH120	20 - 35	20 - 40	20 - 40	0.03 - 0.08	0.05 - 0.13	0.07 - 0.15	0.07 - 0.15	-

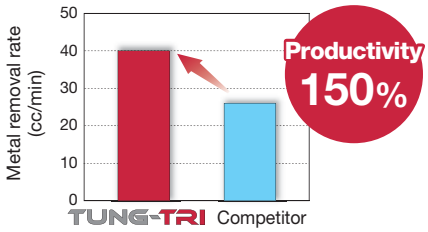
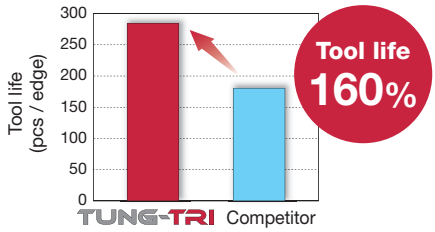
· When you use the NMJ chipbreaker, please set up the feed less than 0.15 mm/t.
· Remove excessive chip accumulation with an air blast.
· For the operation with depth of cut which varies (ex.casting skin) and machining of workpiece materials with interrupted surface, the feed per tooth (*fz*) should 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.

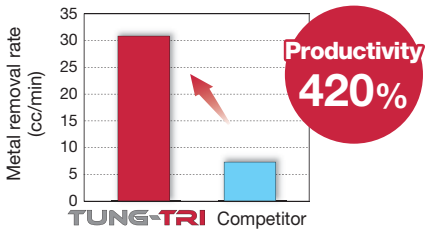
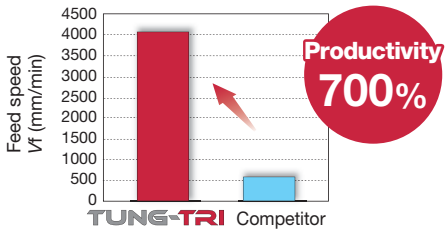
TLA (Roughing type)

ISO	Workpiece materials	Hardness HB	Grades	Cutting speed *Vc* (m/min)		Feed per tooth: *fz* (mm/t)				
						MJ		NMJ	AJ	
				TLA10	TLA15	TLA10	TLA15	TLA15	TLA10	TLA15
P	Low carbon steel (SS400 / E275A, S15C / C15E4, etc.)	- 200	AH3135	100 - 250	100 - 250	0.08 - 0.18	0.08 - 0.22	0.08 - 0.15	-	-
P	High carbon steel (S45C / C45, etc.)	200 - 300	AH3135	100 - 200	100 - 270	0.08 - 0.14	0.08 - 0.18	0.08 - 0.15	-	-
P	Alloy steel (SCM440, etc. / 42CrMo4, etc.)	30 - 40 HRC	AH3135	100 - 150	100 - 180	0.08 - 0.14	0.08 - 0.18	0.08 - 0.15	-	-
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	-	AH3135	80 - 200	90 - 200	0.08 - 0.15	0.08 - 0.18	0.08 - 0.15	-	-
K	Grey cast iron (FC250 / GG25 / 250, etc.)	150 - 250	AH120	100 - 250	140 - 250	0.08 - 0.18	0.08 - 0.25	0.08 - 0.15	-	-
K			T1215	150 - 250	150 - 250	0.08 - 0.15	0.08 - 0.18	-	-	-
K	Ductile cast iron (FCD450 / GGG45 / 450-10S, etc.)	150 - 250	AH120	80 - 200	110 - 200	0.08 - 0.18	0.08 - 0.25	0.08 - 0.15	-	-
K			T1215	150 - 250	150 - 250	0.08 - 0.15	0.08 - 0.18	-	-	-
N	Aluminium (Si < 13%)	-	KS05F	300 - 1000	300 - 1000	-	-	-	0.08 - 0.22	0.08 - 0.22
N	Aluminium (Si ≥ 13%)	-	KS05F	100 - 200	100 - 200	-	-	-	0.08 - 0.22	0.08 - 0.22
S	Titanium alloys (Ti-6Al-4V, etc.)	-	AH120	20 - 60	20 - 60	0.08 - 0.15	0.08 - 0.18	0.08 - 0.15	-	-
S	Heat-resistant alloys (Inconel 718, etc.)	-	AH120	20 - 40	20 - 40	0.05 - 0.13	0.07 - 0.15	0.07 - 0.15	-	-

· When using NMJ chipbreaker, please set up the feed not to exceed 0.15 mm/t.

PRACTICAL EXAMPLES

Workpiece type		Machine part	Housing for brake
Cutter		TPA10R050M22.0E04 (ø50 mm, z = 4)	EPA10R032M32.0-03N (ø32 mm, z = 3)
Insert		TOET100408PDER-MJ	TOET100408PDER-MJ
Grade		AH3135	AH3135
Workpiece material		SUS316Ti / X6CrNiMoTi17-12-2	FC250 / 250 / GG25
		 M	 K
Cutting conditions	Cutting speed: *Vc* (m/min)	200	220
	Feed per tooth: *fz* (mm/t)	0.15	0.08
	Feed speed: *Vf* (mm/min)	764	500
	Depth of cut : *ap* (mm)	1.5	0.5
	Width of cut : *ae* (mm)	35	30
	Machining	Shoulder milling	Shoulder milling
	Coolant	Wet	Wet
	Machine	Vertical M/C, BT50	Vertical M/C, HSK A100
Results		 Optimal wiper edge design offered excellent surface finish even in high speed machining.	 Special wiper edge design provided long and stable tool life.

Workpiece type		Housing	Machine part
Cutter		Special tool (ø32 mm, z = 3)	EPA10R025M25.0-02N (ø25 mm, z = 2)
Insert		TOET100408PDER-MJ	TOGT100408PDFR-AJ
Grade		AH3135	KS05F
Workpiece material		SACM645 / 41CrAlMo74	AC4B
		 P	 N
Cutting conditions	Cutting speed: *Vc* (m/min)	150	457
	Feed per tooth: *fz* (mm/t)	0.2	0.3
	Feed speed: *Vf* (mm/min)	895.2	4072
	Depth of cut : *ap* (mm)	1.5	1.27
	Width of cut : *ae* (mm)	23	-
	Machining	Shoulder milling	Face milling
	Coolant	Wet	Wet (External coolant)
	Machine	Multi tasking lathe	Vertical M/C, BT40
Results		 Ideal wiper edge design allowed increase in feed per tooth and cutting speed, leading to surface finish of Ra < 3.2 µm.	 AJ chipbreaker exhibited high fracture resistance even in a demanding cutting condition.

Tungaloy Corporation (Head office)
11-1 Yoshima-Kogyodanchi
Iwaki-city, Fukushima 970-1144 Japan
Phone: +81-246-36-8501
Fax: +81-246-36-8542
www.tungaloy.co.jp

Tungaloy America, Inc.
3726 N Ventura Drive
Arlington Heights,IL 60004, U.S.A.
Phone: +1-888-554-8394
Fax: +1-888-554-8392
www.tungaloy.com/us

Tungaloy Canada
432 Elgin St. Unit 3
Brantford, Ontario N3S 7P7, Canada
Phone: +1-519-758-5779
Fax: +1-519-758-5791
www.tungaloy.com/ca

Tungaloy de Mexico S.A.
C Los Arellano 113,
Parque Industrial Siglo XXI
Aguascalientes, AGS, Mexico 20290
Phone: +52-449-929-5410
Fax: +52-449-929-5411
www.tungaloy.com/mx

Tungaloy do Brasil Ltda.
Avd. Independencia N4158 Residencial Flora
13280-000 Vinhedo, São Paulo, Brasil
Phone: +55-19-38262757
Fax: +55-19-38262757
www.tungaloy.com/br

Tungaloy Germany GmbH
An der Alten Ziegelei 1
D-40789 Monheim, Germany
Phone: +49-2173-90420-0
Fax: +49-2173-90420-19
www.tungaloy.com/de

Tungaloy France S.A.S.
ZA Courtaboeuf - Le Rio
1 rue de la Terre de feu
F-91952 Courtaboeuf Cedex, France
Phone: +33-1-6486-4300
Fax: +33-1-6907-7817
www.tungaloy.com/fr

Tungaloy Italia S.r.l.
Via E. Andolfato 10
I-20126 Milano, Italy
Phone: +39-02-252012-1
Fax: +39-02-252012-65
www.tungaloy.com/it

Tungaloy Czech s.r.o.
Turanka 115
CZ-627 00 Brno, Czech Republic
Phone: +420-532 123 391
Fax: +420-532 123 392
www.tungaloy.com/cz

Tungaloy Ibérica S.L.
C/Miquel Servet, 43B, Nau 7
Pol. Ind. Bufalvent
ES-08243 Manresa (BCN), Spain
Phone: +34 93 113 1360
Fax: +34 93 876 2798
www.tungaloy.com/es

Tungaloy Scandinavia AB
Bultgatan 38
442 40 Kungälv, Sweden
Phone: +46-462119200
Fax: +46-462119207
www.tungaloy.com/se

Tungaloy Rus, LLC
Andropova avenue, h.18/7,
11 floor, office 3, 115432,
Moscow, Russia
Phone: +7-499-683-01-80
Fax: +7-499-683-01-81
www.tungaloy.com/ru

Tungaloy Polska Sp. z o.o.
Ul. Irysowa 1, 55-040 Bielany
Wrocławskie, Poland
Phone: +48 607 907 237
www.tungaloy.com/pl

Tungaloy U.K. Ltd
Gallan Park, Watling Street,
Cannock, WS110XG, UK
Phone: +44 121 4000 231
Fax: +44 121 270 9694
www.tungaloy.com/uk

Tungaloy Hungary Kft
Erzsébet királyné útja 125
H-1142 Budapest, Hungary
Phone: +36 1 781-6846
Fax: +36 1 781-6866
www.tungaloy.com/hu

Tungaloy Turkey
Serifali Mah.bayraktar Bulvari Kule Sk. No:26
34775 Umraniye / Istanbul / Turkey
Phone: +90 216 540 04 67
Fax: +90 216 540 04 87
www.tungaloy.com/tr

Tungaloy Benelux b.v.
Tjalk 70
NL-2411 NZ Bodegraven, Netherlands
Phone: +31 172 630 420
Fax: +31 172 630 429
www.tungaloy.com/nl

Tungaloy Croatia
Ulica bana Josipa Jelačića 87,
10430, Samobor, Croatia
Phone: +385 1 3326 604
Fax: +385 1 3327 683
www.tungaloy.com/hr

Tungaloy Cutting Tool (Shanghai) Co.,Ltd.
Rm No 401 No.88 Zhabei
Jiangchang No.3 Rd
Shanghai 200436, China
Phone: +86-21-3632-1880
Fax: +86-21-3621-1918
www.tungaloy.com/cn

Tungaloy Cutting Tools (Taiwan) Co.,Ltd.
9F. No.293, Zhongyang Rd,
Xinzhuang Dist, New Taipei City,
24251 Taiwan
Phone: +886-2-8521-9986
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www.tungaloy.com/tw

Tungaloy Cutting Tools (Thailand) Co.,Ltd.
Interlink tower 4th Fl.
1858/5-7 Bangna-Trad Road
km.5 Bangna, Bangna, Bangkok 10260
Thailand
Phone: +66-2-751-5711
Fax: +66-2-751-5715
www.tungaloy.com/th

Tungaloy Singapore (Pte.), Ltd.
62 Ubi Road 1, #06-11 Oxley BizHub 2
Singapore 408734
Phone: +65-6391-1833
Fax: +65-6299-4557
www.tungaloy.com/sg

Tungaloy Vietnam
LE04.38, Lexington Residence
67 Mai Chi Tho St., Dist. 2,
Ho Chi Minh City, Vietnam
Phone: +84-2837406660
www.tungaloy.com/sg

Tungaloy India Pvt. Ltd.
Indiabulls Finance Centre,
Unit # 902-A, 9th Floor,
Tower 1, Senapati Bapat Marg,
Elphinstone Road (West),
Mumbai -400013, India
Phone: +91-22-6124-8804
Fax: +91-22-6124-8899
www.tungaloy.com/in

Tungaloy Korea Co., Ltd
#1312, Byucksan Digital Valley 5-cha
Beotkkot-ro 244, Geumcheon-gu
153-788 Seoul, Korea
Phone: +82-2-2621-6161
Fax: +82-2-6393-8952
www.tungaloy.com/kr

Tungaloy Malaysia Sdn Bhd
50 K-2, Kelana Mall, Jalan SS6/14
Kelana Jaya, 47301
Petaling Jaya, Selangor Darul Ehsan
Malaysia
Phone: +603-7805-3222
Fax: +603-7804-8563
www.tungaloy.com/my

Tungaloy Australia Pty Ltd
Unit 68 1470 Ferntree Gully Road
Knoxfield 3180 Victoria, Australia
Phone: +61-3-9755-8147
Fax: +61-3-9755-6070
www.tungaloy.com/au

PT. Tungaloy Indonesia
Kompleks Grand Wisata Block AA-10 No.3-5
Cibitung
Bekasi 17510, Indonesia
Phone: +62-21-8261-5808
Fax: +62-21-8261-5809
www.tungaloy.com/id

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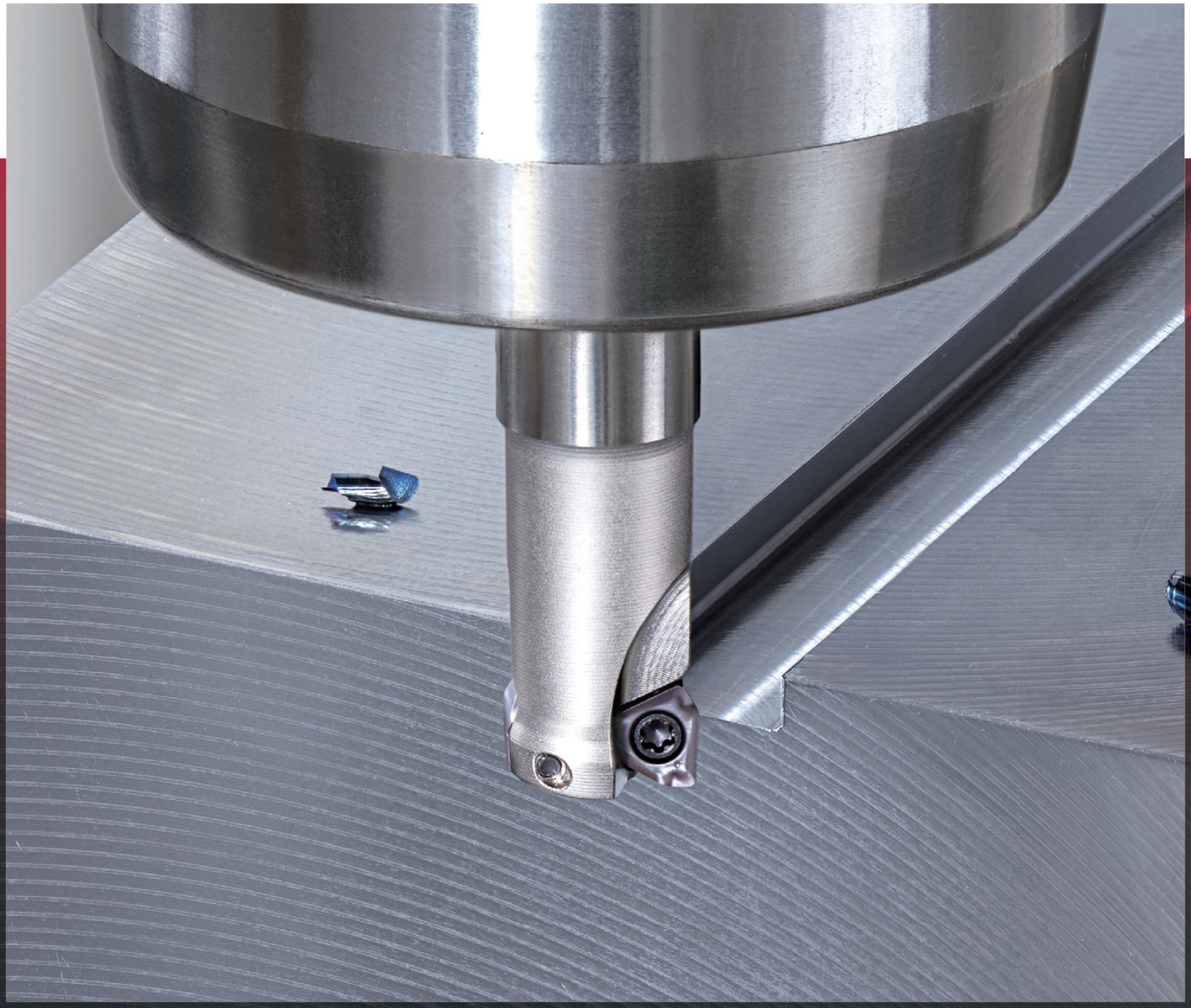
MillLine
Expansion 2

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 ø8 mm**



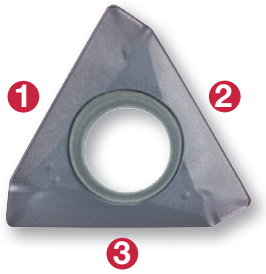
TUNGALOY ADDFORCE ACCELERATED LINES

TUNG-TRI

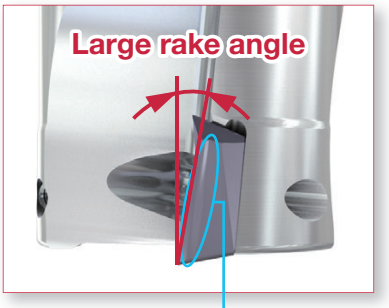
For more information

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

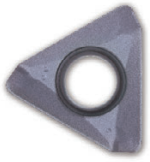
Cutter: EPA04

APMX: 6 mm

Size 06

ø12 - ø50 mm

Cutter: TPA06, EPA06, HPA06-M

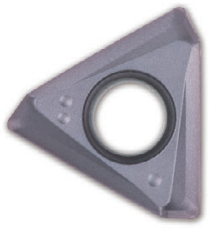


APMX: 10 mm

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

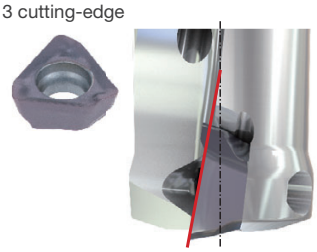
Size 04

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
3 cutting-edge

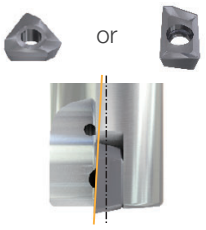


12° rake

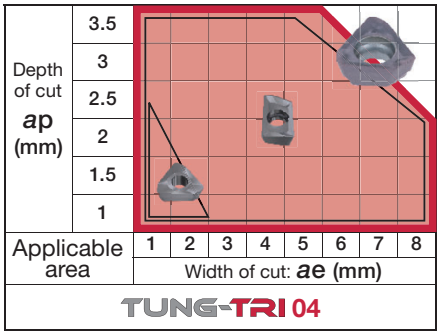
Light cutting geometry with high rake angle

>

Competitors
3 cutting-edge 2 cutting-edge

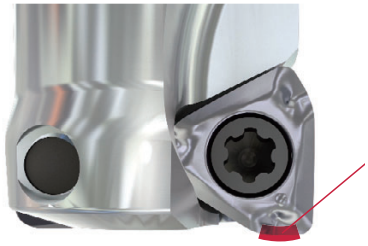


3° - 8° rake



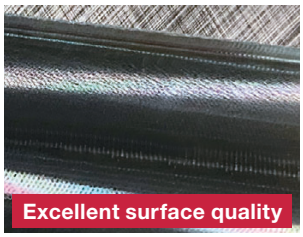
Cutter	: EPA04R010M10.0-02 (ø10 mm, z = 2)	Coolant	: Air blast
Insert	: TOMT040204PXER-MM AH3225	Overhang length	: 20 mm
Workpiece	: S55C / C55	Machine	: Vertical M/C, HSK63A
Cutting speed	: *Vc* = 200 m/min	Criteria	: Chattering
Feed per tooth	: *fz* = 0.07 mm/t		

Large wiper radius provides improved surface quality

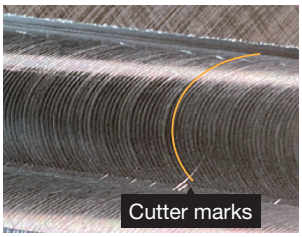


Large radius wiper

TUNG-TRI 04

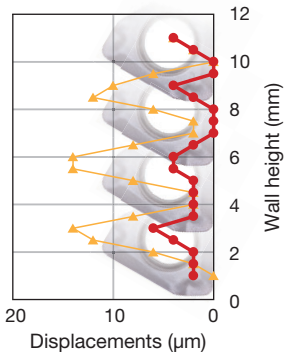


Competitor



Cutter	: EPA04R025M25.0-06 (ø25 mm, z = 6)	Depth of cut	: *ap* = 1 mm
Insert	: TOMT040204PXER-MM AH3225	Width of cut	: *ae* = 20 mm
Workpiece	: S50C / C50	Coolant	: Air blast
Cutting speed	: *Vc* = 200 m/min	Overhang length	: 35 mm
Feed per tooth	: *fz* = 0.07 mm/t	Machine	: Vertical M/C, BT40

Excellent vertical wall surface accuracy



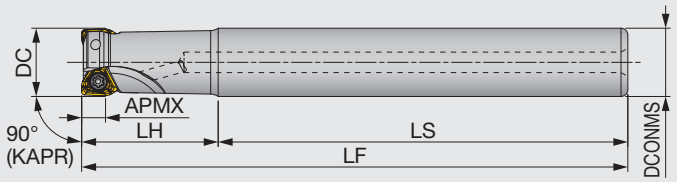
Cutter	: EPA04R010M10.0-02 (ø10 mm, z = 2)
Insert	: TOMT040204PXER-MM AH3225
Workpiece	: S55C / C55
Cutting speed	: *Vc* = 200 m/min
Feed per tooth	: *fz* = 0.07 mm/t
Depth of cut	: *ap* = 3 mm x 4 pass
Width of cut	: *ae* = 0.5 mm
Coolant	: Air blast
Overhang length	: 20 mm
Machine	: Vertical M/C, HSK63A

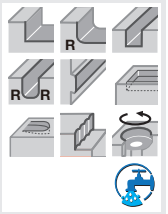
TUNG-TRI 04
Competitor's insert (with 2 cutting-edge)

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...

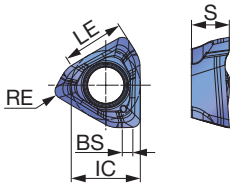
SPARE PARTS

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



		AH3225	AH120	AH8015
P	Steel	★	☆	
M	Stainless	★		
K	Cast iron		★	
N	Non-ferrous			
S	Superalloys	★		★
H	Hard materials			★

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated AH3225	Coated AH120	Coated AH8015	LE	IC	S	BS
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

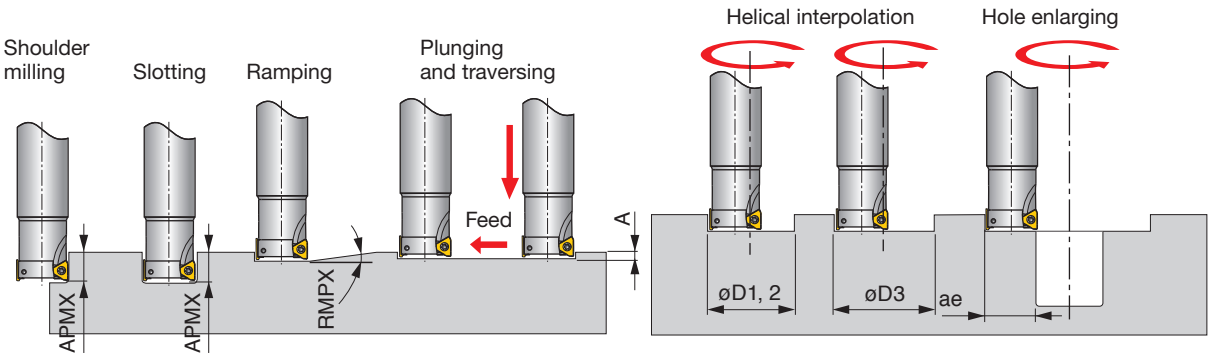
STANDARD CUTTING CONDITIONS

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.	40 - 50 HRC	AH8015	50 - 150	0.04 - 0.07
		SKD11, etc. X153CrMoV12, etc.	50 - 60 HRC	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

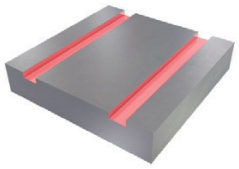
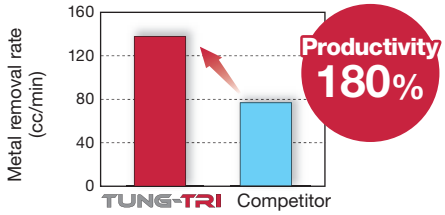
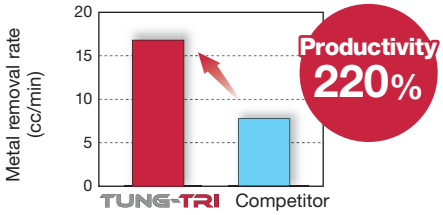


Designation	DC	Max. depth of cut APMX	Max. ramping angle RMPX	Max. plunging depth A	Min. machining depth øD1	Max. machining diameter øD2	Max. machining diameter øD3 *	Max. cutting width in enlarging ae
EPA04R008…	8	3.5	0.3°	0.02	12.8	15.6	13.6	7.5
EPA04R010…	10	3.5	0.2°	0.02	16.8	19.6	17.6	9.5
EPA04R012…	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  P	S50C / C50  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		 Thanks to close-pitch cutter design and large axial rake, **Tung-Tri** offered high productivity, while elminating chip packing.	 **Tung-Tri**'s large axial rake enabled smooth entry to the cut and greater depth of cut without generating chatter.

MEMO

Tungaloy Corporation (Head office)
11-1 Yoshima-Kogyodanchi
Iwaki-city, Fukushima 970-1144 Japan
Phone: +81-246-36-8501
Fax: +81-246-36-8542
www.tungaloy.co.jp

Tungaloy America, Inc.
3726 N Ventura Drive
Arlington Heights,IL 60004, U.S.A.
Phone: +1-888-554-8394
Fax: +1-888-554-8392
www.tungaloy.com/us

Tungaloy Canada
432 Elgin St. Unit 3
Brantford, Ontario N3S 7P7, Canada
Phone: +1-519-758-5779
Fax: +1-519-758-5791
www.tungaloy.com/ca

Tungaloy de Mexico S.A.
C Los Arellano 113,
Parque Industrial Siglo XXI
Aguascalientes, AGS, Mexico 20290
Phone: +52-449-929-5410
Fax: +52-449-929-5411
www.tungaloy.com/mx

Tungaloy do Brasil Ltda.
Avd. Independencia N4158 Residencial Flora
13280-000 Vinhedo, São Paulo, Brasil
Phone: +55-19-38262757
Fax: +55-19-38262757
www.tungaloy.com/br

Tungaloy Germany GmbH
An der Alten Ziegelei 1
D-40789 Monheim, Germany
Phone: +49-2173-90420-0
Fax: +49-2173-90420-19
www.tungaloy.com/de

Tungaloy France S.A.S.
ZA Courtaboeuf - Le Rio
1 rue de la Terre de feu
F-91952 Courtaboeuf Cedex, France
Phone: +33-1-6486-4300
Fax: +33-1-6907-7817
www.tungaloy.com/fr

Tungaloy Italia S.r.l.
Via E. Andolfato 10
I-20126 Milano, Italy
Phone: +39-02-252012-1
Fax: +39-02-252012-65
www.tungaloy.com/it

Tungaloy Czech s.r.o.
Turanka 115
CZ-627 00 Brno, Czech Republic
Phone: +420-532 123 391
Fax: +420-532 123 392
www.tungaloy.com/cz

Tungaloy Ibérica S.L.
C/Miquel Servet, 43B, Nau 7
Pol. Ind. Bufalvent
ES-08243 Manresa (BCN), Spain
Phone: +34 93 113 1360
Fax: +34 93 876 2798
www.tungaloy.com/es

Tungaloy Scandinavia AB
Bultgatan 38
442 40 Kungälv, Sweden
Phone: +46-462119200
Fax: +46-462119207
www.tungaloy.com/se

Tungaloy Rus, LLC
Andropova avenue, h.18/7,
11 floor, office 3, 115432,
Moscow, Russia
Phone: +7-499-683-01-80
Fax: +7-499-683-01-81
www.tungaloy.com/ru

Tungaloy Polska Sp. z o.o.
Ul. Irysowa 1, 55-040 Bielany
Wrocławskie, Poland
Phone: +48 607 907 237
www.tungaloy.com/pl

Tungaloy U.K. Ltd
Gallan Park, Watling Street,
Cannock, WS110XG, UK
Phone: +44 121 4000 231
Fax: +44 121 270 9694
www.tungaloy.com/uk

Tungaloy Hungary Kft
Erzsébet királyné útja 125
H-1142 Budapest, Hungary
Phone: +36 1 781-6846
Fax: +36 1 781-6866
www.tungaloy.com/hu

Tungaloy Turkey
Serifali Mah.bayraktar Bulvari Kule Sk. No:26
34775 Umraniye / Istanbul / Turkey
Phone: +90 216 540 04 67
Fax: +90 216 540 04 87
www.tungaloy.com/tr

Tungaloy Benelux b.v.
Tjalk 70
NL-2411 NZ Bodegraven, Netherlands
Phone: +31 172 630 420
Fax: +31 172 630 429
www.tungaloy.com/nl

Tungaloy Croatia
Ulica bana Josipa Jelačića 87,
10430, Samobor, Croatia
Phone: +385 1 3326 604
Fax: +385 1 3327 683
www.tungaloy.com/hr

Tungaloy Cutting Tool (Shanghai) Co.,Ltd.
Rm No 401 No.88 Zhabei
Jiangchang No.3 Rd
Shanghai 200436, China
Phone: +86-21-3632-1880
Fax: +86-21-3621-1918
www.tungaloy.com/cn

Tungaloy Cutting Tools (Taiwan) Co.,Ltd.
9F. No.293, Zhongyang Rd,
Xinzhuang Dist, New Taipei City,
24251 Taiwan
Phone: +886-2-8521-9986
Fax: +886-2-8521-8935
www.tungaloy.com/tw

Tungaloy Cutting Tools (Thailand) Co.,Ltd.
Interlink tower 4th Fl.
1858/5-7 Bangna-Trad Road
km.5 Bangna, Bangna, Bangkok 10260
Thailand
Phone: +66-2-751-5711
Fax: +66-2-751-5715
www.tungaloy.com/th

Tungaloy Singapore (Pte.), Ltd.
62 Ubi Road 1, #06-11 Oxley BizHub 2
Singapore 408734
Phone: +65-6391-1833
Fax: +65-6299-4557
www.tungaloy.com/sg

Tungaloy Vietnam
LE04.38, Lexington Residence
67 Mai Chi Tho St., Dist. 2,
Ho Chi Minh City, Vietnam
Phone: +84-2837406660
www.tungaloy.com/sg

Tungaloy India Pvt. Ltd.
Indiabulls Finance Centre,
Unit # 902-A, 9th Floor,
Tower 1, Senapati Bapat Marg,
Elphinstone Road (West),
Mumbai -400013, India
Phone: +91-22-6124-8804
Fax: +91-22-6124-8899
www.tungaloy.com/in

Tungaloy Korea Co., Ltd
#1312, Byucksan Digital Valley 5-cha
Beotkkot-ro 244, Geumcheon-gu
153-788 Seoul, Korea
Phone: +82-2-2621-6161
Fax: +82-2-6393-8952
www.tungaloy.com/kr

Tungaloy Malaysia Sdn Bhd
50 K-2, Kelana Mall, Jalan SS6/14
Kelana Jaya, 47301
Petaling Jaya, Selangor Darul Ehsan
Malaysia
Phone: +603-7805-3222
Fax: +603-7804-8563
www.tungaloy.com/my

Tungaloy Australia Pty Ltd
Unit 68 1470 Ferntree Gully Road
Knoxfield 3180 Victoria, Australia
Phone: +61-3-9755-8147
Fax: +61-3-9755-6070
www.tungaloy.com/au

PT. Tungaloy Indonesia
Kompleks Grand Wisata Block AA-10 No.3-5
Cibitung
Bekasi 17510, Indonesia
Phone: +62-21-8261-5808
Fax: +62-21-8261-5809
www.tungaloy.com/id

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