

MillLine

TUNG-TRI

www.tungaloy.com

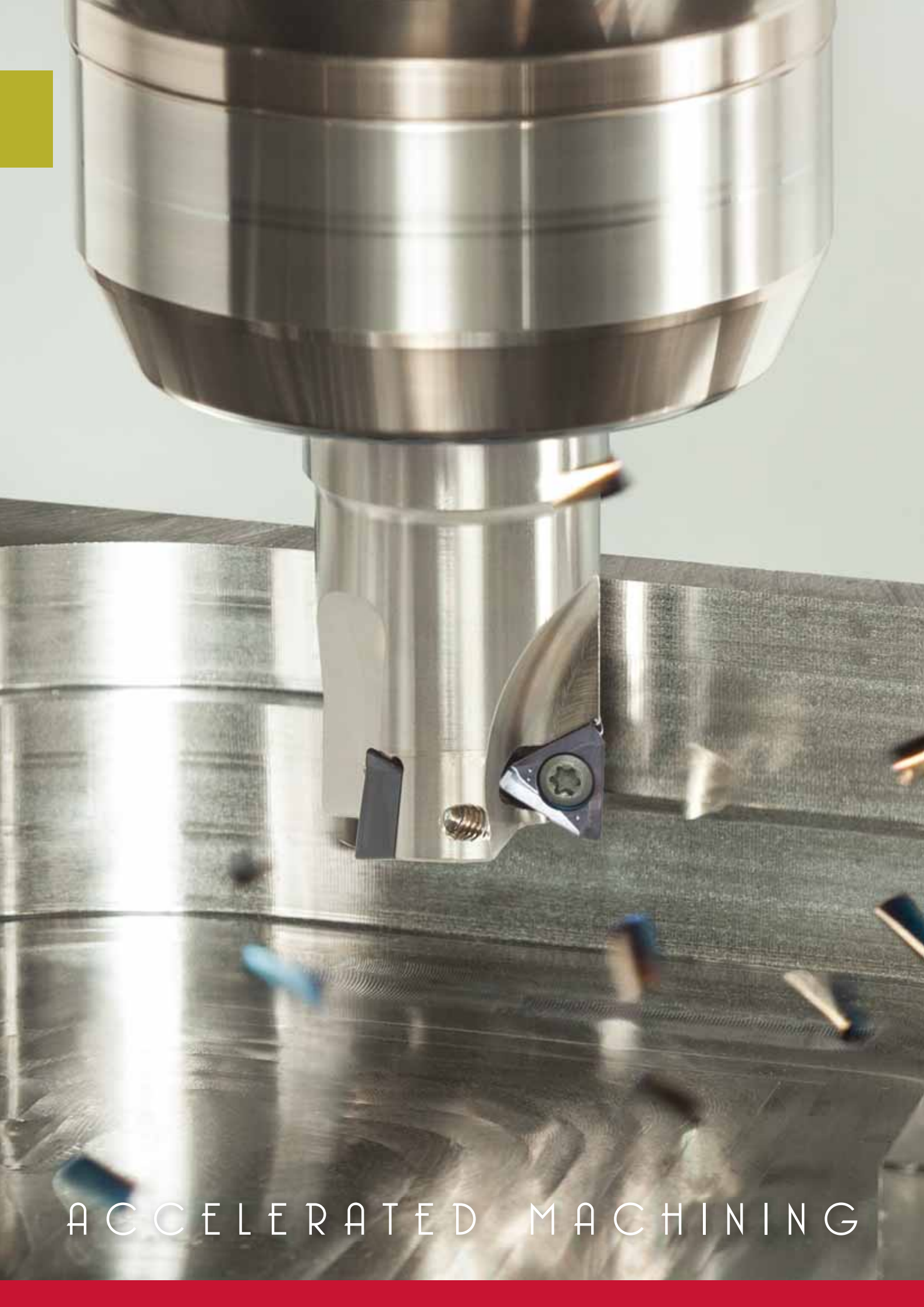
Tungaloy Report No. 421-G

TUNG-TRI

Why settle for 2 cutting edges
while you can have **3 on one insert?**



Member IMC Group
Tungaloy



ACCELERATED MACHINING



MillLine

TUNG-TRI
TUNGALOY

TUNG ACCELERATED MACHINING **FORCE** **MILL**



Tung-Tri's economical insert with 3 cutting edges and optimized geometry **improves efficiency and productivity** with the square shoulder milling cutter.

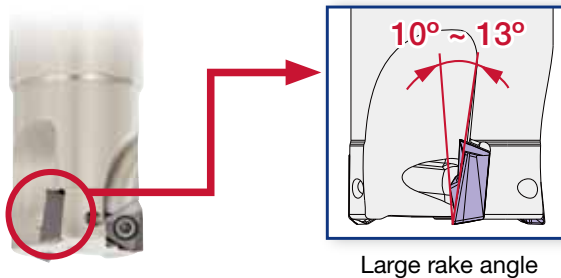
Excellent cutting performance with improved profitability

Economical 3 cutting-edge inserts



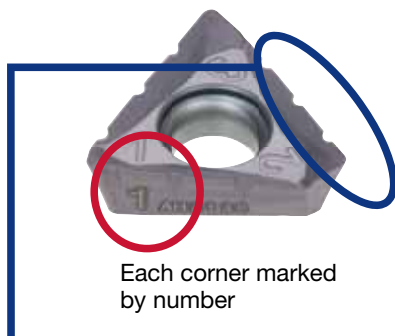
Drastically reduced cutting force

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



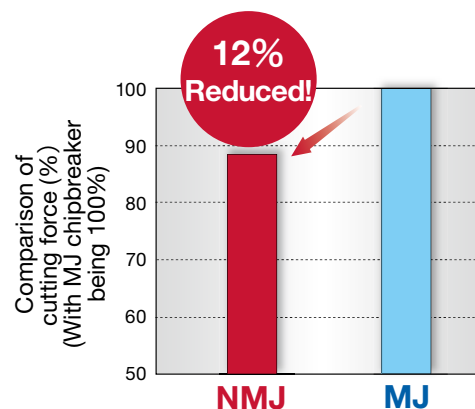
Excellent chip formation

New NMJ chipbreaker



Chip splitter help 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.

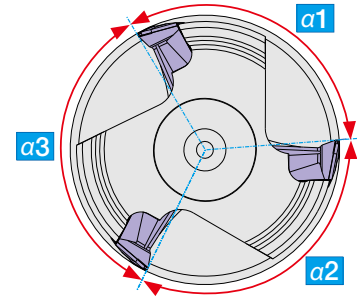


Cutter : TPA15R080M25.4-06 ($\phi D_c = 80$ mm, $z = 6$)
 Insert : TOMT150608PDER-NMJ
 TOMT150608PDER-MJ
 Grade : AH3135
 Workpiece : SCM440 (200HB)
 Cutting speed : $V_c = 100$ m/min
 Feed per tooth : $f_z = 0.10$ mm/t
 Depth of cut : $a_p = 13$ mm
 Width of cut : $a_e = 29$ mm
 Coolant : Wet
 Machine : Vertical M/C, BT50

Applicable for a wide range of cutting conditions

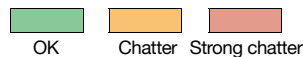
Insert positioning in irregular pitch, combined with uniquely designed flank face of inserts, prevents chattering during machining.

Irregular pitch



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

Cutting performance



ap (mm)	10	OK	OK	OK	OK	OK
	9	OK	OK	OK	OK	OK
	8	OK	OK	OK	OK	OK
	7	OK	OK	OK	OK	OK
	6	OK	OK	OK	OK	OK
	5	OK	OK	OK	OK	OK
	4	OK	OK	OK	OK	OK
	3	OK	OK	OK	OK	OK
	2	OK	OK	OK	OK	OK
	1	OK	OK	OK	OK	OK
Applicable area		0.05	0.10	0.15	0.20	0.25
		fz (mm/t)				
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ap (mm)	10	Strong chatter	Strong chatter	Strong chatter	Strong chatter	Strong chatter
	9	Strong chatter	Strong chatter	Strong chatter	Strong chatter	Strong chatter
	8	Strong chatter	Strong chatter	Strong chatter	Strong chatter	Strong chatter
	7	Strong chatter	Chatter	OK	OK	OK
	6	OK	OK	OK	OK	OK
	5	OK	OK	OK	OK	OK
	4	OK	OK	OK	OK	OK
	3	OK	OK	OK	OK	OK
	2	OK	OK	OK	OK	OK
	1	OK	OK	OK	OK	OK
Applicable area		0.05	0.10	0.15	0.20	0.25
		fz (mm/t)				
Competitor						

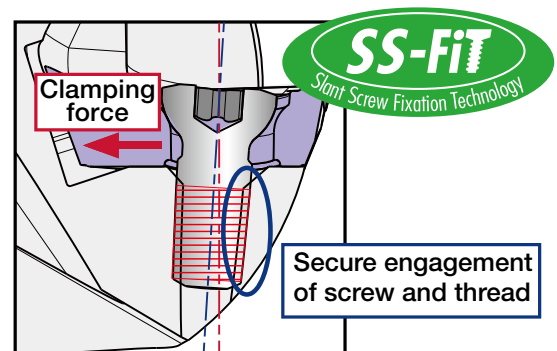
Cutter : EPA10R032M32.0-03N
($\phi D_c = 32 \text{ mm}$, $z = 3$)
Insert : TOMT100404PDER-MJ
Grade : AH3135
Workpiece : S55C / C55 (200 HB)
Cutting speed : $V_c = 150 \text{ m/min}$
Width of cut : $a_e = 32 \text{ mm}$
Machine : Vertical M/C, BT50

High reliability

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

Screw size

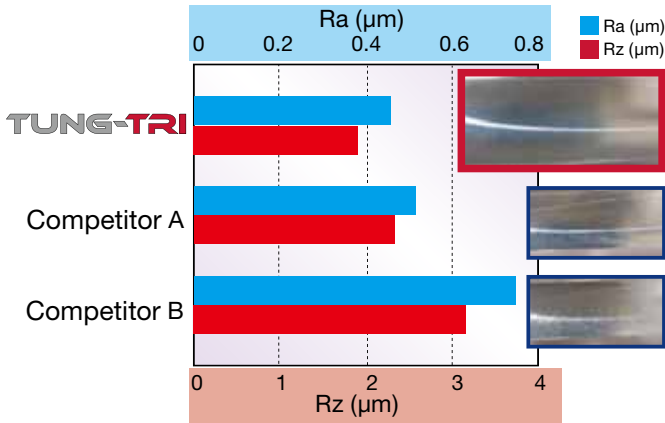
Inserts	TUNG-TRI	Competitor
TOMT06	M2.5	M1.8
TOMT10	M3.5	M2.5
TOMT15	M4.5	M4



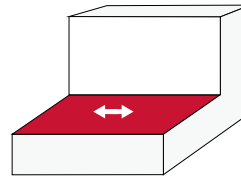
Excellent surface finish and high wall accuracy

Outstanding surface finish due to positive and large wiper edge geometry designed for low cutting force

Bottom surface finish

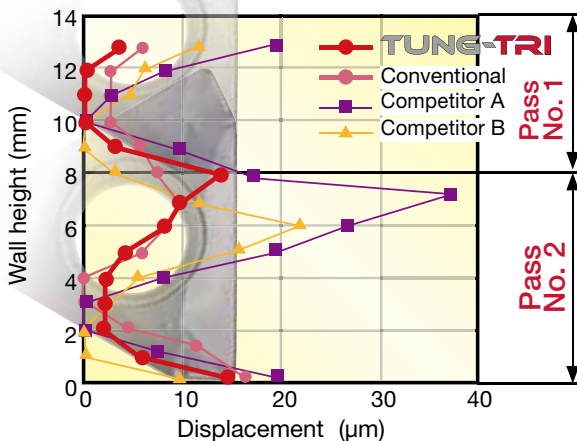


Cutter : EPA10R032M32.0-03N ($\phi D_c = 32$ mm, $z = 3$)
 Insert : TOMT100404PDER-MJ
 Grade : AH3135
 Workpiece : S55C / C55 (200HB)
 Cutting speed : $V_c = 150$ m/min
 Feed per tooth : $f_z = 0.1$ mm/t
 Depth of cut : $a_p = 5$ mm
 Width of cut : $a_e = 21$ mm
 Machine : Vertical M/C, BT50

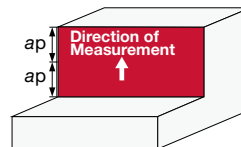


High wall accuracy due to helical cutting edge with low cutting force

Wall accuracy



Cutter : EPA10R032M32.0-03N ($\phi D_c = 32$ mm, $z = 3$)
 Insert : TOMT100404PDER-MJ
 Grade : AH3135
 Workpiece : S55C / C55 (200HB)
 Cutting speed : $V_c = 150$ m/min
 Feed per tooth : $f_z = 0.1$ mm/t
 Depth of cut : $a_p = 8$ mm x 2 pass
 Width of cut : $a_e = 5$ mm
 Machine : Vertical M/C, BT50



Result amount of displacement

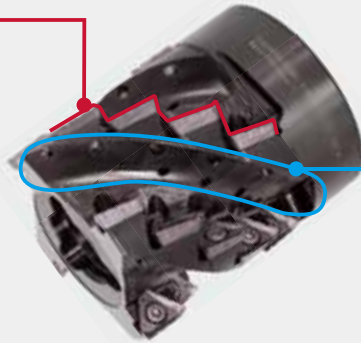
TUNG-TRI : within 15 μm
 Conventional : within 17 μm
 Competitor A : within 22 μm
 Competitor B : within 35 μm

New

Roughing type

Excellent chattering resistance

- Ideal insert positioning in high helix angle
- Irregular pitch

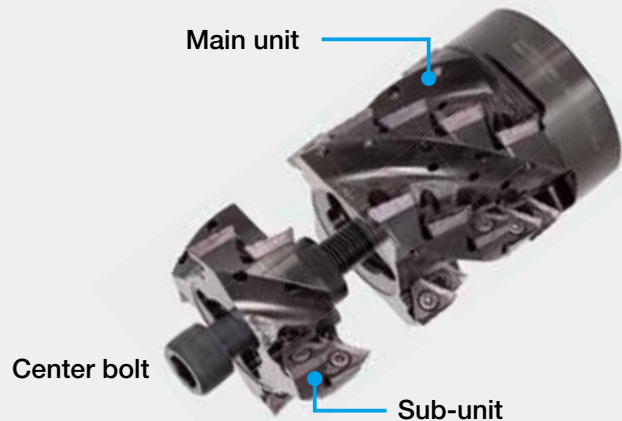


Smooth chip evacuation

- 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 are applicable 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

30	38%	with NMJ chipbreaker			
		0.05	0.10	0.15	0.20
20	25%	with MJ chipbreaker			
		OK			
10	13%	OK			
ae (mm)		ae / øDc (mm)		fz (mm/t)	
Width of cut					

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30	38%	OK			
		0.05	0.10	0.15	0.20
20	25%	Strong chatter			
		OK			
10	13%	OK			
ae (mm)		ae / øDc (mm)		fz (mm/t)	
Width of cut					

Competitor

Cutter : TLA15R080L070M31.7-04M
(øDc = 80 mm, z = 4)
Insert : TOMT150608PDER-NMJ,
TOMT150608PDER-MJ
Grade : AH3135
Workpiece : SCM440 (270HB)

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

New coated grade offers long tool life

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

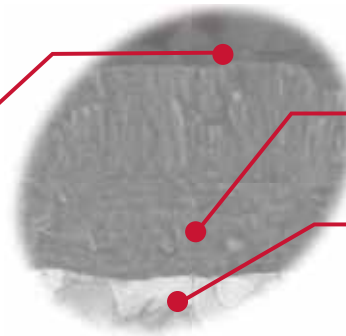
- Multi-layered coating prevents crack expansion which causes chipping and fracture.
- Exclusive carbide substrate with remarkable impact resistance and toughness.

AH3135



Special Surface Technology
PREMIUMTEC

Smooth insert surface prevents chip adhesion!

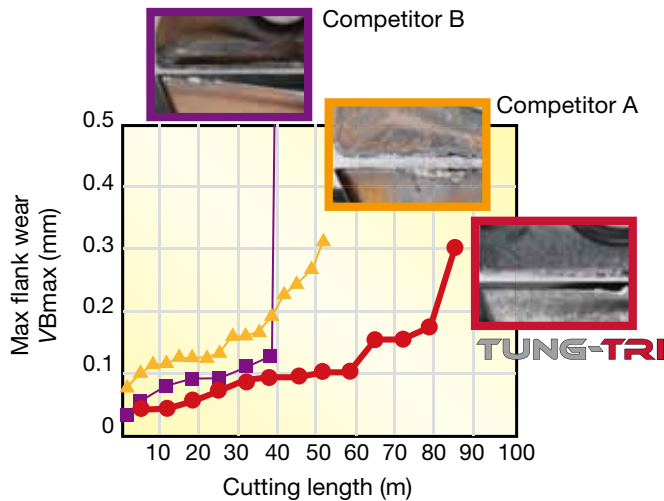


Multi-layered coating with high chipping resistance

Carbide substrate with incredible toughness

Long tool life due to high wear resistance

■ Tool life



Cutter : EPA15R040M32.0-03N
($\phi D_c = 40$ mm, $z = 3$)
Insert : TOMT150608PDER-MJ
Grade : AH3135
Workpiece material : S55C (200HB)
Cutting speed : $V_c = 200$ m/min
Feed per tooth : $f_z = 0.2$ mm/t
Depth of cut : $a_p = 9$ mm
Width of cut : $a_e = 13$ mm
Coolant : Dry
Machine : Vertical M/C, BT50

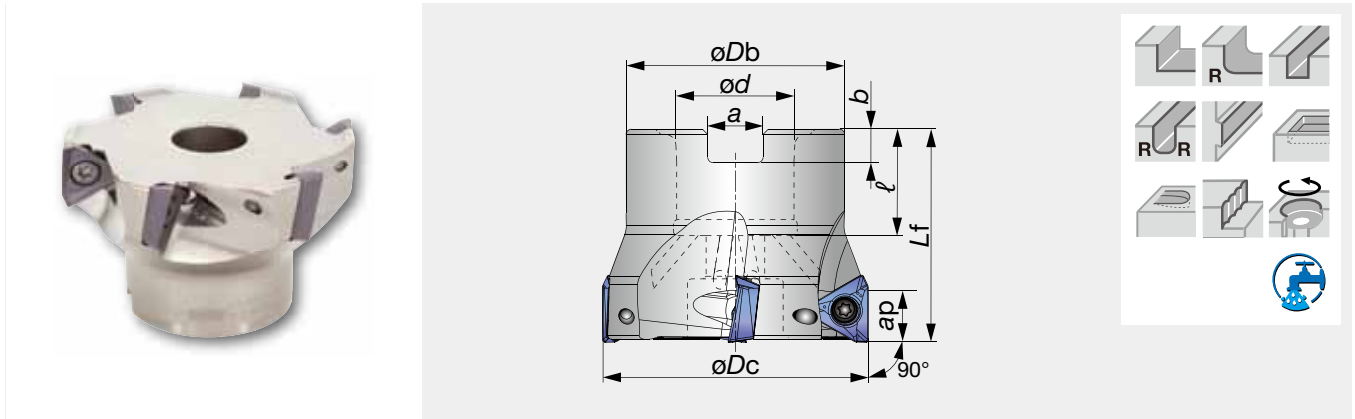
Specification

Application	Grade	Substrate			Coating layer		Features
	Application code	Relative density	Hardness HRA	T.R.S. (GPa)	Main Composition	Thickness (μ m)	
	AH3135	14.0	89.5	2.8	(Ti, Al)N Multi-layer	4	New grade for steel and stainless steel machining Dramatically improved chipping and fracture resistance
	P30 - P40						
	AH120	14.5	90.8	2.8	(Ti, Al)N	3	For general purpose Good balance between wear and fracture resistance
	K15 - K30						

High precision shoulder square mills with triangular inserts

CUTTER - BORE TYPE

Tung-Tri TPA



Designation	Max. ap	$\varnothing Dc$	z	$\varnothing Db$	$\varnothing d$	ℓ	L_f	b	a	Kg	C.bolt	Insert
TPA06R032M16.0E05	6	32	5	30	16	18	40	5.6	8.4	0.14	FSHM8-30H	TOMT06...
TPA06R040M16.0E06	6	40	6	35	16	18	40	5.6	8.4	0.22	CM8x30H	TOMT06...
TPA06R050M22.0E08	6	50	8	41	22	20	40	6.3	10.4	0.31	CM10x30H	TOMT06...
TPA10R040M16.0E04	10	40	4	35	16	18	40	5.6	8.4	0.20	CM8X30H	TOMT10...
TPA10R050M22.0E04	10	50	4	41	22	20	40	6.3	10.4	0.31	CM10X30H	TOMT10...
TPA10R063M22.0E06	10	63	6	41	22	20	40	6.3	10.4	0.51	CM10X30H	TOMT10...
TPA10R080M25.4-07	10	80	7	58	25.4	26	50	6	9.5	1.04	CM12X30H	TOMT10...
TPA10R080M27.0E07	10	80	7	50	27	22	50	7	12.4	1.04	CM12X30H	TOMT10...
TPA10R100M31.7-08	10	100	8	70	31.75	32	63	8	12.7	2.02	CM16X40H	TOMT10...
TPA10R100M32.0E08	10	100	8	60	32	28.5	50	8	14.4	2.02	CM16X40H	TOMT10...
TPA15R050M22.0E04	15	50	4	41	22	20	40	6.3	10.4	0.27	FSHM10-40H	TOMT15...
TPA15R063M22.0E05	15	63	5	41	22	20	40	6.3	10.4	0.41	CM10x30H	TOMT15...
TPA15R080M25.4-06	15	80	6	46	25.4	26	50	6	9.5	0.83	CM12x30H	TOMT15...
TPA15R080M27.0E06	15	80	6	50	27	22	50	7	12.4	0.86	CM12x30H	TOMT15...
TPA15R100M31.7-07	15	100	7	60	31.75	32	50	8	12.7	1.30	TMBA-M16H	TOMT15...
TPA15R100M32.0E07	15	100	7	60	32	28.5	50	8	14.4	1.27	TMBA-M16H	TOMT15...
TPA15R125M38.1-08	15	125	8	80	38.1	38	63	10	15.9	2.70	TMBA-M20H	TOMT15...
TPA15R125M40.0E08	15	125	8	71	40	32	63	9	16.4	2.47	TMBA-M20H	TOMT15...
TPA15R160M40.0E10N	15	160	10	100	40	29	63	9	16.4	4.77	-	TOMT15...
TPA15R160M50.8-10N	15	160	10	100	50.8	46	63	11	19	4.40	-	TOMT15...

SPARE PARTS

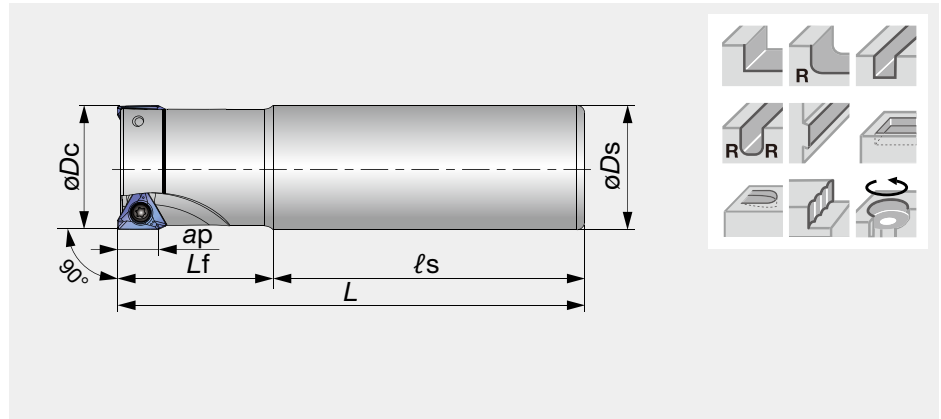


Designation	Clamping Screw	Wrench			Mono block type wrench
		Torx Bit	Grip	Grip	
TPA06	CSTB-2.5	-	-	-	T-8D
TPA10	SR14-562/S	BLDT10/S7	SW6-SD	-	-
TPA15	TS45120I	BT20S	-	H-TB2W	-

High precision shoulder square endmills with triangular inserts

CUTTER - SHANK TYPE

Tung-Tri EPA



Designation	Max. ap	ϕD_c	z	ϕD_s	ℓ_s	L_f	L	Kg	Insert
EPA06R012M16.0-01N	6	12	1	16	50	18	68	0.09	TOMT06...
EPA06R016M16.0-02N	6	16	2	16	60	24	84	0.12	TOMT06...
EPA06R018M16.0-02N	6	18	2	16	60	24	84	0.13	TOMT06...
EPA06R020M16.0-02N	6	20	2	16	60	30	90	0.14	TOMT06...
EPA06R020M20.0-02N	6	20	2	20	70	30	100	0.23	TOMT06...
EPA06R020M20.0-03N	6	20	3	20	70	30	100	0.22	TOMT06...
EPA06R022M20.0-02N	6	22	2	20	70	30	100	0.23	TOMT06...
EPA06R022M20.0-03N	6	22	3	20	70	30	100	0.23	TOMT06...
EPA06R025M25.0-03N	6	25	3	25	80	35	115	0.41	TOMT06...
EPA06R025M25.0-04N	6	25	4	25	80	35	115	0.41	TOMT06...
EPA06R028M25.0-03N	6	28	3	25	80	35	115	0.42	TOMT06...
EPA06R028M25.0-04N	6	28	4	25	80	35	115	0.42	TOMT06...
EPA10R025M25.0-02N	10	25	2	25	80	35	115	0.38	TOMT10...
EPA10R028M25.0-02N	10	28	2	25	80	35	115	0.39	TOMT10...
EPA10R032M32.0-02N	10	32	2	32	80	40	120	0.66	TOMT10...
EPA10R032M32.0-03N	10	32	3	32	80	40	120	0.65	TOMT10...
EPA10R035M32.0-02N	10	35	2	32	80	40	120	0.70	TOMT10...
EPA10R035M32.0-03N	10	35	3	32	80	40	120	0.68	TOMT10...
EPA10R040M32.0-03N	10	40	3	32	80	40	120	0.72	TOMT10...
EPA10R040M32.0-04N	10	40	4	32	80	40	120	0.73	TOMT10...
EPA15R040M32.0-03N	15	40	3	32	80	40	120	0.73	TOMT15...
EPA15R050M32.0-04N	15	50	4	32	80	40	120	0.83	TOMT15...



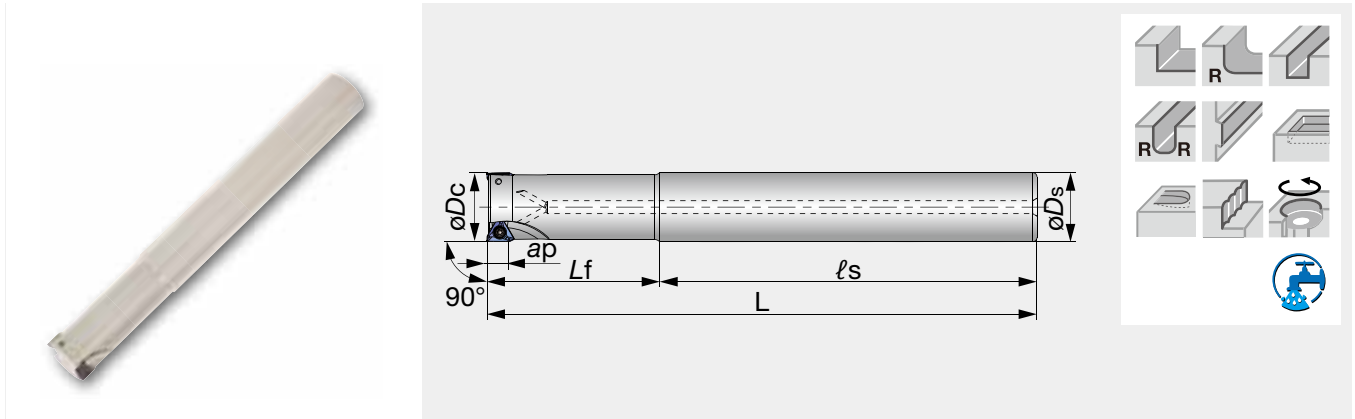
SPARE PARTS

Designation	Clamping Screw	Wrench			
		Torx Bit	Grip	Mono block type wrench	
EPA06	$\phi D_c \leq 18$ mm	CSTB-2.5S	-	-	T-8D
	$\phi D_c \geq 20$ mm	CSTB-2.5	-	-	T-8D
EPA10	SR14-562/S	BLDT10/S7	SW6-SD	-	-
EPA15	TS45120I	BT20S	-	H-TB2W	-

High precision shoulder square long endmills with triangular inserts

CUTTER - LONG SHANK TYPE

Tung-Tri EPA



Designation	Max. ap	ϕD_c	z	ϕD_s	l_s	L_f	L	Kg	Insert
EPA06R016M16.0-02L	6	16	2	16	105	40	145	0.20	TOMT06...
EPA06R018M16.0-02L	6	18	2	16	115	30	145	0.21	TOMT06...
EPA06R020M20.0-02L	6	20	2	20	135	50	185	0.41	TOMT06...
EPA06R022M20.0-02L	6	22	2	20	145	40	185	0.42	TOMT06...
EPA06R025M25.0-02L	6	25	2	25	150	70	220	0.78	TOMT06...
EPA06R028M25.0-02L	6	28	2	25	180	40	220	0.80	TOMT06...
EPA10R025M25.0-02L	10	25	2	25	150	70	220	0.75	TOMT10...
EPA10R028M25.0-02L	10	28	2	25	185	35	220	0.78	TOMT10...
EPA10R032M32.0-02L	10	32	2	32	175	80	255	1.46	TOMT10...
EPA10R035M32.0-02L	10	35	2	32	215	40	255	1.52	TOMT10...
EPA10R040M32.0-02L	10	40	2	32	205	50	255	1.57	TOMT10...
EPA15R040M32.0-02L	15	40	2	32	205	50	255	1.56	TOMT15...
EPA15R050M42.0-02L	15	50	2	42	310	50	360	3.84	TOMT15...

SPARE PARTS

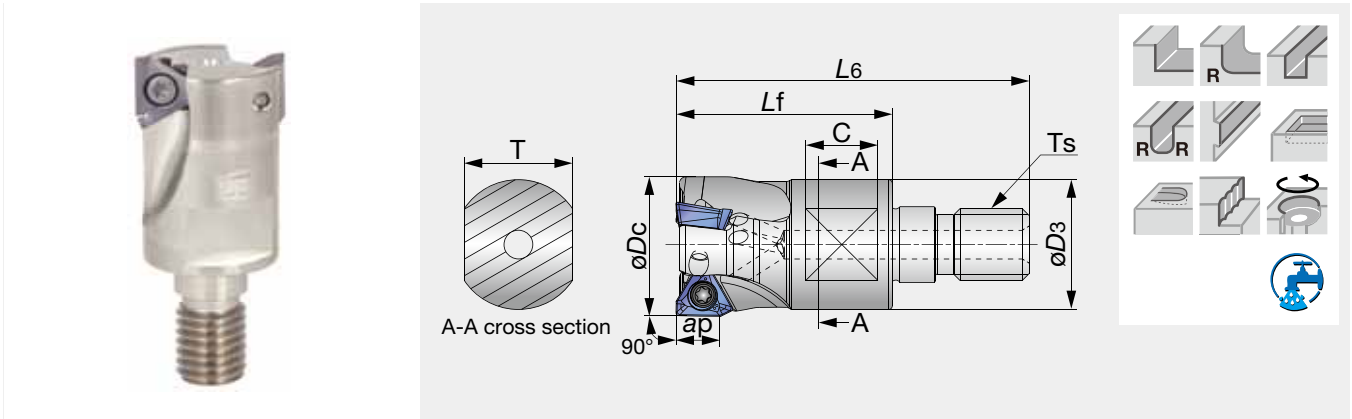


Designation	Clamping Screw	Wrench			Mono block type wrench	
		Torx Bit	Grip	Grip		
EPA06	$\phi D_c \leq 18$ mm	CSTB-2.5S	-	-	-	T-8D
	$\phi D_c = 20$ mm	CSTB-2.5	-	-	-	T-8D
EPA10	SR14-562/S	BLDT10/S7	SW6-SD	-	-	-
EPA15	TS45120I	BT20S	-	H-TB2W	-	-

High precision shoulder square endmills with TOMT06 inserts.

CUTTER - MODULAR TYPE

Tung-Tri HPA06M



Designation	Max. ap	øDc	L6	Lf	C	T	øD3	Ts	Kg	z	Insert
HPA06R016MM08-02	6	16	42	25	8	10	13	M8	0.03	2	TOMT0603...
HPA06R020MM10-03	6	20	49	30	10	15	18	M10	0.06	3	TOMT0603...
HPA06R025MM12-04	6	25	57	35	10	17	21	M12	0.10	4	TOMT0603...
HPA06R032MM16-05	6	32	63	40	12	22	29	M16	0.20	5	TOMT0603...

SPARE PARTS

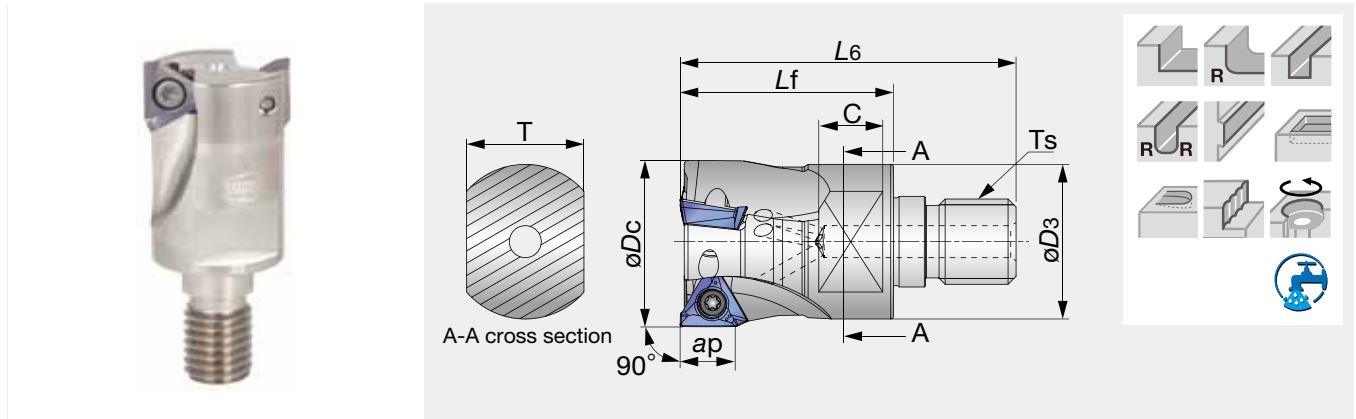


Designation	Clamping Screw	Mono block type wrench
HPA06R016	CSTB-2.5S	T-8D
HPA06R020	CSTB-2.5	T-8D
HPA06R025	CSTB-2.5	T-8D
HPA06R032	CSTB-2.5	T-8D

High precision shoulder square endmills with TOMT10 triangular inserts.

CUTTER - MODULAR TYPE

Tung-Tri HPA10M



Designation	Max. ap	ϕD_c	L6	Lf	C	T	ϕD_3	Ts	Kg	z	Insert
HPA10R025MM12-02	10	25	57	35	10	17	21	M12	0.09	2	TOMT1004...
HPA10R032MM16-03	10	32	63	40	12	22	29	M16	0.18	3	TOMT1004...

SPARE PARTS

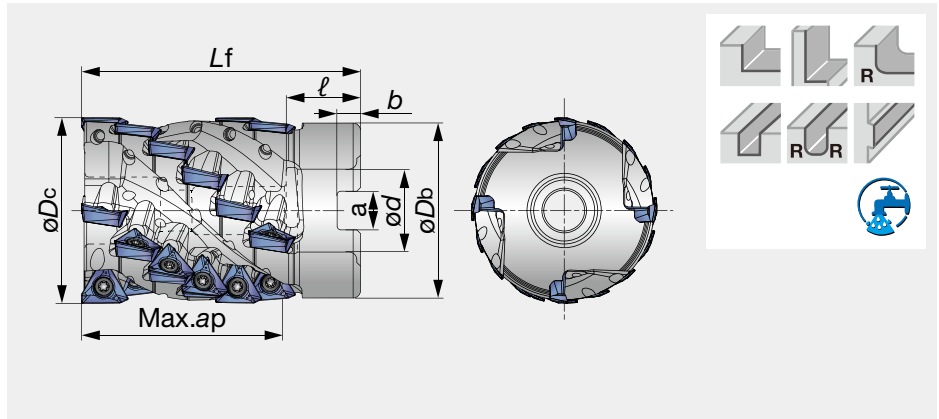


Designation	Clamping Screw	Wrench	
		Torx Bit	Grip
HPA10...	SR14-562/S	BLDT10/S7	SW6-SD

Extended flute square shoulder mills for roughing with TOMT10 triangular inserts

CUTTER - ROUGHING TYPE-BORE

Tung-Tri TLA10



Designation	Max. ap	øDc	Z eff	øDb	ød	l	Lf	b	a	Kg	z	C.bolt	Insert
TLA10R050L054M22.0E04	54	50	4	47	22	20	75	6.3	10.4	0.64	24	CAP-CM10x1.5x55-H	TOMT10...
TLA10R063L054M25.4-04	54	63	4	60	25.4	26	80	6	9.5	1.26	24	CAP-CM12x1.75x50	TOMT10...
TLA10R063L054M27.0E04	54	63	4	60	27	22	80	7	12.4	1.25	24	CAP-CM12x1.75x50	TOMT10...

SPARE PARTS

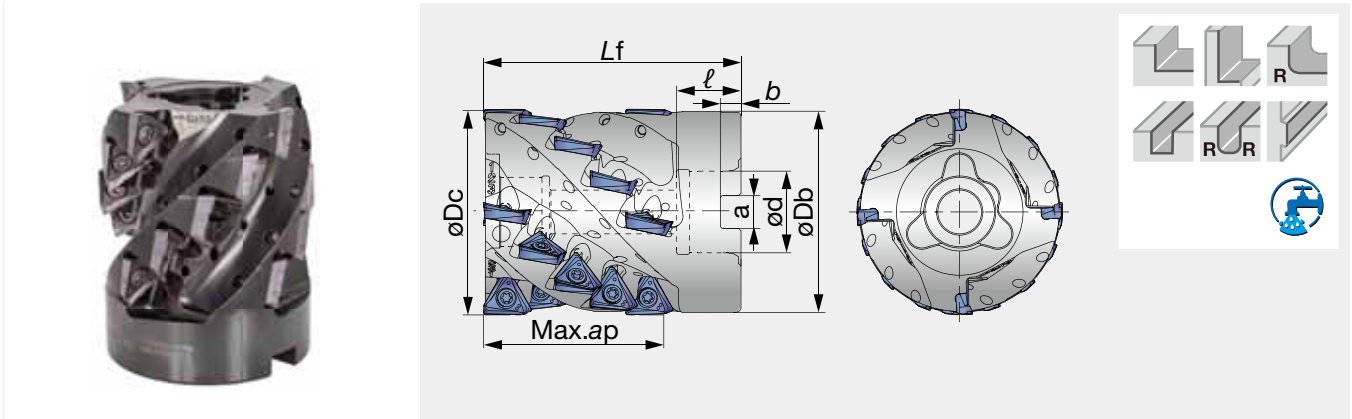


Clamping screw	Wrench
SR 14-562	T-10D

Extended flute square shoulder mills for roughing with TOMT15 triangular inserts

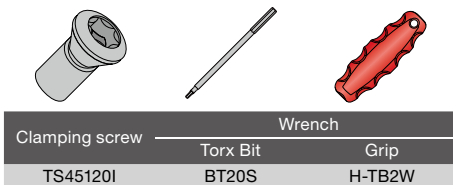
CUTTER - ROUGHING TYPE MAIN UNIT-BORE

Tung-Tri TLA15-M



Designation	Max. ap	øDc	Z eff	øDb	ød	l	Lf	b	a	Kg	z	C.bolt	Insert
TLA15R080L070M31.7-04M	70	80	4	78	31.75	25	100	8	12.7	2.29	20	CM16x75	TOMT15...
TLA15R080L070M32.0E04M	70	80	4	78	32	25	100	8	14.4	2.38	20	CM16x75	TOMT15...
TLA15R100L083M38.1-05M	83	100	5	98	38.1	38	110	10	15.9	4.24	30	CM20x80	TOMT15...
TLA15R100L083M40.0E05M	83	100	5	98	40	32	110	9	16.4	4.26	30	CM20x80	TOMT15...

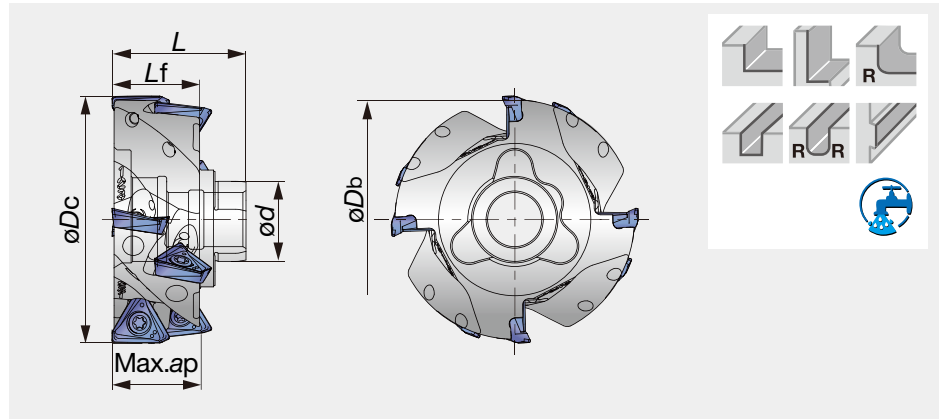
SPARE PARTS



Sub unit to mount on TLA15 - M type for longer Max.ap reach.

CUTTER - ROUGHING TYPE SUB UNIT

Tung-Tri TLA15-S



Designation	Max. ap	øDc	Z eff	øDb	ød	L	Lf	Kg	z	Insert
TLA15R080L028-04S	28	80	4	77.6	27	43	28.2	0.65	8	TOMT15...
TLA15R100L028-05S	28	100	5	97.2	33	46	28	1.05	10	TOMT15...

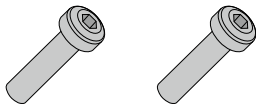
SPARE PARTS



Clamping screw	Wrench	
	Torx Bit	Grip
TS45120I	BT20S	H-TB2W

CENTER BOLT

*Optional parts

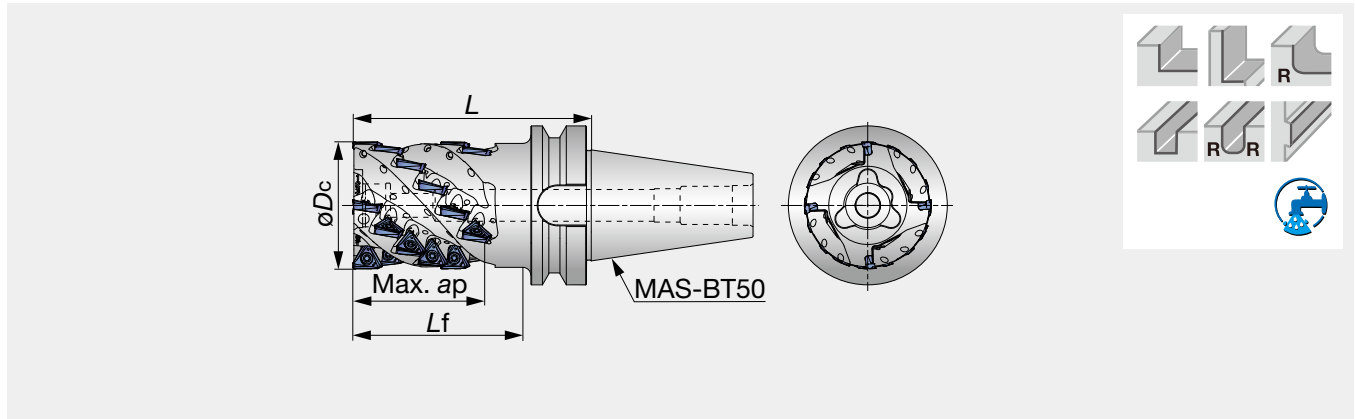


No. of sub-units	1	2
TLA15R080...	CM16x120	CM16x140
TLA15R100...	CM20x120	CM20x150

Extended flute square shoulder mills for roughing with TOMT15 triangular inserts.

CUTTER - ROUGHING TYPE WITH BT50 TAPER

Tung-Tri TLA15-BT



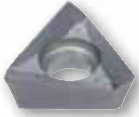
Designation	Max. ap	øDc	Z eff	L	Lf	Kg	z	C.bolt	Insert
TLA15R080L083BT50-04M	83	80	4	150	107	6.29	24	CAP-CM16x2.0x55	TOMT15...
TLA15R100L097BT50-05M	97	100	5	165	126.5	8.92	35	CAP-CM20x2.5x50	TOMT15...

SPARE PARTS

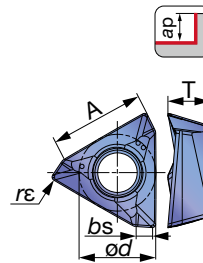
Clamping screw	Wrench	
	Torx Bit	Grip
TS45120I	BT20S	H-TB2W

INSERTS

TOMT-MJ



TOMT-NMJ



Designation	Max. ap	A	od	T	re	bs	AH3135	AH120
TOMT060302PDER-MJ	6	6.2	5.6	3.2	0.2	1.4	● ● ● ●	○ ● ● ●
TOMT060304PDER-MJ	6	6.2	5.6	3.2	0.4	1.2	● ● ● ●	○ ● ● ●
TOMT060308PDER-MJ	6	6.2	5.6	3.2	0.8	0.8	● ● ● ●	○ ● ● ●
TOMT100404PDER-MJ	10	10.5	8.6	4.7	0.4	1.5	● ● ● ●	○ ● ● ●
TOMT100408PDER-MJ	10	10.5	8.6	4.7	0.8	1.1	● ● ● ●	○ ● ● ●
TOMT100416PDER-MJ	10	10.5	8.6	4.7	1.6	0.2	● ● ● ●	○ ● ● ●
TOMT150604PDER-MJ	15	15.7	12.7	6	0.4	2.2	● ● ● ●	○ ● ● ●
TOMT150608PDER-MJ	15	15.7	12.7	6	0.8	1.9	● ● ● ●	○ ● ● ●
TOMT150616PDER-MJ	15	15.7	12.7	6	1.6	1.1	● ● ● ●	○ ● ● ●
TOMT150620PDER-MJ	15	15.7	12.7	6	2	0.7	● ● ● ●	○ ● ● ●
TOMT150608PDER-NMJ	15	15.7	12.7	6	0.8	1.9	● ● ● ●	○ ● ● ●

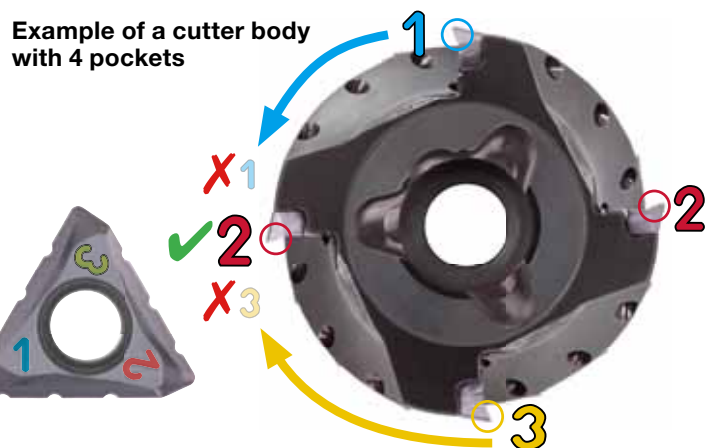
● First choice

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

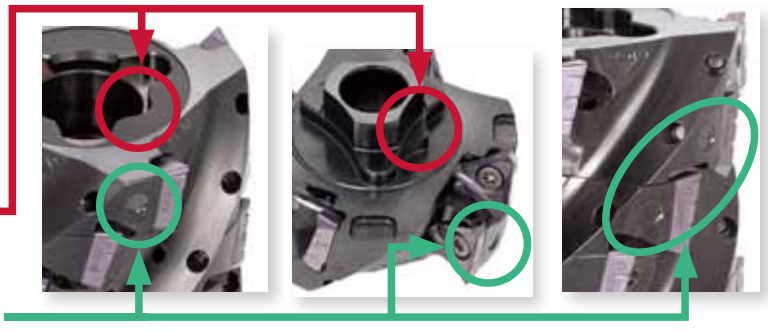


How to set a sub-unit

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 (Poka-yoke) to avoid setting error.

Projection for error-proofing (Poka-yoke)

Marking



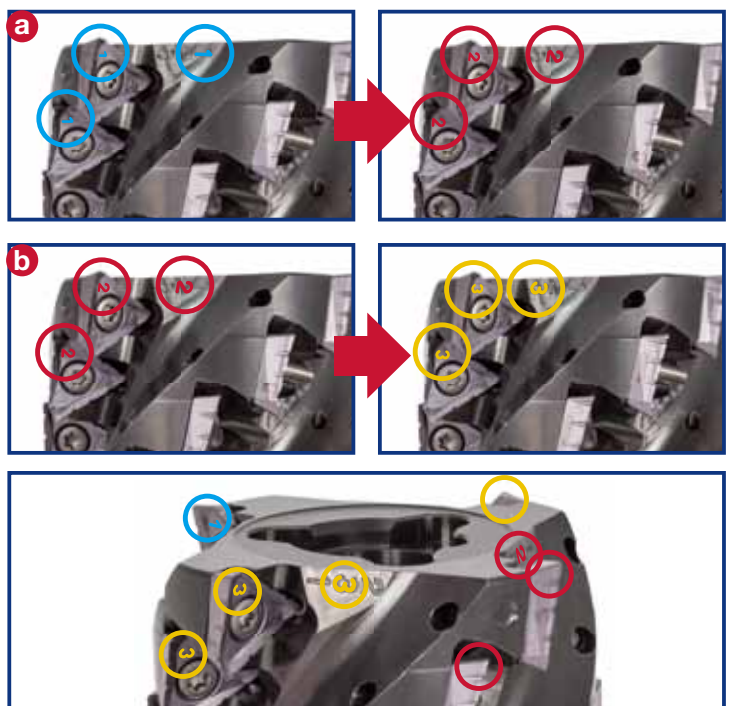
Directions for setting NMJ inserts on roughing type bodies

- 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.



STANDARD CUTTING CONDITIONS

TPA/EPA/HPA

ISO	Workpiece materials	Hardness	Grades	Cutting speed: Vc (m/min)			Feed per tooth: fz (mm/t)		
				T/EPA06	T/EPA10	T/EPA15	T/EPA06	T/EPA10	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
	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
	Alloy steel (SCM440, etc. / 42CrMo4, etc.)	200 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12	0.08 - 0.15	0.08 - 0.2
	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
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
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
	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
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
	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

- 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.

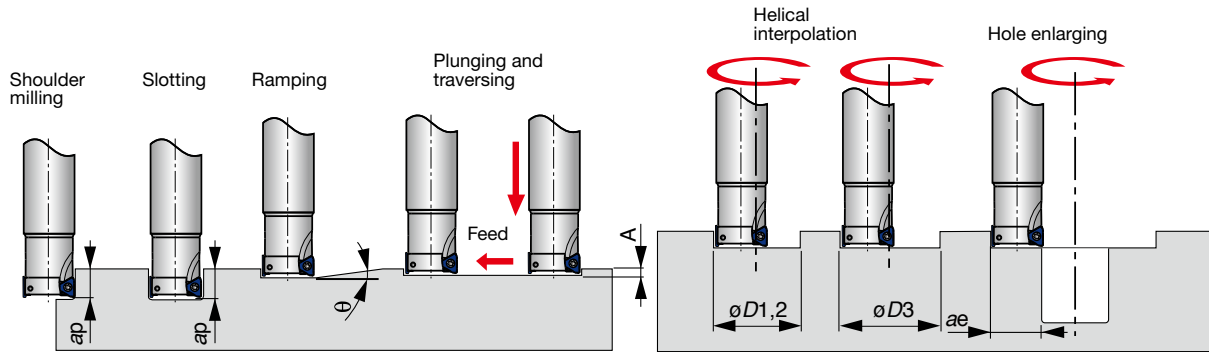
- Cutting conditions maybe limited depending on machine power, workpiece rigidity, and spindle output. When the cutting width, depth, or overhang length is large, set Vc and fz to the lower recommended values and check the machine power and vibration.

TLA (Roughing type)

ISO	Workpiece materials	Hardness	Grades	Cutting speed: Vc (m/min)		Feed per tooth: fz (mm/t)	
				TLA10	TLA15	TLA10	TLA15
P	Low carbon steel (SS400 / E275A, S15C / C15E4, etc.)	- 200	AH3135	100 - 220	100 - 250	100 - 250	0.05 - 0.15
	High carbon steel (S45C / C45, etc.)	200 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12
	Alloy steel (SCM440, etc. / 42CrMo4, etc.)	200 - 300	AH3135	100 - 170	100 - 200	100 - 230	0.05 - 0.12
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	-	AH3135	80 - 150	80 - 200	90 - 200	0.05 - 0.15
K	Grey cast iron (FC250 / GG25 / 250, etc.)	150 - 250	AH120	100 - 200	100 - 250	140 - 250	0.05 - 0.15
	Ductile cast iron (FCD450 / GGG45 / 450-10S, etc.)	150 - 250	AH120	80 - 150	80 - 200	110 - 200	0.05 - 0.15
S	Titanium alloys (Ti-6Al-4V, etc.)	-	AH120	20 - 50	20 - 60	20 - 60	0.05 - 0.1
	Heat-resistant alloys (Inconel 718, etc.)	-	AH120	20 - 35	20 - 40	20 - 40	0.03 - 0.08

- When you use the NMJ chipbreaker, please set up the feed less than 0.15 mm/t.

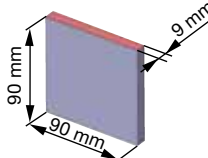
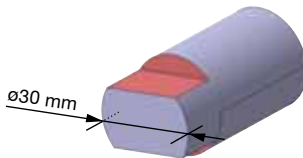
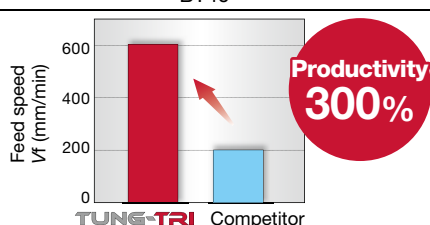
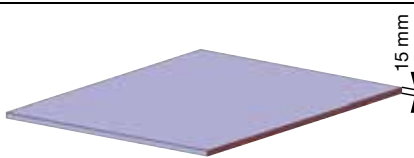
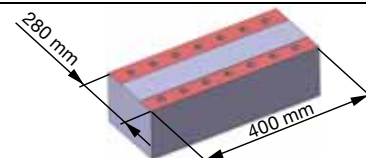
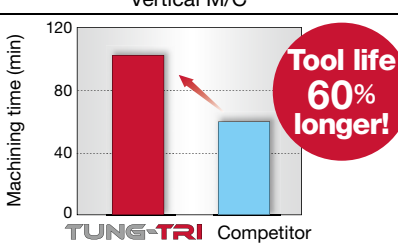
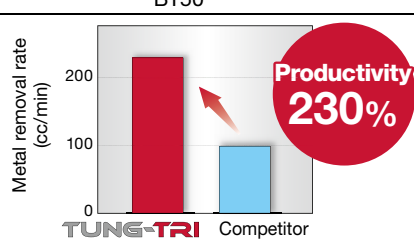
MACHINING APPLICATIONS




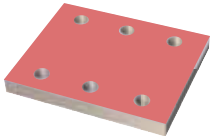
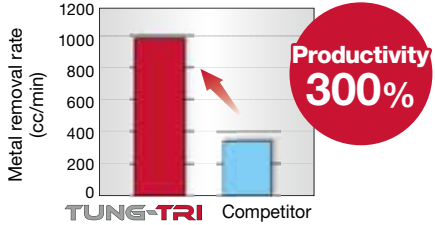
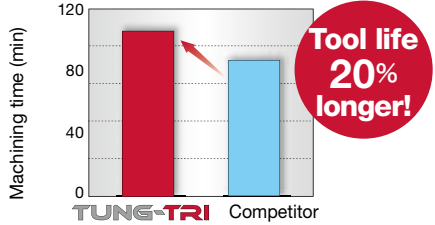
Designation	ϕDc	Max. depth of cut	Max. ramping angle	Max. plunging	Min. machining	Max. machining			Max. cutting width in enlarging
		ap	θ	A	$\phi D1$	$\phi D2$	$\phi D3^*$	$r\epsilon$	ae
EPA06R012...	12	6	5°	0.6	18	23.6	21	0.4	11.5
EPA06R016...	16	6	4.3°	0.6	25	31.6	29	0.4	15.5
EPA06R018...	18	6	3.5°	0.6	29.5	35.6	33	0.4	17.5
EPA06R020...	20	6	2.8°	0.6	33.5	39.6	37	0.4	19.5
EPA06R022...	22	6	2.5°	0.6	37.5	43.6	41	0.4	21.5
EPA06R025...	25	6	2°	0.6	43.5	49.6	47	0.4	24.5
EPA06R028...	28	6	1.8°	0.6	49.5	55.6	53	0.4	27.5
TPA06R032...	32	6	1.5°	0.6	57.5	63.6	61	0.4	31.5
TPA06R040...	40	6	1°	0.6	73.5	79.6	77	0.4	39.5
TPA06R050...	50	6	0.7°	0.6	94	99.6	97	0.4	49.5
EPA10R025...	25	10	2°	0.6	42.1	49.6	47	0.4	24.5
EPA10R028...	28	10	2°	0.6	48.1	55.6	53	0.4	27.5
EPA10R032...	32	10	2°	0.6	56.1	63.6	61	0.4	31.5
EPA10R035...	35	10	1.7°	0.6	62.1	69.6	67	0.4	34.5
E/TPA10R040...	40	10	1.4°	0.6	72.1	79.6	77	0.4	39.5
TPA10R050...	50	10	0.9°	0.6	92.1	99.6	97	0.4	49.5
TPA10R063...	63	10	0.8°	0.6	118.1	125.6	123	0.4	62.5
TPA10R080...	80	10	0.6°	0.6	152.1	159.6	157	0.4	79.5
TPA10R100...	100	10	0.5°	0.6	192.1	199.6	197	0.4	99.5
EPA15R040...	40	15	2.3°	0.8	68.5	79.2	75.5	0.8	39
E/TPA15R050...	50	15	1.7°	0.8	88.5	99.2	95.5	0.8	49
TPA15R063...	63	15	1.4°	0.8	114.5	125.2	121.5	0.8	62
TPA15R080...	80	15	1°	0.8	148.5	159.2	155.5	0.8	79
TPA15R100...	100	15	0.8°	0.8	188.5	199.2	195.5	0.8	99
TPA15R125...	125	15	0.6°	0.8	238.5	249.2	245.5	0.8	124
TPA15R160...	160	15	0.5°	0.8	308.5	319.2	315.5	0.8	159

*Flat bottom hole

PRACTICAL EXAMPLES

Workpiece type	Plate	Machine part									
Cutter	EPA06R020M20.0-03N ($\phi 20$, $z = 3$)	EPA10R032M32.0-03N ($\phi 32$, $z = 3$)									
Insert	TOMT060304PDER-MJ	TOMT100404PDER-MJ									
Grade	AH3135	AH3135									
Workpiece material	SUS304 / X5CrNi18-9	S45C / C45									
	 M	 P									
Cutting conditions	Cutting speed: V_c (m/min)	125	150								
	Feed per tooth: f_z (mm/t)	0.083	0.19								
	Feed speed: V_f (mm/min)	600	836								
	Depth of cut : a_p (mm)	1.5	1								
	Width of cut : a_e (mm)	9	5								
	Machining	Face milling	Shoulder milling								
	Coolant	Dry	External air								
	Machine	BT40	Turn-Mill center								
Results	 <p>Uniquely designed cutting edge geometry delivers low cutting force and prevents chattering, resulting in highly efficient machining of steel sheet.</p>	<table border="1"> <thead> <tr> <th>Conditions</th> <th>Burr</th> <th>Wall surface finish</th> </tr> </thead> <tbody> <tr> <td>TUNG-TRI</td> <td>Small</td> <td>Better</td> </tr> <tr> <td>Competitor</td> <td>Big</td> <td>Worse</td> </tr> </tbody> </table> <p>Due to low cutting force, Tung-Tri leaves a smaller burr and better wall surface finish compared to the competitor.</p>	Conditions	Burr	Wall surface finish	TUNG-TRI	Small	Better	Competitor	Big	Worse
	Conditions	Burr	Wall surface finish								
TUNG-TRI	Small	Better									
Competitor	Big	Worse									
Workpiece type	Base	Bed frame									
Cutter	EPA10R032M32.0-03N ($\phi 32$, $z = 3$)	TPA15R080M25.4-06 ($\phi 80$, $z = 6$)									
Insert	TOMT100404PDER-MJ	TOMT150604PDER-MJ									
Grade	AH3135	AH120									
Workpiece material	S50C / C50	FC300 / GG30									
	 P	 K									
Cutting conditions	Cutting speed: V_c (m/min)	130	200								
	Feed per tooth: f_z (mm/t)	0.1	0.2								
	Feed speed: V_f (mm/min)	390	955								
	Depth of cut : a_p (mm)	1.5	4								
	Width of cut : a_e (mm)	25	60								
	Machining	Shoulder milling	Shoulder milling								
	Coolant	External air	Dry								
	Machine	Vertical M/C	BT50								
Results	 <p>Due to strong wear resistance of AH3135 grade, tool life is increased by 60%.</p>	 <p>Low cutting force achieves outstanding surface finish even at doubled feed per tooth.</p>									

ACCELERATED MACHINING

Workpiece type		Molding machine part	Blank
Cutter	New	TLA15R080L070M31.7-04M (ø80) TLA15R080L028-04S	EPA10R040M32.0-04N (ø40, z = 4)
Insert		TOMT150608PDER-MJ	TOMT100408PDER-MJ
Grade		AH120	AH3135
Workpiece material		FCD400 / 400-15S	Titanium
		 K	 S
Cutting conditions	Cutting speed: V_c (m/min)	180	55
	Feed per tooth: f_z (mm/t)	0.2	0.1
	Feed speed: V_f (mm/min)	573.0	175
	Depth of cut : a_p (mm)	74	2.5
	Width of cut : a_e (mm)	24	25
	Machining	Contouring	Face milling
	Coolant	Dry	Wet (External coolant)
Machine	Vertical M/C, BT50	Vertical M/C, BT50	
Results		 <p>Productivity 300%</p> <p>Metal removal rate (cc/min)</p> <p>TUNG-TRI Competitor</p> <p>NMJ insert reduces cutting force, and dramatically improves efficiency.</p>	 <p>Tool life 20% longer!</p> <p>Machining time (min)</p> <p>TUNG-TRI Competitor</p> <p>Sharp cutting edges prevent welding, which extends tool life.</p>

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