Member IMC Group
Tungaloy
INDUSTRY 4.0

MillLine

Square shoulder milling cutter

TUNGFORCE FREC

Tungaloy Report No. 506-US

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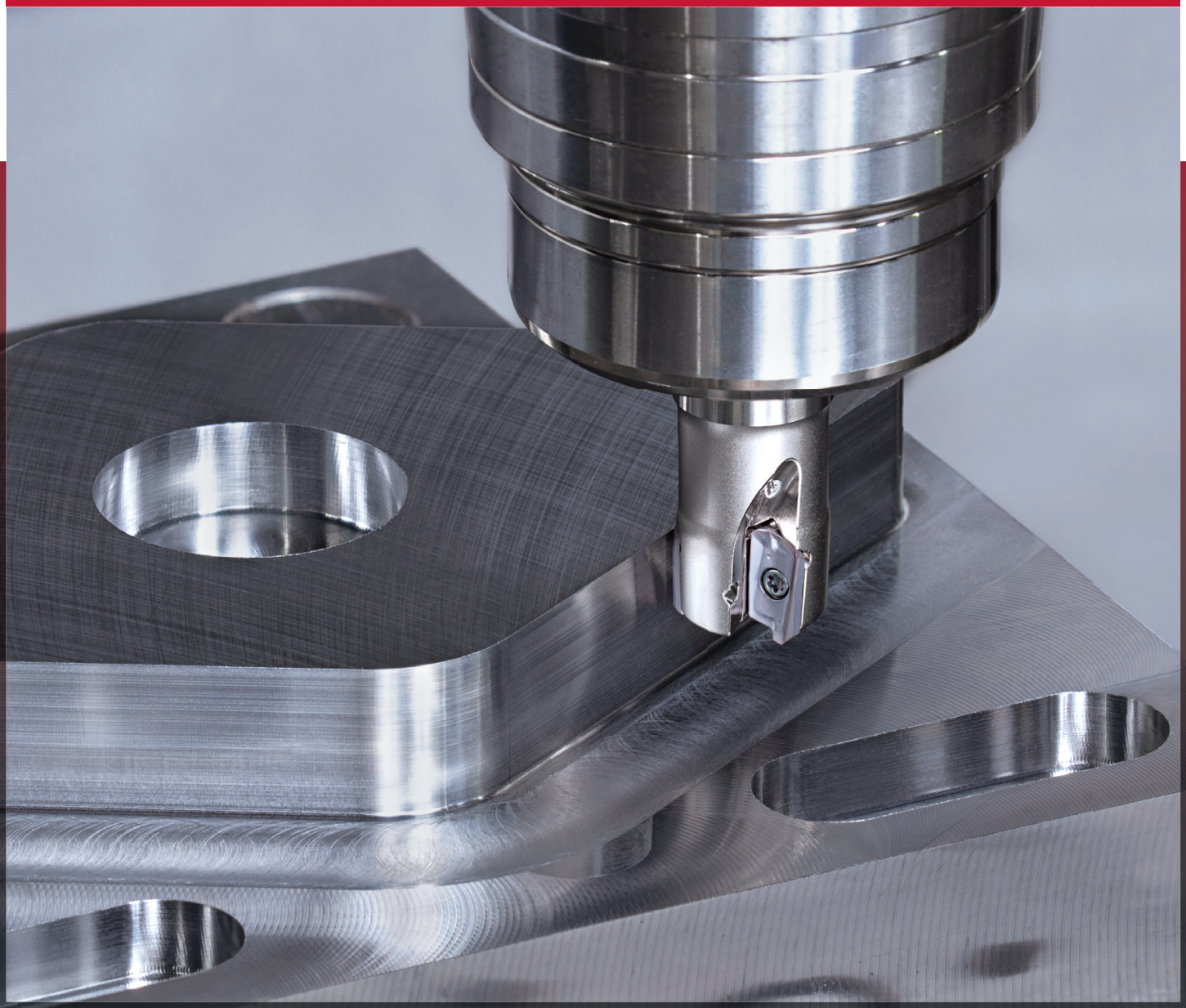
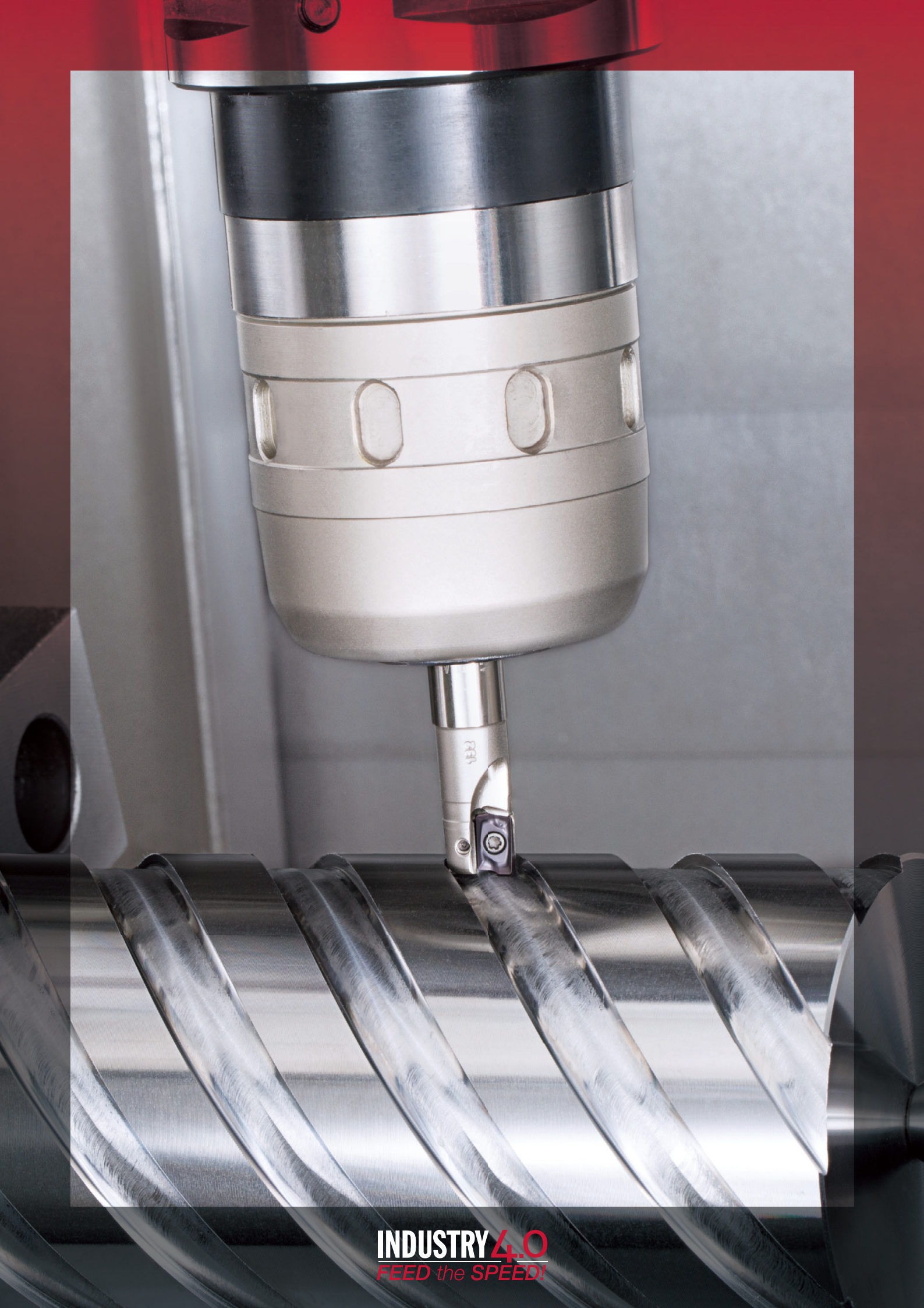
Extremely versatile shoulder milling cutter with unique V shape inserts **- Now offering size 04 inserts for small diameter cutters**



TUNGALOY ADDFORCE
ACCELERATED LINES


INDUSTRY 4.0
FEED the SPEED!

TUNGALOY

ADDFORCE MILL

ACCELERATED MILLING

TUNGFORCE REC

Unique insert clamping ensures high precision and efficiency machining with stability

New Size-04 inserts are now available for small-diameter cutters covering **a wider application range with three insert sizes**

New

Size 04

Max. depth of cut: 4 mm
Tool diameter: ø6 - ø16 mm

- Tool diameters **as small as (ø0.236") ø6 mm** available as standard
- Perfect replacement for solid carbide endmills
- **Better cost-per-edge economy** than solid endmills or shoulder mills with larger inserts when used at light depth of cut ≤ 4 mm

Size 06

Max. depth of cut: 0.236" (6 mm)
Tool diameter: ø0.312 - ø1.000"
(ø8 - ø40 mm)

- **Precision-ground insert** for high part quality
- Creates **virtually step-free wall and bottom surfaces**
- Inserts available in **R0 nose radii**
  - perfect for machining small parts in **Swiss machines**

Size 12

Max. depth of cut: 0.453" (11.5 mm)
Tool diameter: ø0.625" - ø2.000"
(ø12 - ø63 mm)

- **Robust cutter body design**
- **Close pitch cutter for high productivity**
- **Extensive lineup of insert nose radii** and **grades** for a wide application coverage

Lineup of each insert size

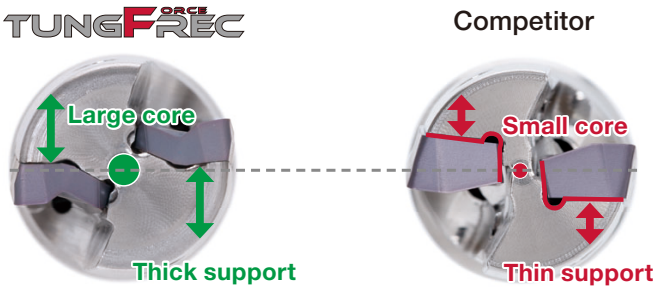
Size	Max. depth of cut (mm)	Corner radius (mm)	Workpiece material	Tool diameter (mm) / Number of inserts
New 04	4	0.4 / 0.8	P M K S H	ø6: 1 · ø8: 2 · ø10: 2, 3 · ø12: 3, 4 · ø16: 4, 5
06	6	0 / 0.2 0.4 / 0.8	P M K S N H	ø8: 1 · ø10: 2 · ø12: 2, 3 · ø14: 2, 3 · ø16: 3, 4 · ø18: 3, 4 · ø20: 4, 5 · ø22: 4, 5 · ø25: 4, 5, 6 · ø32: 6, 8 · ø40: 10
12	11.5	0.4 / 0.8 1.2 / 1.6 2 / 3	P M K S N H	ø12: 1 · ø16: 2, 3 · ø20: 3, 4 · ø25: 3, 4, 6 · ø32: 3, 6, 8 · ø40: 6, 8 · ø50: 8, 12 · ø63: 8, 14

Size	Max depth of cut (inch)	Corner radius (inch)	Workpiece material	Tool diameter (inch) / Number of inserts
06	0.236	0.000 / 0.008 / 0.016 / 0.031	P M K S N H	ø0.313: 1 · ø0.375: 1 · ø0.500: 2, 3 · ø0.625: 3, 4 · ø0.750: 4, 5 · ø1.000: 4, 5, 6
12	0.453	0.016 / 0.031 / 0.047 / 0.063 / 0.079 / 0.118	P M K S N H	ø0.625: 2, 3 · ø0.750: 3, 4 · ø1.000: 3, 6 · ø1.250: 3, 8 · ø2.000: 12

Unique V shape insert for machining security

Strong cutter body design
V shape insert design enables the cutter to have a thick core and insert backing.

Extremely secure insert clamping
V shape design prevents insert movement during machining.



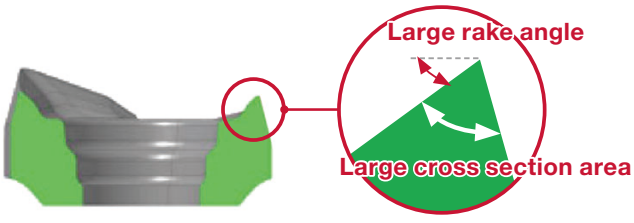
Ensures high productivity and stability.

Eliminates premature insert failure, while providing machining stability.

Sharp and strong cutting edge for increased productivity

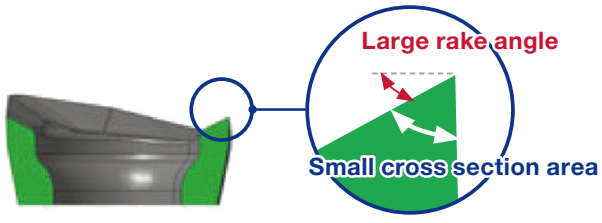
TUNGFREC

Large rake angle and obtuse flank surface provide low cutting force and anti-chipping performance.



Competitor

Large rake angle offers low cutting force but small cross section area leads to chipping on the edge.



High productivity and stability are achieved with the unique cutting edge design.

TUNGFORCE-REC

GRADES

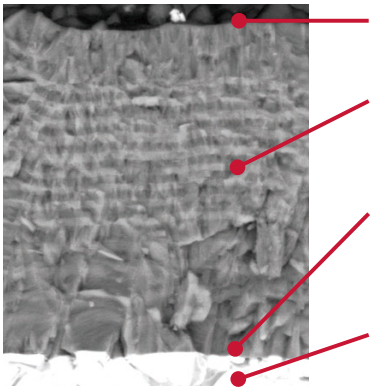
Addition of AH3225 grade for enhanced insert grade lineup

Offering four PVD grades, two CVD grades, and one uncoated carbide grade

New

AH3225 P M

- 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



Resistance to built-up edge
The coating surface prevents built-up edge

Resistance to wear, oxidation, and fracture
Multi-layered coating is designed to resist wear and oxidation, while preventing micro-cracks from propagating in the coating layer for improved resistance to edge chipping

Strong coating / substrate adhesion
Coating is optimized for strong adhesion property with substrate to maintain strong cutting edge integrity

Carbide substrate
High resistance to fracture

PREMIUMTEC

AH3135 P M

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

AH120 P K

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

T1215 K

- CVD grade with outstanding wear and chipping resistance
- Best for cast iron at high-speed machining

T3225 P M

- CVD grade with high chipping and fracture resistance

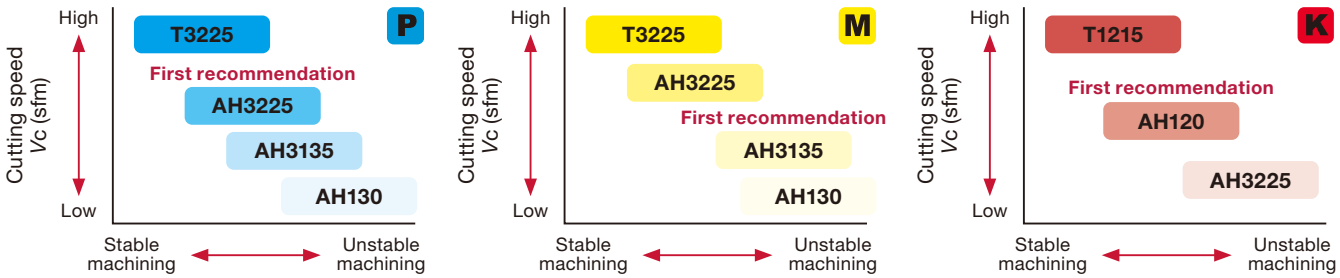
AH130 P M S

- Demonstrates high wear and chipping resistance in the machining of Titanium alloy or heat-resistant alloys
- Remarkable reliability in wet machining

KS05F N

- Fine-grained cemented carbide grade with high wear resistance
- Extremely sharp edge is suitable for non-ferrous materials

APPLICATION AREAS

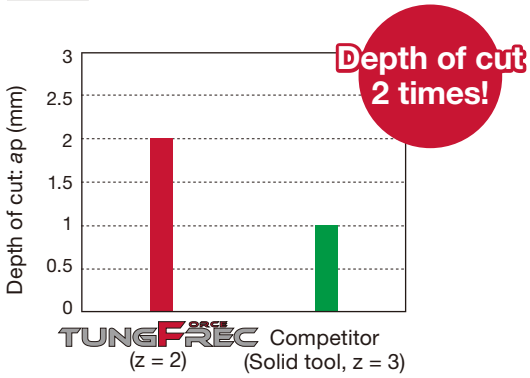


CUTTING PERFORMANCE

Size 04 - First choice for cutter diameters ø6 - ø10 mm

■ TungForce-Rec performance in slot milling vs solid carbide endmill ø8 mm

Slotting

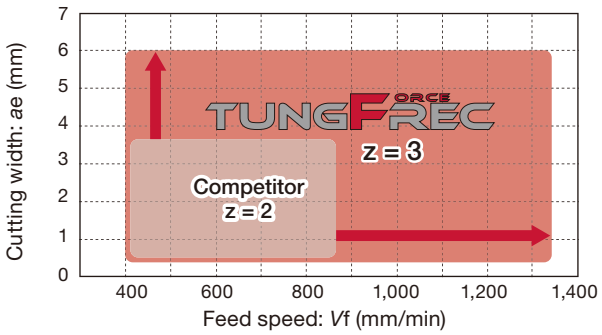


Cutter	: EPAV04M008C08.0R02 (ø8 mm, z = 2)
Insert	: AVMT040204PPER-MM AH3225
Workpiece material	: S55C / C55 (1055)
Cutting speed	: *Vc* = 100 m/min (330 sfm)
Feed speed	: *Vf*= 448 mm/min (17.63" ipm)
Overhang length	: 20 mm (0.787")
Coolant	: Air blast
Machine	: Vertical M/C, BT30
Tool life criteria	: Chatter generation

Boosts productivity for shoulder milling thanks to increased tooth density and tool rigidity

■ Comparison with the competitor's tool (ø10 mm)

Shoulder milling



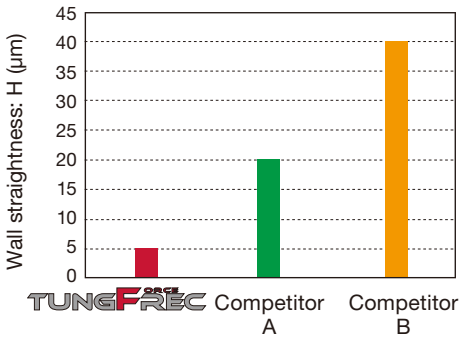
■ Comparison of web thickness

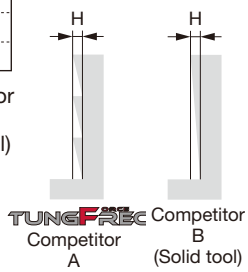
Cutter	: EPAV04M010C10.0R03 (ø10 mm, z = 3)
Insert	: AVMT040204PPER-MM AH3225
Workpiece material	: S55C / C55 (1055)
Cutting speed	: *Vc* = 200 m/min (660 sfm)
Feed per tooth	: *fz* = 0.07 mm/t (0.0027" ipt)
Depth of cut	: *ap* = 4 mm (0.157")
Overhang length	: 20 mm (0.787")
Coolant	: Air blast
Machine	: Vertical M/C, HSK63A
Tool life criteria	: Chatter generation

CUTTING PERFORMANCE

Size 06 - For outstanding part quality

■ Wall straightness: Carbon steel



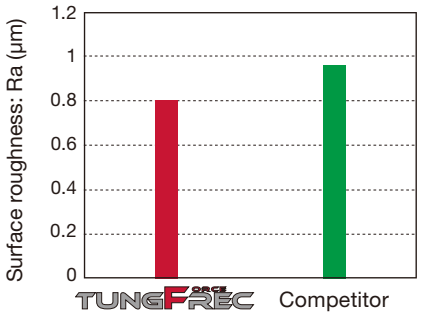


P

Cutter	: EPAV06U0.50C0.50R03 (ø0.500", z = 3)
Insert	: AVGT060304PBER-MJ AH3135
Workpiece material	: 1055 (180HB)
Cutting speed	: *Vc* = 330 m/min (Competitor B: 60 m/min)
Feed per tooth	: *fz* = 0.004 ipt (Competitor B: 0.0016 ift)
Depth of cut	: *ap* = 0.157" x 3 pass (Competitor B: 0.472")
Cutting width	: *ae* = 0.079"
Coolant	: Dry
Machine	: Vertical M/C, BT40

TungForce-Rec has achieved the best wall finish quality.

■ Surface finish: Carbon steel



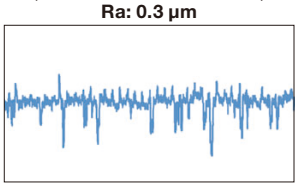
P

Cutter	: EPAV06U0.37C0.37R02 (ø0.370", z = 2)
Insert	: AVGT060302PBER-MJ AH3135
Workpiece material	: 1055 (180HB)
Cutting speed	: *Vc* = 891 sfm
Feed per tooth	: *fz* = 0.003 ipt
Depth of cut	: *ap* = 0.079"
Cutting width	: *ae* = 0.276"
Coolant	: Dry
Machine	: Vertical M/C, CAT40

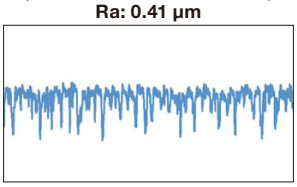
TungForce-Rec provides good surface finish compared with the competitors.

■ Surface roughness comparison (in machining steel)

(ø10 mm, z = 2, **Corner R0**)
Ra: 0.3 µm

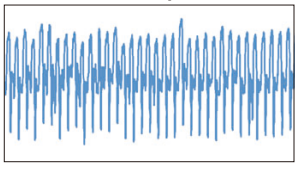


(ø10 mm, z = 2, **Corner R0.4**)
Ra: 0.41 µm



Competitor's solid endmill

(ø10 mm, z = 3, **Corner R0**)
Ra: 1.1 µm



P

Cutter	: HPAV06M010S06R02 (ø10 mm, z = 3)
Insert	: AVGT060300PBER-MJ AH3135 AVGT060304PBER-MJ AH3135
Shank	: VER16CL010S06-S
Workpiece material	: S45C / C45 (1045)
Cutting speed	: *Vc* = 60 m/min (1980 sfm)
Feed	: *f* = 0.1 mm/rev (0.0039")
Feed speed	: *Vf* = 191 mm/min (7.51")
Depth of cut	: *ap* = 1 mm (0.039")
Width of cut	: *ae* = 4 mm (0.157")
Machine	: Swiss lathe

R0 insert achieved better surface quality than solid endmill.

Size 12 - For extreme productivity and part quality

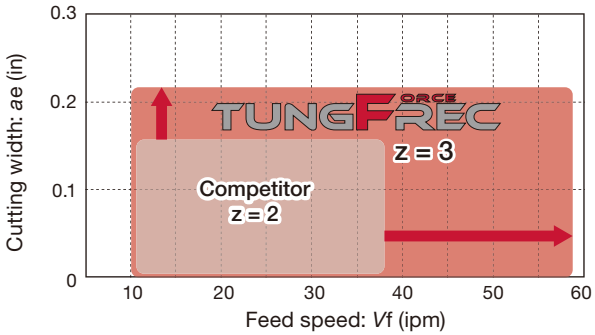
Close pitch cutter body design

The use of V shape inserts enables TungForce-Rec to have higher tooth density than competitors' shoulder mills.

Tool dia. (in)	No. of inserts		Competitor	Productivity improvement compared to competitor
	TungForce-Rec			
	Coarse pitch	Close pitch		
ø0.625	2	3	2	1.5 times
ø0.750	3	4	3	1.33 times
ø1.000	4	6	4	1.5 times
ø1.250	6	8	6	1.5 times
ø2.000	8	12	8	1.5 times

■ Performance comparison - Cutting width vs Table feed (ø16 mm)

Shoulder milling



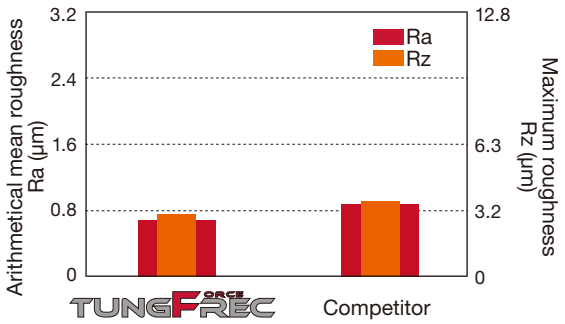
P

Cutter : EPAV12U0.62W062R03 (ø0.625", z = 3)
Insert : AVMT120408PBER-MM AH3225
Workpiece material : 1055
Cutting speed : *Vc* = 525 sfm
Feed per tooth : *fz* = 0.005 ipt
Depth of cut : *ap* = 0.354"
Overhang length : 1.378"
Coolant : Dry

TungForce-Rec enables high efficiency machining of up to 1.4x greater cutting width at a maximum of 1.5x faster table feed.

■ Performance comparison - Precise machining

Surface finishing

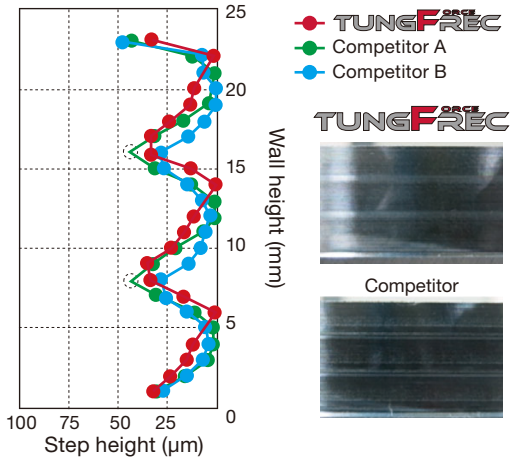


P

Cutter : EPAV12M020C20.0R03 (ø20 mm, z = 3)
Insert : AVMT120408PBER-MM AH3225
Workpiece material : S55C / C55 (1055)
Cutting speed : *Vc* = 180 m/min (594 sfm)
Feed per tooth : *fz* = 0.1 mm/t (0.004 ipt)
Depth of cut : *ap* = 1 mm (0.039")
Cutting width : *ae* = 16 mm (0.629")
Coolant : Dry

Better surface quality vs the competitor.

Wall finishing



P

Cutter : EPAV12M020C20.0R03 (ø20 mm, z = 3)
Insert : AVMT120408PBER-MM AH3225
Workpiece material : S55C / C55 (1055)
Cutting speed : *Vc* = 180 m/min (594 sfm)
Feed per tooth : *fz* = 0.1 mm/t (0.004 ipt)
Depth of cut : *ap* = 8 mm (0.315")
Cutting width : *ae* = 3 mm (0.118")
Coolant : Dry

Equal or better wall step than competitors.

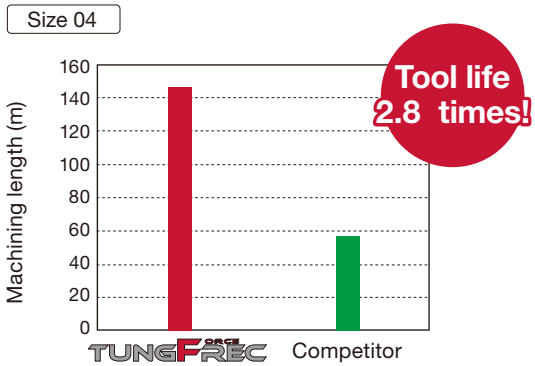
CUTTING PERFORMANCE

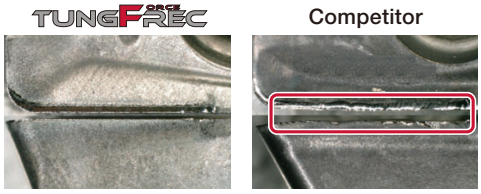
Tool life

Shoulder milling

P S55C / C55 (1055)

Size 04





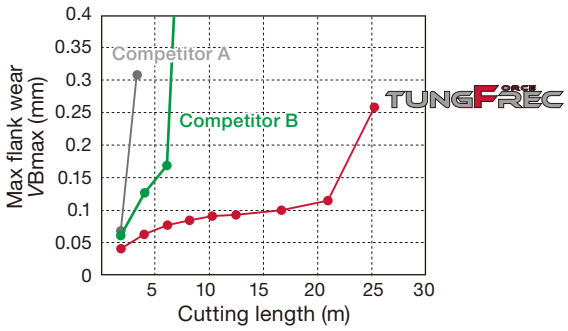
Damage on cutting edges at the same machining time

Cutter	: EPAV04M008C08.0R02 (ø8 mm, z = 2)
Insert	: AVMT040204PPER-MM AH3225
Cutting speed	: *Vc* = 200 m/min (60.6 sfm)
Feed per tooth	: *fz* = 0.07 mm/t (0.0027 ipt)
Depth of cut	: *ap* = 3 mm (0.118")
Cutting width	: *ae* = 2.7 mm (0.106")
Coolant	: Air blast

Soft cutting geometry with strong cutting edge design provide long and predictable tool life.

M SUS304 / X5CrNi18-9 (304)

Size 06

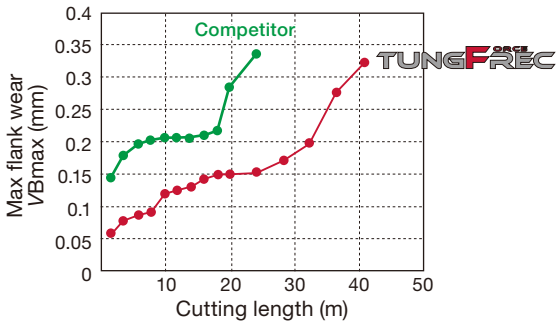


Cutter	: EPAV06M010C10.0R02 (ø10 mm, z = 2)
Insert	: AVGT060302PBER-MJ AH3135
Cutting speed	: *Vc* = 260 m/min (858 sfm)
Feed per tooth	: *fz* = 0.07 mm/t (0.0027 ipt)
Depth of cut	: *ap* = 3 mm (0.118")
Cutting width	: *ae* = 2.9 mm (0.114")
Coolant	: Dry
Machine	: Vertical M/C, BT40

Light cutting action, reduced built-up edge and thermal cracking, and improved insert life.

S Ti-6Al-4V

Size 06



Cutter	: EPAV06M016C16.0R04 (ø16 mm, z = 4)
Insert	: AVGT060304PBER-MJ AH130
Cutting speed	: *Vc* = 80 m/min (264 sfm)
Feed per tooth	: *fz* = 0.08 mm/t (0.0031 ipt)
Depth of cut	: *ap* = 5 mm (0.196")
Cutting width	: *ae* = 5 mm (0.196")
Coolant	: Wet
Machine	: Vertical M/C, BT40, 18.5 kW

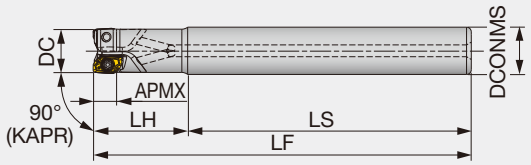
Highly wear resistant in a wet cutting, AH130 has dramatically improved the tool life.

New

EPAV04

Square shoulder endmill, shank type, with screw clamp system

GAMP = +6°~ +7.6°, GAMF = -37.1°~ -32.4°



Metric	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPAV04M006C06.0R01	4	6	1	6	48	12	60	0.01	With	AVMT04...
EPAV04M008C08.0R02	4	8	2	8	48	12	60	0.02	With	AVMT04...
EPAV04M008C08.0R02L	4	8	2	8	60	20	80	0.03	With	AVMT04...
EPAV04M010C10.0R02	4	10	2	10	60	20	80	0.04	With	AVMT04...
EPAV04M010C10.0R03	4	10	3	10	60	20	80	0.04	With	AVMT04...
EPAV04M010C10.0R02L	4	10	2	10	65	35	100	0.05	With	AVMT04...
EPAV04M012C12.0R03	4	12	3	12	60	20	80	0.06	With	AVMT04...
EPAV04M012C12.0R04	4	12	4	12	60	20	80	0.06	With	AVMT04...
EPAV04M012C12.0R03L	4	12	3	12	85	35	120	0.09	With	AVMT04...
EPAV04M016C16.0R04	4	16	4	16	70	20	90	0.12	With	AVMT04...
EPAV04M016C16.0R05	4	16	5	16	70	20	90	0.12	With	AVMT04...
EPAV04M016C16.0R04L	4	16	4	16	105	35	140	0.19	With	AVMT04...

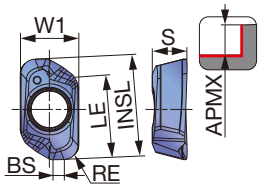
SPARE PARTS

Designation	Clamping screw	Wrench
EPAV04M006C06.0R01	CSPB-1.8L3.3	IP-6DB
EPAV04M008... - EPAV04M016...	CSPB-1.8L3.6	IP-6DB

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

INSERT

AVMT04-MM



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

★ : First choice
☆ : Second choice

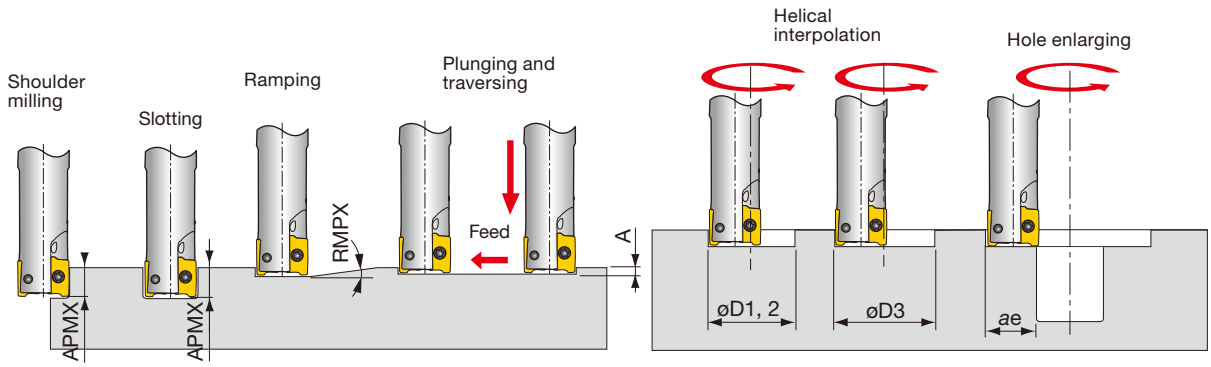
Designation	RE	APMX	Coated AH120	Coated AH3225	W1	INSL	S	BS	LE
AVMT040204PPER-MM	0.016	0.157	●	●	0.138	0.238	0.083	0.039	0.173
AVMT040208PPER-MM	0.031	0.157	●	●	0.138	0.238	0.083	0.024	0.173

● : New product

STANDARD CUTTING CONDITIONS

ISO	Workpiece meterials		Hardness	Priority	Grades	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steel 1015, etc.		- 200 HB	First choice	AH3225	328 - 984	0.002 - 0.005
P	Carbon steel and alloy steel 1055, etc.		- 300 HB	First choice	AH3225	328 - 820	0.002 - 0.005
P	Prehardend steel NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3225	328 - 656	0.002 - 0.004
M	Stainless steel 304SS, etc.		-	First choice	AH3225	262 - 591	0.002 - 0.004
K	Gray cast iron Class 25, etc.		150 - 250 HB	First choice	AH120	328 - 984	0.002 - 0.005
K	Ductile cast iron 60-40-18, 80-55-06, etc.		150 - 250 HB	First choice	AH120	328 - 820	0.002 - 0.005
S	Titanium alloys Ti-6Al-4V, etc.		-	First choice	AH3225	66 - 197	0.002 - 0.003
S	Superalloys Inconel718, etc.		-	First choice	AH120	66 - 131	0.002 - 0.003
H	Hardened steel	H-13, etc.	40 - 50 HRC	First choice	AH120	164 - 492	0.002 - 0.003
H	Hardened steel	D2, etc.	50 - 60 HRC	First choice	AH120	131 - 230	0.002 - 0.003

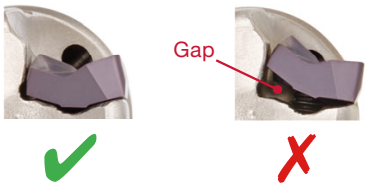
MACHINING APPLICATIONS



		Max. depth of cut	Max. ramping angle	Max. plunging	Min. machining	Max. machining		Max. cutting width in enlarging
Metric	**DC**	**APMX**	**RMPX**	**A**	**øD1**	**øD2**	**øD3***	***ae***
EPAV04M006C06.0R01	6	4	0.4°	0.03	9.3	11.6	9.9	5.5
EPAV04M008C08.0R02	8	4	0.5°	0.04	12.7	15.6	13.6	7.5
EPAV04M008C08.0R02L	8	4	0.5°	0.04	12.7	15.6	13.6	7.5
EPAV04M010C10.0R02	10	4	4.1°	0.4	15.3	19.6	17.5	9.5
EPAV04M010C10.0R03	10	4	1.7°	0.2	16.1	19.6	17.5	9.5
EPAV04M010C10.0R02L	10	4	4.1°	0.4	16.1	19.6	17.5	9.5
EPAV04M012C12.0R03	12	4	2.7°	0.4	19.3	23.6	21.5	11.5
EPAV04M012C12.0R04	12	4	1.3°	0.2	20.1	23.6	21.5	11.5
EPAV04M012C12.0R03L	12	4	2.7°	0.4	19.3	23.6	21.5	11.5
EPAV04M016C16.0R04	16	4	2°	0.4	27.2	31.6	29.5	15.5
EPAV04M016C16.0R05	16	4	2°	0.4	27.2	31.6	29.5	15.5
EPAV04M016C16.0R04L	16	4	2°	0.4	27.2	31.6	29.5	15.5

*Flat bottom hole

When clamping the insert, please confirm that there is no gap between the cutter body and the insert as shown in the picture.



Estimation of chip thickness - calculated from feed per tooth (*fz*) and cutting width (*ae*) data

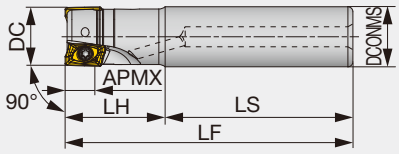
Recommended chip thickness

	Cutting width (%): *ae* (in) / Tool dia.: DC (in)														
Feed per tooth *fz* (ipt)	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.001	0.0002	0.0003	0.0004	0.0004	0.0005	0.0005	0.0007	0.0008	0.0009	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012
0.002	0.0004	0.0006	0.0006	0.0007	0.0008	0.0009	0.0012	0.0014	0.0016	0.0017	0.0018	0.0019	0.0019	0.0020	0.0020
0.003	0.0006	0.0009	0.0010	0.0011	0.0012	0.0014	0.0019	0.0022	0.0025	0.0027	0.0029	0.0030	0.0031	0.0031	0.0031
0.004	0.0008	0.0011	0.0012	0.0013	0.0015	0.0017	0.0024	0.0028	0.0031	0.0034	0.0036	0.0037	0.0039	0.0039	0.0039
0.005	0.0009	0.0013	0.0015	0.0016	0.0019	0.0020	0.0028	0.0034	0.0038	0.0041	0.0043	0.0045	0.0046	0.0047	0.0047
0.006	0.0012	0.0017	0.0019	0.0020	0.0023	0.0026	0.0035	0.0042	0.0047	0.0051	0.0054	0.0056	0.0058	0.0059	0.0059
0.007	0.0014	0.0020	0.0022	0.0024	0.0028	0.0031	0.0043	0.0051	0.0057	0.0061	0.0065	0.0068	0.0069	0.0070	0.0071
0.008	0.0016	0.0022	0.0024	0.0027	0.0031	0.0034	0.0047	0.0056	0.0063	0.0068	0.0072	0.0075	0.0077	0.0078	0.0079
0.009	0.0017	0.0024	0.0027	0.0030	0.0034	0.0038	0.0052	0.0062	0.0069	0.0075	0.0080	0.0083	0.0085	0.0086	0.0087
0.010	0.0020	0.0028	0.0031	0.0033	0.0039	0.0043	0.0059	0.0070	0.0079	0.0085	0.0090	0.0094	0.0096	0.0098	0.0098
0.011	0.0022	0.0031	0.0034	0.0038	0.0043	0.0048	0.0066	0.0079	0.0088	0.0095	0.0101	0.0105	0.0108	0.0110	0.0110
0.012	0.0024	0.0033	0.0037	0.0040	0.0046	0.0052	0.0071	0.0084	0.0094	0.0102	0.0108	0.0113	0.0116	0.0117	0.0118
0.013	0.0031	0.0044	0.0049	0.0054	0.0062	0.0069	0.0094	0.0113	0.0126	0.0136	0.0144	0.0150	0.0154	0.0157	0.0157

EPAV06

Square shoulder endmill, shank type, with screw clamp system

GAMP = +6°~ +7.7°, GAMF = -37.1°~ -30°



Inch	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(lb)	Insert
EPAV06U0.31C0.37R01	0.236	0.313	1	0.375	2.463	0.787	3.250	0.09	AVGT06...
EPAV06U0.37C0.37R01	0.236	0.375	1	0.375	2.463	0.787	3.250	0.09	AVGT06...
EPAV06U0.37C0.37R01L	0.236	0.375	1	0.375	2.622	1.378	4.000	0.11	AVGT06...
EPAV06U0.50C0.50R02	0.236	0.500	2	0.500	2.463	0.787	3.250	0.15	AVGT06...
EPAV06U0.50C0.50R03	0.236	0.500	3	0.500	2.463	0.787	3.250	0.15	AVGT06...
EPAV06U0.50C0.50R02L	0.236	0.500	2	0.500	3.388	1.362	4.750	0.22	AVGT06...
EPAV06U0.62C0.62R03	0.236	0.625	3	0.625	2.713	0.787	3.500	0.26	AVGT06...
EPAV06U0.62C0.62R04	0.236	0.625	4	0.625	2.713	0.787	3.500	0.26	AVGT06...
EPAV06U0.62C0.62R03L	0.236	0.625	3	0.625	4.122	1.378	5.500	0.42	AVGT06...
EPAV06U0.75C0.62R04	0.236	0.750	4	0.625	2.815	1.185	4.000	0.33	AVGT06...
EPAV06U0.75C0.75R04	0.236	0.750	4	0.750	2.815	1.185	4.000	0.44	AVGT06...
EPAV06U0.75C0.75R05	0.236	0.750	5	0.750	2.815	1.185	4.000	0.44	AVGT06...
EPAV06U0.75C0.75R04L	0.236	0.750	4	0.750	6.500	1.375	7.875	0.90	AVGT06...
EPAV06U1.00C0.75R06	0.236	1.000	6	0.750	3.125	1.375	4.500	0.55	AVGT06...
EPAV06U1.00C1.00R05	0.236	1.000	5	1.000	3.125	1.375	4.500	0.93	AVGT06...
EPAV06U1.00C1.00R06	0.236	1.000	6	1.000	3.125	1.375	4.500	0.93	AVGT06...
EPAV06U1.00C1.00R04L	0.236	1.000	4	1.000	6.425	1.575	8.000	1.68	AVGT06...

Metric	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Insert
EPAV06M008C10.0R01	6	8	1	10	60	20	80	0.04	AVGT06...
EPAV06M010C10.0R02	6	10	2	10	60	20	80	0.04	AVGT06...
EPAV06M010C10.0R02L	6	10	2	10	65	35	100	0.06	AVGT06...
EPAV06M010C08.0R02L	6	10	2	8	80	20	100	0.04	AVGT06...
EPAV06M012C12.0R02	6	12	2	12	60	20	80	0.06	AVGT06..
EPAV06M012C12.0R03	6	12	3	12	60	20	80	0.06	AVGT06...
EPAV06M012C12.0R02L	6	12	2	12	85	35	120	0.09	AVGT06...
EPAV06M012C10.0R02L	6	12	2	10	100	20	120	0.07	AVGT06...
EPAV06M012C10.0R03	6	12	3	10	60	20	80	0.04	AVGT06...
EPAV06M014C12.0R03	6	14	3	12	60	20	80	0.07	AVGT06...
EPAV06M014C12.0R03L	6	14	3	12	120	20	140	0.11	AVGT06...
EPAV06M016C16.0R03	6	16	3	16	70	20	90	0.12	AVGT06...
EPAV06M016C16.0R04	6	16	4	16	70	20	90	0.12	AVGT06...
EPAV06M016C16.0R03L	6	16	3	16	105	35	140	0.20	AVGT06...
EPAV06M018C16.0R03	6	18	3	16	70	20	90	0.13	AVGT06...
EPAV06M018C16.0R04	6	18	4	16	70	20	90	0.13	AVGT06...
EPAV06M018C16.0R03L	6	18	3	16	160	20	180	0.26	AVGT06...
EPAV06M020C20.0R04	6	20	4	20	70	30	100	0.23	AVGT06...
EPAV06M020C20.0R05	6	20	5	20	70	30	100	0.21	AVGT06...
EPAV06M020C20.0R04L	6	20	4	20	165	35	200	0.45	AVGT06...
EPAV06M020C16.0R04	6	20	4	16	80	30	110	0.17	AVGT06...
EPAV06M025C25.0R05	6	25	5	25	80	35	115	0.4	AVGT06...
EPAV06M025C25.0R06	6	25	6	25	80	35	115	0.4	AVGT06...
EPAV06M025C25.0R04L	6	25	4	25	160	40	200	0.72	AVGT06...
EPAV06M025C20.0R06	6	25	6	20	80	35	115	0.27	AVGT06...
EPAV06M032C32.0R08	6	32	8	32	80	40	120	0.7	AVGT06...
EPAV06M032C32.0R06L	6	32	6	32	155	45	200	1.2	AVGT06...

SPARE PARTS

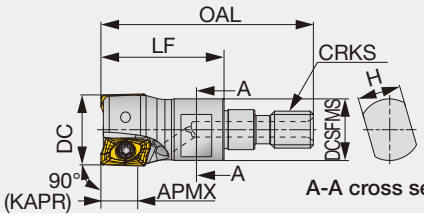
Designation	Clamping screw	Lubricant	Wrench
EPAV06...	CSPB-2H	M-1000	IP-6DB

*Recommended clamping torque (N·m): CSPB-2H = 0.7

HPAV06-M

Square shoulder endmill, modular type (TungFlex), with screw clamp system

GAMP = +6.9°~ +7.6°, GAMF = -35.2°~ -32.4°



Metric	APMX	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Insert
HPAV06M010M06R02	6	10	2	34.5	20	7	9.5	M6	0.01	AVGT06...
HPAV06M012M06R02	6	12	2	34.5	20	7	10	M6	0.01	AVGT06...
HPAV06M012M06R03	6	12	3	34.5	20	7	10	M6	0.01	AVGT06...
HPAV06M016M08R03	6	16	3	42	25	10	13	M8	0.03	AVGT06...
HPAV06M016M08R04	6	16	4	42	25	10	13	M8	0.03	AVGT06...

For metric shank details, please refer to TungFlex series in TR419 TungFlex

SPARE PARTS



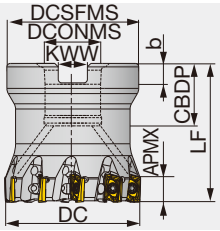
Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

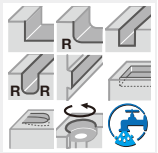
*Recommended clamping torque (N·m): CSPB-2H = 0.7

TPAV06

Square shoulder mill, bore type, with screw clamp system

GAMP = +7.7°, GAMF = -29.8°





Metric	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	KWW	b	WT(kg)	Insert
TPAV06M040B16.0R10	6	40	10	38	16	18	40	8.4	5.6	0.24	AVGT06...

SPARE PARTS



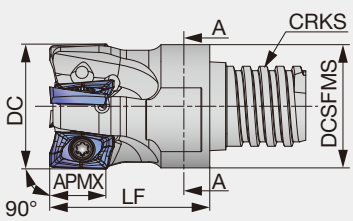

Designation	Clamping screw	Lubricant	Wrench	Center bolt
TPAV06M040B16.0R10	CSPB-2H	M-1000	IP-6DB	CM8X30H

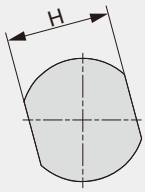
*Recommended clamping torque (N·m): CSPB-2H = 0.7

HPAV06-S

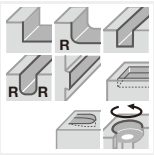
Square shoulder endmill, modular type (TungMeister), with screw clamp system

GAMP = +6.9°~ +7.6°, GAMF = -35.2°~ -32.4°





A-A cross section



Metric	APMX	DC	CICT	LF	H	DCSFMS	CRKS	WT(kg)	Insert
HPAV06M010S05R02	6	10	2	10	8	8	S05	0.01	AVGT06...
HPAV06M010S06R02	6	10	2	16	8	9.8	S06	0.01	AVGT06...
HPAV06M012S08R02	6	12	2	18	10	11.7	S08	0.02	AVGT06...
HPAV06M012S08R03	6	12	3	18	10	11.7	S08	0.02	AVGT06...
HPAV06M016S10R03	6	16	3	20	13	15.4	S10	0.03	AVGT06...
HPAV06M016S10R04	6	16	4	20	13	15.4	S10	0.03	AVGT06...

- For shank details, please refer to TR381 TungMeister
  Shank types: VSSD, VTSD, VSC, VSTD, VER
- For connections between metric shank and TungMeister thread, please use VAD-M type connector

Designation	Wrench*	
HPAV06M010S...	KEYV-S06	
HPAV06M012S...	KEYV-S08	
HPAV06M016S...	KEYV-S10	

*sold separately

SPARE PARTS

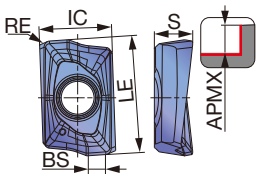


Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

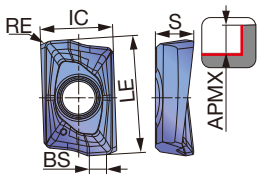
*Recommended clamping torque (N·m): CSPB-2H = 0.7

INSERT

AVGT-MJ



AVGT-AJ



		Coated				Carbide
		AH120	AH130	AH3135	AH3225	KS05F
P	Steel	☆		☆	★	
M	Stainless		☆	☆	☆	
K	Cast iron	★				
N	Non-ferrous					★
S	Superalloys	☆	★			
H	Hard materials	★				

★ : First choice
☆ : Second choice

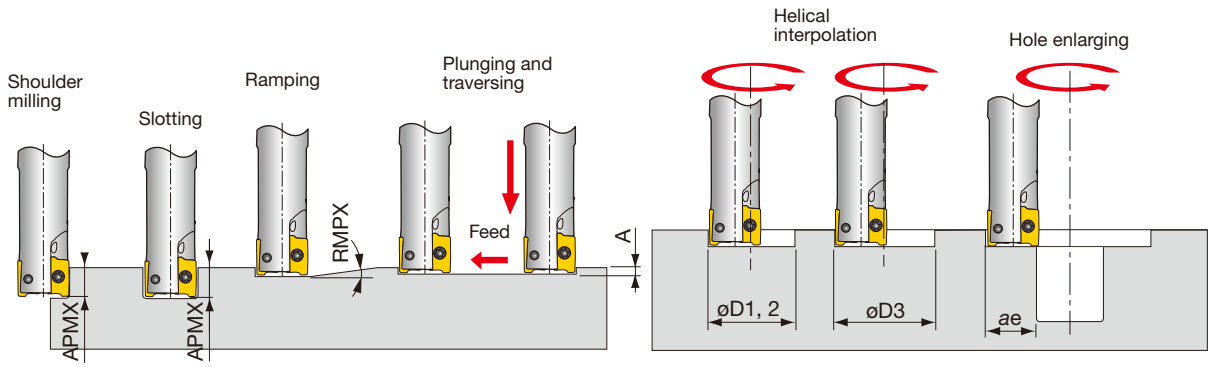
Designation	RE	APMX	Coated AH120	Coated AH130	Coated AH3135	Coated AH3225	Carbide KS05F	LE	IC	S	BS
AVGT060300PBER-MJ	0.000	0.236			●	●		0.315	0.197	0.106	0.063
AVGT060302PBER-MJ	0.008	0.236	●	●	●	●		0.315	0.197	0.106	0.059
AVGT060304PBER-MJ	0.016	0.236	●	●	●	●		0.315	0.197	0.106	0.051
AVGT060308PBER-MJ	0.031	0.236	●	●	●	●		0.315	0.197	0.102	0.035
AVGT060300PBFR-AJ	0.000	0.236					●	0.315	0.197	0.106	0.063
AVGT060302PBFR-AJ	0.008	0.236					●	0.315	0.197	0.106	0.059
AVGT060304PBFR-AJ	0.016	0.236					●	0.315	0.197	0.106	0.051
AVGT060308PBFR-AJ	0.031	0.236					●	0.315	0.197	0.102	0.035

● : New product
● : Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials		Hardness	Priority	Grades	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steels (1018, 1026, etc.)		- 200 HB	First choice	AH3225	755 - 1410	0.003 - 0.005
P	Carbon steel and alloy steel (1055, 4140, etc.)		- 300 HB	First choice	AH3225	490 - 1150	0.003 - 0.005
P	Prehardened steel (H-13, P-20, etc.)		30 - 40 HRC	First choice	AH3225	325 - 750	0.003 - 0.005
M	Stainless steel (304, 316, etc.)		-	First choice	AH3135	490 - 720	0.003 - 0.004
K	Gray cast iron (Class 25, Class 30, etc.)		150 - 250 HB	First choice	AH120	655 - 1080	0.003 - 0.005
K	Ductile cast iron (60-40-12, 80-55-06, etc.)		150 - 250 HB	First choice	AH120	490 - 785	0.003 - 0.005
N	Aluminum allows (Si < 13%)		-	First choice	KS05F	2130 - 3280	0.003 - 0.005
N	Aluminum alloys (Si > 13%)		-	First choice	KS05F	325 - 750	0.003 - 0.005
S	Titanium alloys (Ti-6Al-4V, etc.)		-	First choice	AH130	130 - 295	0.0016 - 0.004
S	Superalloys (Inconel718, etc.)		-	First choice	AH130	145 - 210	0.0016 - 0.004
H	Hardened steel	(H13, etc.)	40 - 50 HRC	First choice	AH120	145 - 225	0.002 - 0.004
H	Hardened steel	(H13, etc.)	50 - 60 HRC	First choice	AH120	130 - 210	0.0016 - 0.003

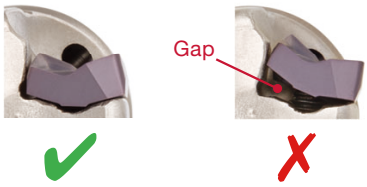
MACHINING APPLICATIONS



Designation	DC	Max. depth of cut APMX	Max. ramping angle RMPX	Max. plunging A	Min. machining øD1	Max. machining øD2	Max. machining øD3*	Max. cutting width in enlarging *ae*
EPAV06U0.31...	0.313	0.236	-	-	-	-	-	-
EPAV06U0.37...	0.375	0.236	3°	0.012	0.591	0.748	0.709	0.374
EPAV06U0.50...	0.500	0.236	3°	0.012	0.709	0.906	0.866	0.453
EPAV06U0.62...	0.625	0.236	2.3°	0.012	1.026	1.220	1.181	0.610
EPAV06U0.75...	0.750	0.236	2°	0.012	1.276	1.460	1.421	0.730
EPAV06U1.00...	1.000	0.236	1.6°	0.012	1.775	1.960	1.921	0.980

*Flat bottom hole

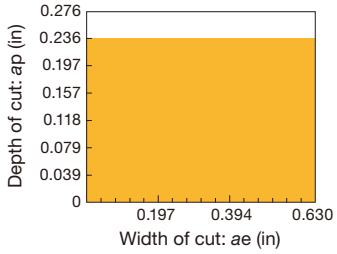
When clamping the insert, please confirm that there is no gap between the cutter body and the insert as shown in the picture.



Caution for using a large diameter cutter (over ø18 mm)

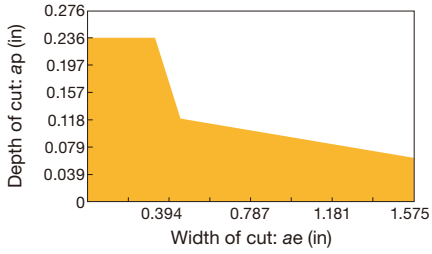
When using a cutter diameter over 18 mm, please note that the applicable range of cutting depth significantly drops as the cutting width applied increases, thus an additional finishing process may be required.

Cutting depth in relation to cutting width (for up to ø16 mm)



Cutter	: EPAV06U0.62C0.62R04 (ø0.625", z = 4)
Insert	: AVGT060304PBER-MJ AH3135
Workpiece material	: 1055
Cutting speed	: *Vc* = 820 sfm
Feed per tooth	: *fz* = 0.003 ipt
Machining	: Slotting
Coolant	: Dry
Machine	: Vertical M/C, BT40, 18.5 kW

Cutting depth in relation to cutting width (for ø18 mm and up)

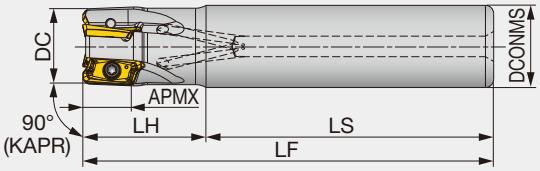


Cutter	: EPAV06U1.00C1.00R06 (1.000", z = 6)
Insert	: AVGT060304PBER-MJ AH3135
Workpiece material	: 1055
Cutting speed	: *Vc* = 820 sfm
Feed per tooth	: *fz* = 0.003 ipt
Coolant	: Dry
Machine	: Vertical M/C, BT40, 18.5 kW

EPAV12

Square shoulder endmill, shank type, with screw clamp system

GAMP = +6°~ +7.6°, GAMF = -37.1°~ -32.4°



Inch	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(lb)	Air Hole	Insert
EPAV12U0.62W0.62R03	0.453	0.625	3	0.625	1.906	1.000	2.906	0.220	with	AVM/GT12...
EPAV12U0.75W0.75R04	0.453	0.750	4	0.750	2.031	1.250	3.281	0.330	with	AVM/GT12...
EPAV12U1.00W1.00R06	0.453	1.000	6	1.000	2.281	1.500	3.781	0.710	with	AVM/GT12...
EPAV12U1.25W1.25R08	0.453	1.250	8	1.250	2.281	1.500	3.781	1.150	with	AVM/GT12...
EPAV12U0.62C0.62R02L	0.453	0.625	2	0.625	4.250	1.500	5.750	0.440	with	AVM/GT12...
EPAV12U0.75C0.75R03L	0.453	0.750	3	0.750	5.250	2.000	7.250	0.790	with	AVM/GT12...
EPAV12U1.00C1.00R03L	0.453	1.000	3	1.000	5.750	2.750	8.500	1.650	with	AVM/GT12...
EPAV12U1.25C1.25R03L	0.453	1.250	3	1.250	7.000	3.000	10.000	3.150	with	AVM/GT12...

Metric	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air Hole	Insert
EPAV12M012C12.0R01	11.5	12	1	12	60	25	85	0.06	with	AVM/GT12...
EPAV12M016C16.0R02	11.5	16	2	16	60	25	85	0.12	with	AVM/GT12...
EPAV12M016C16.0R03	11.5	16	3	16	60	25	85	0.12	with	AVM/GT12...
EPAV12M016C16.0R02L	11.5	16	2	16	105	40	145	0.20	with	AVM/GT12...
EPAV12M020C20.0R03	11.5	20	3	20	70	30	100	0.22	with	AVM/GT12...
EPAV12M020C20.0R04	11.5	20	4	20	70	30	100	0.21	with	AVM/GT12...
EPAV12M020C20.0R02L	11.5	20	2	20	135	50	185	0.41	with	AVM/GT12...
EPAV12M025C25.0R04	11.5	25	4	25	80	35	115	0.38	with	AVM/GT12...
EPAV12M025C25.0R06	11.5	25	6	25	80	35	115	0.39	with	AVM/GT12...
EPAV12M025C25.0R03L	11.5	25	3	25	150	70	220	0.74	with	AVM/GT12...
EPAV12M032C32.0R06	11.5	32	6	32	80	40	120	0.68	with	AVM/GT12...
EPAV12M032C32.0R08	11.5	32	8	32	80	40	120	0.68	with	AVM/GT12...
EPAV12M032C32.0R03L	11.5	32	3	32	175	80	255	1.47	with	AVM/GT12...

SPARE PARTS

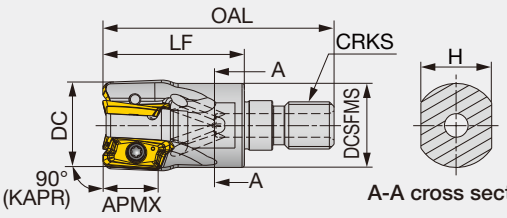
Designation	Clamping screw	Wrench
EPAV12M012C12.0R01	CPSB-2.5	IP-8D
EPAV12M016C16.0R02	CPSB-2.5	IP-8D
EPAV12M016C16.0R03	CPSB-2.5S	IP-8D
EPAV12M016C16.0R02L	CPSB-2.5	IP-8D
EPAV12M020C20.0R03	CPSB-2.5	IP-8D
EPAV12M020C20.0R04	CPSB-2.5S	IP-8D
EPAV12M020C20.0R02L	CPSB-2.5	IP-8D
EPAV12M025C25.0R04	CPSB-2.5	IP-8D
EPAV12M025C25.0R06	CPSB-2.5S	IP-8D
EPAV12M025C25.0R03L	CPSB-2.5	IP-8D
EPAV12M032C32.0R06	CPSB-2.5	IP-8D
EPAV12M032C32.0R08	CPSB-2.5S	IP-8D
EPAV12M032C32.0R03L	CPSB-2.5	IP-8D
EPAV12U0.62W0.62R03	CSPB-2.5S	IP-8D
EPAV12U0.75W0.75R04	CSPB-2.5S	IP-8D
EPAV12U1.00W1.00R06	CSPB-2.5S	IP-8D
EPAV12U1.25W1.25R08	CSPB-2.5S	IP-8D
EPAV12U0.62C0.62R02L	CSPB-2.5	IP-8D
EPAV12U0.75C0.75R03L	CSPB-2.5	IP-8D
EPAV12U1.00C1.00R03L	CSPB-2.5	IP-8D
EPAV12U1.25C1.25R03L	CSPB-2.5	IP-8D

*Recommended clamping torque (N·m): CSPB-2.5, CSPB-2.5S = 1.3

HPAV12-M

Square shoulder endmill, modular type (TungFlex), with screw clamp system

GAMP = +6°~ +7.6°, GAMF = -37.1°~ -32.4°



Metric	APMX	DC	CICT	OAL	LF	H	DCSFMS	CRKS	WT(kg)	Air hole	Insert
HPAV12M016M08R02	11.5	16	2	42	25	10	14.5	M8	0.03	With	AVM/GT12...
HPAV12M016M08R03	11.5	16	3	42	25	10	14.5	M8	0.03	With	AVM/GT12...
HPAV12M020M10R03	11.5	20	3	49	30	15	17.8	M10	0.06	With	AVM/GT12...
HPAV12M020M10R04	11.5	20	4	49	30	15	17.8	M10	0.05	With	AVM/GT12...
HPAV12M025M12R04	11.5	25	4	57	35	17	23	M12	0.1	With	AVM/GT12...
HPAV12M025M12R06	11.5	25	6	57	35	17	23	M12	0.1	With	AVM/GT12...
HPAV12M032M16R06	11.5	32	6	63	40	22	28.8	M16	0.21	With	AVM/GT12...
HPAV12M032M16R08	11.5	32	8	63	40	22	28.8	M16	0.21	With	AVM/GT12...
HPAV12M040M16R06	11.5	40	6	63	40	22	28.8	M16	0.25	With	AVM/GT12...
HPAV12M040M16R08	11.5	40	8	63	40	22	28.8	M16	0.24	With	AVM/GT12...

SPARE PARTS

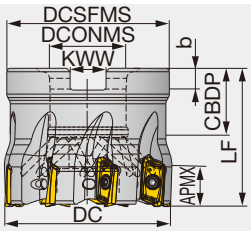
Designation	Clamping screw	Wrench
HPAV12M016M08R02	CSPB-2.5	IP-8D
HPAV12M016M08R03	CSPB-2.5S	IP-8D
HPAV12M020M10R03	CSPB-2.5	IP-8D
HPAV12M020M10R04	CSPB-2.5S	IP-8D
HPAV12M025M12R04	CSPB-2.5	IP-8D
HPAV12M025M12R06	CSPB-2.5S	IP-8D
HPAV12M032M16R06	CSPB-2.5	IP-8D
HPAV12M032M16R08	CSPB-2.5S	IP-8D
HPAV12M040M16R06	CSPB-2.5	IP-8D
HPAV12M040M16R08	CSPB-2.5	IP-8D

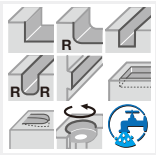
*Recommended clamping torque (N·m): CSPB-2.5, CSPB-2.5S = 1.3

TPAV12

Square shoulder mill, bore type, with screw clamp system

GAMP = +6°~ +7.6°, GAMF = -37.1°~ -32.4°





Inch	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	KWW	b	WT(lb)	Air Hole	Insert
TPAV12U2.00B0.75R12	0.453	2.000	12	1.772	0.750	0.750	1.575	0.315	0.197	0.840	with	AVM/GT12...

Metric	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	KWW	b	WT(kg)	Air Hole	Insert
TPAV12M050B22.0R08	11.5	50	8	47	22	20	40	10.4	6.3	0.37	with	AVM/GT12...
TPAV12M050B22.0R12	11.5	50	12	47	22	20	40	10.4	6.3	0.37	with	AVM/GT12...
TPAV12M063B22.0R08	11.5	63	8	47	22	20	40	10.4	6.3	0.52	with	AVM/GT12...
TPAV12M063B22.0R14	11.5	63	14	47	22	20	40	10.4	6.3	0.54	with	AVM/GT12...

SPARE PARTS



Designation	Clamping screw	Wrench	Shell locking bolt
TPAV12...	CSPB-2.5	IP-8D	CM10x30H

*Recommended clamping torque (N·m): CSPB-2.5, CSPB-2.5S = 1.3

INSERT

AVMT-MM

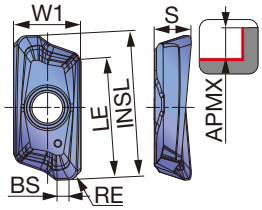


Fig. 1

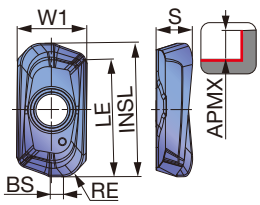


Fig. 2

AVGT-AM

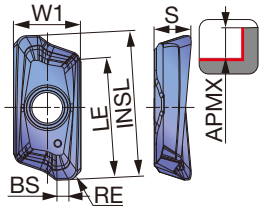


Fig. 3

		Coated				Carbide
		AH120	AH3225	T1215	T3225	KS05F
P	Steel		★		☆	
M	Stainless		★		☆	
K	Cast iron	★		☆		
N	Non-ferrous					★
S	Superalloys	★	★			
H	Hard materials	★				

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated AH120	Coated AH3225	Coated T1215	Coated T3225	Carbide KS05F	W1	INSL	S	BS	LE	Fig.
AVMT120404PDER-MM	0.016	0.453	●	●	●	●		0.260	0.559	0.142	0.059	0.465	1
AVMT120408PDER-MM	0.031	0.453	●	●	●	●		0.260	0.559	0.142	0.043	0.465	1
AVMT120412PDER-MM	0.047	0.453	●	●	●	●		0.260	0.559	0.142	0.028	0.465	1
AVMT120416PDER-MM	0.063	0.453	●	●	●	●		0.260	0.559	0.142	0.012	0.465	1
AVMT120420PDER-MM	0.079	0.413	●	●	●	●		0.260	0.500	0.134	0.047	0.437	2
AVMT120430PDER-MM	0.118	0.413	●	●	●	●		0.260	0.500	0.134	0.008	0.437	2
AVGT120404PDFR-AM	0.016	0.453					●	0.260	0.559	0.142	0.059	0.465	3
AVGT120408PDFR-AM	0.031	0.453					●	0.260	0.559	0.142	0.043	0.465	3

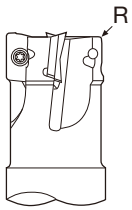
● : Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece meterials		Hardness	Priority	Grades	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steel 1028, etc.		- 200 HB	First choice	AH3225	328 - 984	0.002 - 0.009
			- 200 HB	Wear resistance	T3225	656 - 1312	0.002 - 0.007
	Carbon steel and alloy steel 1045, etc.		- 300 HB	First choice	AH3225	328 - 820	0.002 - 0.009
			- 300 HB	Wear resistance	T3225	656 - 1312	0.002 - 0.007
	Prehardend steel NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3225	328 - 656	0.002 - 0.009
			30 - 40 HRC	Wear resistance	T3225	656 - 1312	0.002 - 0.006
M	Stainless steel 304SS, etc.		-	First choice	AH3225	262 - 591	0.003 - 0.008
K	Gray cast iron No. 250B, etc.		150 - 250 HB	First choice	AH120	328 - 984	0.002 - 0.005
			150 - 250 HB	Wear resistance	T1215	656 - 1312	0.002 - 0.007
	Ductile cast iron 60-40-18, etc.		150 - 250 HB	First choice	AH120	328 - 820	0.002 - 0.005
			150 - 250 HB	Wear resistance	T1215	492 - 984	0.002 - 0.007
N	Aluminum alloys Si < 13%		-	First choice	KS05F	984 - 4921	0.002 - 0.013
	Aluminum alloys Si ≥ 13%		-	First choice	KS05F	328 - 656	0.002 - 0.013
S	Titanium alloys Ti-6Al-4V, etc.		- 40 HRC	First choice	AH3225	66 - 197	0.002 - 0.006
	Superalloys Inconel718, etc.		- 40 HRC	First choice	AH120	66 - 131	0.002 - 0.006
H	Hardened steel	H13. etc/	40 - 50 HRC	First choice	AH120	164 - 492	0.002 - 0.003
		D2, etc.	50 - 60 HRC	First choice	AH120	131 - 230	0.002 - 0.003

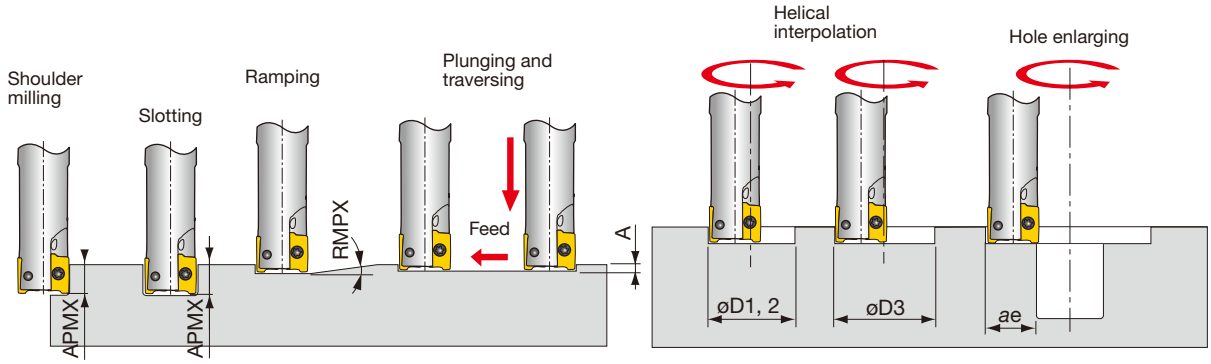
Cautionary point in modifying cutter bodies

When using inserts with corner radius RE ≥ 0.0787", standard cutter bodies have to be modified “R”. (EPAV12, TPAV12, HPAV12)



Corner radius RE (inch)	The dimension of modifying (inch)
0.0157 - 0.0623	Unnecessary
0.0787 - 0.1181	0.0787

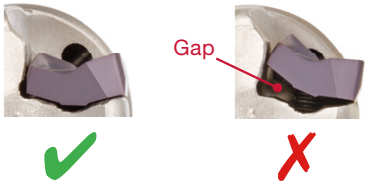
MACHINING APPLICATIONS



		Max. depth of cut	Max. ramping angle	Max. plunging	Min. machining	Max. machining		Max. cutting width in enlarging
Metric	**DC**	**APMX**	**RMPX**	**A**	**øD1**	**øD2**	**øD3***	***ae***
EPAV12M012...	12	11.5	4.5°	0.5	17.8	23	22	11
E/HPAV12M016...	16	11.5	3.5°	0.5	25.3	31	30	15
E/HPAV12M020...	20	11.5	3°	0.5	33	39	38	19
E/HPAV12M025...	25	11.5	2.5°	0.5	42.6	49	48	24
E/HPAV12M032...	32	11.5	2°	0.5	56.4	63	62	31
HPAV12M040...	40	11.5	2°	0.5	71.5	78	77	39
TPAV12M050...	50	11.5	2°	0.5	90.4	99	98	49
TPAV12M063...	63	11.5	1.8°	0.5	115.6	125	124	62

*Flat bottom hole

When clamping the insert, please confirm that there is no gap between the cutter body and the insert as shown in the picture.



Estimation of chip thickness - calculated from feed per tooth (*fz*) and cutting width (*ae*) data

Recommended chip thickness

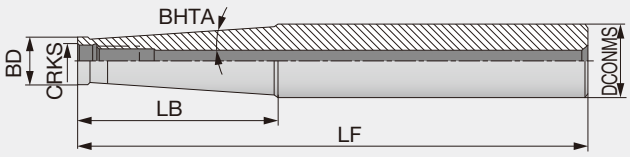
	Cutting width (%): *ae* (in) / Tool dia.: DC (in)														
Feed per tooth *fz* (ipt)	**1%**	**2%**	**2.5%**	**3%**	**4%**	**5%**	**10%**	**15%**	**20%**	**25%**	**30%**	**35%**	**40%**	**45%**	**50% -**
0.001	0.0002	0.0003	0.0004	0.0004	0.0005	0.0005	0.0007	0.0008	0.0009	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012
0.002	0.0004	0.0006	0.0006	0.0007	0.0008	0.0009	0.0012	0.0014	0.0016	0.0017	0.0018	0.0019	0.0019	0.0020	0.0020
0.003	0.0006	0.0009	0.0010	0.0011	0.0012	0.0014	0.0019	0.0022	0.0025	0.0027	0.0029	0.0030	0.0031	0.0031	0.0031
0.004	0.0008	0.0011	0.0012	0.0013	0.0015	0.0017	0.0024	0.0028	0.0031	0.0034	0.0036	0.0037	0.0039	0.0039	0.0039
0.005	0.0009	0.0013	0.0015	0.0016	0.0019	0.0020	0.0028	0.0034	0.0038	0.0041	0.0043	0.0045	0.0046	0.0047	0.0047
0.006	0.0012	0.0017	0.0019	0.0020	0.0023	0.0026	0.0035	0.0042	0.0047	0.0051	0.0054	0.0056	0.0058	0.0059	0.0059
0.007	0.0014	0.0020	0.0022	0.0024	0.0028	0.0031	0.0043	0.0051	0.0057	0.0061	0.0065	0.0068	0.0069	0.0070	0.0071
0.008	0.0016	0.0022	0.0024	0.0027	0.0031	0.0034	0.0047	0.0056	0.0063	0.0068	0.0072	0.0075	0.0077	0.0078	0.0079
0.009	0.0017	0.0024	0.0027	0.0030	0.0034	0.0038	0.0052	0.0062	0.0069	0.0075	0.0080	0.0083	0.0085	0.0086	0.0087
0.010	0.0020	0.0028	0.0031	0.0033	0.0039	0.0043	0.0059	0.0070	0.0079	0.0085	0.0090	0.0094	0.0096	0.0098	0.0098
0.011	0.0022	0.0031	0.0034	0.0038	0.0043	0.0048	0.0066	0.0079	0.0088	0.0095	0.0101	0.0105	0.0108	0.0110	0.0110
0.012	0.0024	0.0033	0.0037	0.0040	0.0046	0.0052	0.0071	0.0084	0.0094	0.0102	0.0108	0.0113	0.0116	0.0117	0.0118
0.016	0.0031	0.0044	0.0049	0.0054	0.0062	0.0069	0.0094	0.0113	0.0126	0.0136	0.0144	0.0150	0.0154	0.0157	0.0157

TUNGFORCE-REC

TUNGFLEX

SM

TungFlex - Modular shank

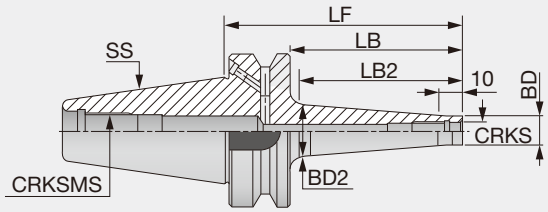


Metric	DCONMS	BD	LF	LB	BHTA	CRKS
SM06-L60C10	10	9.7	60	20	0°	M6
SM06-L105-C12	12	9.7	105	60	1.2°	M6
SM06-L125-C16	16	9.7	125	60	3.3°	M6
SM08-L73C16	16	13	73	25	0°	M8
SM08-L128-C16	16	13	128	80	0.9°	M8
SM08-L170-C20	20	13	170	66.8	3.3°	M8
SM10-L80-C20	20	18	80	30	0°	M10
SM10-L130-C20	20	18	130	80	0.6°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

TUNGFLEX

BT-ODP (Screw clamping head holder)

TungFlex modular tooling system with BT shank



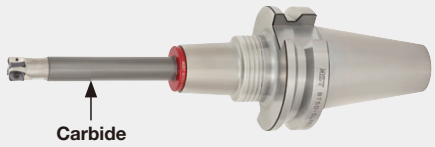
Metric	SS	CRKS	BD	BD2	LF	LB	LB2	CRKSMS
BT40ODP6X66	40	M6	9.8	13	66	39	30	M16
BT40ODP6X106	40	M6	9.8	23	106	79	70	M16
BT40ODP8X66	40	M8	13	15	66	39	30	M16
BT40ODP8X106	40	M8	13	23	106	79	70	M16
BT40ODP10X66	40	M10	18	20	66	39	30	M16
BT40ODP10X106	40	M10	18	28	106	79	70	M16
BT40ODP12X66	40	M12	21	24	66	39	30	M16
BT40ODP12X106	40	M12	21	31	106	79	70	M16
BT40ODP16X66	40	M16	29	28.6	66	39	-	M16
BT40ODP16X106	40	M16	29	34	106	79	70	M16
BT50ODP12X94	50	M12	23	30	94	56	50	M24
BT50ODP12X144 (1)	50	M12	23	40	144	106	100	M24
BT50ODP12X194 (1)	50	M12	23	40	194	156	150	M24
BT50ODP12X244 (1)	50	M12	23	46	244	206	200	M24
BT50ODP16X94 (1)	50	M16	29	34	94	56	50	M24
BT50ODP16X144 (1)	50	M16	29	40	144	106	100	M24
BT50ODP16X194 (1)	50	M16	29	55	194	156	150	M24
BT50ODP16X244 (1)	50	M16	29	60	244	206	200	M24

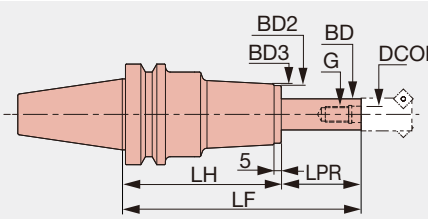
Applicable for 10 MPa pressure coolant
(1) Balanced to G6.3 at 12,000 min^{-1}

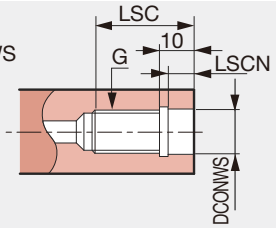
TUNGFLEX

BT-RSG (Screw clamping head holder)

TungFlex modular tooling system with BT shank

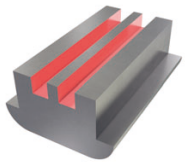
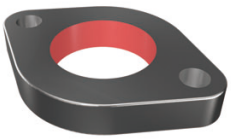
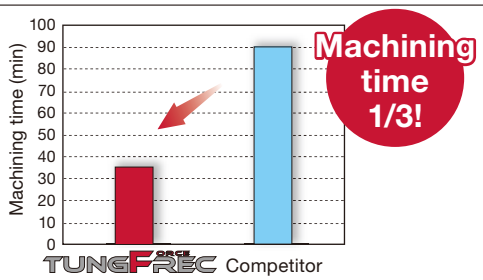
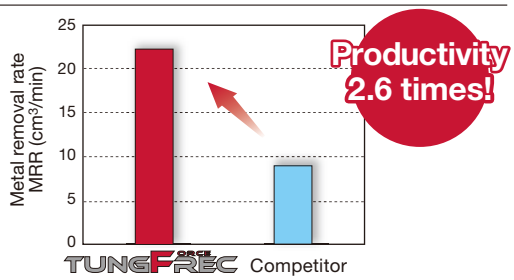


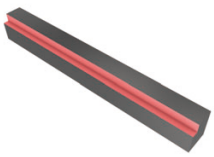
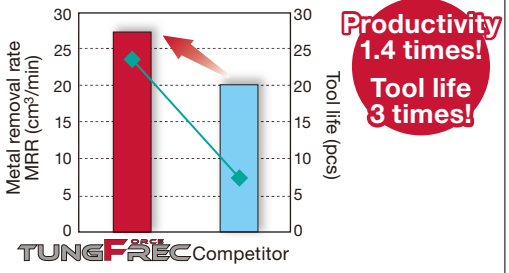
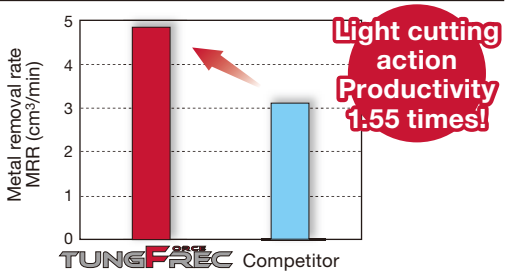




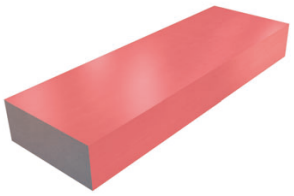
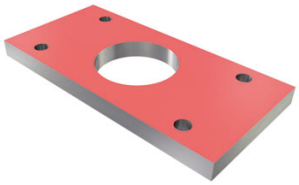
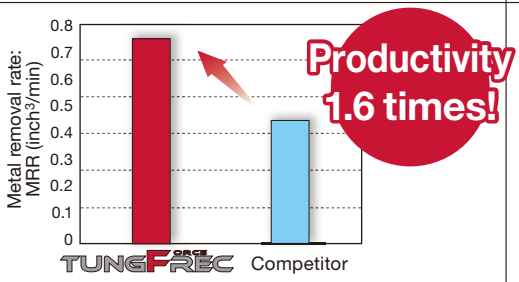
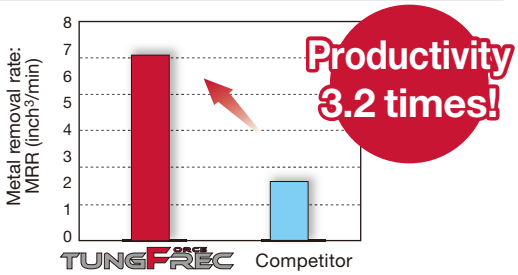
Metric	DCONWS	LSC	LSCN	BD	LF	LPR	LH	BD2	BD3	WT (kg)	G
BT40-RSG 8-105-M 25	8.5	18	6.5	15	105	25	80	30	32	1.4	M8
BT40-RSG 8-135-M 25	8.5	18	6.5	15	135	25	110	30	32	1.8	M8
BT40-RSG 8-130-M 50	8.5	18	6.5	15	130	50	80	30	32	1.4	M8
BT40-RSG 8-160-M 50	8.5	18	6.5	15	160	50	110	30	32	1.8	M8
BT40-RSG 8-155-M 75	8.5	18	6.5	15	155	75	80	30	32	1.5	M8
BT40-RSG 8-185-M 75	8.5	18	6.5	15	185	75	110	30	32	1.9	M8
BT40-RSG 10-125-M 25	10.5	22	6.5	19	125	25	100	36	38	1.8	M10
BT40-RSG 10-155-M 25	10.5	22	6.5	19	155	25	130	36	38	2.2	M10
BT40-RSG 10-150-M 50	10.5	22	6.5	19	150	50	100	36	38	1.9	M10
BT40-RSG 10-180-M 50	10.5	22	6.5	19	180	50	130	36	38	2.3	M10
BT40-RSG 10-175-M 75	10.5	22	6.5	19	175	75	100	36	38	2	M10
BT40-RSG 10-205-M 75	10.5	22	6.5	19	205	75	130	36	38	2.4	M10
BT40-RSG 10-200-M100	10.5	22	6.5	19	200	100	100	36	38	2	M10
BT40-RSG 10-230-M100	10.5	22	6.5	19	230	100	130	36	38	2.4	M10
BT40-RSG 12-125-M 25	12.5	22	6	24	125	25	100	43	45	2	M12
BT40-RSG 12-155-M 25	12.5	22	6	24	155	25	130	43	45	2.4	M12
BT40-RSG 12-150-M 50	12.5	22	6	24	150	50	100	43	45	2.1	M12
BT40-RSG 12-180-M 50	12.5	22	6	24	180	50	130	43	45	2.5	M12
BT40-RSG 12-175-M 75	12.5	22	6	24	175	75	100	43	45	2.3	M12
BT40-RSG 12-205-M 75	12.5	22	6	24	205	75	130	43	45	2.7	M12
BT40-RSG 12-200-M100	12.5	22	6	24	200	100	100	43	45	2.4	M12
BT40-RSG 12-230-M100	12.5	22	6	24	230	100	130	43	45	2.8	M12
BT50-RSG 8-120-M 25	8.5	18	6.5	15	120	25	95	30	32	4	M8
BT50-RSG 8-150-M 25	8.5	18	6.5	15	150	25	125	30	32	4.3	M8
BT50-RSG 8-145-M 50	8.5	18	6.5	15	145	50	95	30	32	4	M8
BT50-RSG 8-175-M 50	8.5	18	6.5	15	175	50	125	30	32	4.3	M8
BT50-RSG 8-170-M 75	8.5	18	6.5	15	170	75	95	30	32	4.1	M8
BT50-RSG 8-200-M 75	8.5	18	6.5	15	200	75	125	30	32	4.4	M8
BT50-RSG 10-140-M 25	10.5	22	6.5	19	140	25	115	36	38	4.3	M10
BT50-RSG 10-170-M 25	10.5	22	6.5	19	170	25	145	36	38	4.6	M10
BT50-RSG 10-165-M 50	10.5	22	6.5	19	165	50	115	36	38	4.4	M10
BT50-RSG 10-195-M 50	10.5	22	6.5	19	195	50	145	36	38	4.7	M10
BT50-RSG 10-190-M 75	10.5	22	6.5	19	190	75	115	36	38	4.5	M10
BT50-RSG 10-220-M 75	10.5	22	6.5	19	220	75	145	36	38	4.8	M10
BT50-RSG 10-215-M100	10.5	22	6.5	19	215	100	115	36	38	4.5	M10
BT50-RSG 10-245-M100	10.5	22	6.5	19	245	100	145	36	38	4.8	M10
BT50-RSG 12-140-M 25	12.5	22	6	24	140	25	115	43	45	4.6	M12
BT50-RSG 12-170-M 25	12.5	22	6	24	170	25	145	43	45	5	M12
BT50-RSG 12-165-M 50	12.5	22	6	24	165	50	115	43	45	4.7	M12
BT50-RSG 12-195-M 50	12.5	22	6	24	195	50	145	43	45	5.1	M12
BT50-RSG 12-190-M 75	12.5	22	6	24	190	75	115	43	45	4.9	M12
BT50-RSG 12-220-M 75	12.5	22	6	24	220	75	145	43	45	5.3	M12
BT50-RSG 12-215-M100	12.5	22	6	24	215	100	115	43	45	5	M12
BT50-RSG 12-245-M100	12.5	22	6	24	245	100	145	43	45	5.4	M12
BT50-RSG 12-240-M125	12.5	22	6	24	240	125	115	43	45	5.2	M12
BT50-RSG 16-140-M 25	17	25	6	29	140	25	115	52	54	5.4	M16
BT50-RSG 16-165-M 50	17	25	6	29	165	50	115	52	54	5.6	M16
BT50-RSG 16-190-M 75	17	25	6	29	190	75	115	52	54	5.8	M16
BT50-RSG 16-215-M100	17	25	6	29	215	100	115	52	54	6	M16
BT50-RSG 16-240-M125	17	25	6	29	240	125	115	52	54	6.2	M16

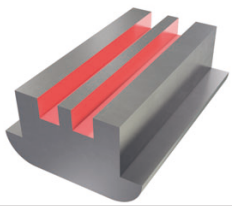
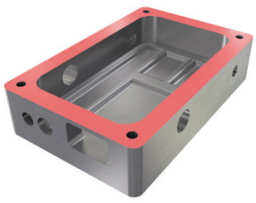
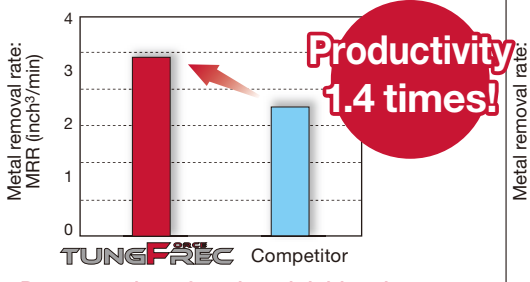
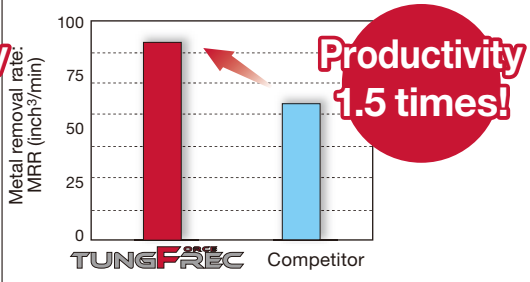
PRACTICAL EXAMPLES

Workpiece type		Machine parts	Machine parts
Cutter		EPAV04M008C08.0R02 (ø8 mm, z=2)	EPAV04M008C08.0R02L (ø8 mm, z=2)
Insert		AVMT040204PPER-MM	AVMT040204PPER-MM
Grade		AH3225	AH3225
Workpiece material		SUS304 / X5CrNiMo18-9	S50C
		 M	 P
Cutting conditions	Cutting speed : *Vc* (m/min)	150 (495 sfm)	251 (828 sfm)
	Feed per tooth : *fz* (mm/t)	0.08 (0.0031 ipt)	0.07 (0.0027 ipt)
	Feed speed : *Vf* (m/min)	895 (35.2")	1,400 (55.18")
	Depth of cut : *ap* (mm)	1.429 (0.056")	2 (0.078")
	Width of cut : *ae* (mm)	8 (0.315")	8 (0.315")
	Machining	Slotting	Slotting
	Coolant	Air blast	Air blast
	Machine	Vertical M/C, BT50	Vertical M/C, BT50
Results		 TungForce-Rec endmill with high rigidity shortened the machining time to 1/3 compared to the solid endmill.	 TungForce-Rec endmill machines with 2.6 times higher productivity due to the incredible rigidity.

Workpiece type		Machine parts	Spindle
Cutter		EPAV06M014C12.0R03 (ø14 mm, z=3)	EPAV06M012C12.0R03 (ø12 mm, z = 3)
Insert		AVGT060302PBER-MJ	AVGT060304PBER-MJ
Grade		AH3225	AH3135
Workpiece material		SS400 / E275A	Alloy steel (Low carbon, 30HRC)
		 P	 P
Cutting conditions	Cutting speed : *Vc* (m/min)	264 (871 sfm)	143 (471 sfm)
	Feed per tooth : *fz* (mm/t)	0.125 (0.0049 ipt)	0.04 (0.0015 ipt)
	Feed speed : *Vf* (m/min)	1,500 (59.05")	601 (23.66")
	Depth of cut : *ap* (mm)	6 (0.236")	1 (0.039")
	Width of cut : *ae* (mm)	3 (0.118")	1.6 (0.062")
	Machining	Shoulder milling	Shoulder milling
	Coolant	Wet (External)	Dry
	Machine	Vertical M/C, BT40	Vertical M/C, BT30
Results		 TungForce-Rec endmill achieves 3 times longer tool life and 140 % productivity compareed to the solid endmill, thanks to the latest AH3225 grade with high performance.	 The sharp cutting edge geometry has enabled smoother, vibration-free cutting at higher parameters even on a low power machine.

PRACTICAL EXAMPLES

Workpiece type		1. Plate for mold	2. Machine parts
Cutter		EPAV12U0.75W0.75R04 (ø0.750", z = 4)	TPAV12U2.00B0.75R12 (ø2.000", z = 12)
Insert		AVMT120408PDER-MM	AVMT120408PDER-MM
Grade		AH3225	AH3225
Workpiece material		Prehardened steel	Structural steel
		 P	 P
Cutting conditions	Cutting speed : *Vc* (sfm)	236	515
	Feed per tooth: *fz* (ipt)	0.004	0.005
	Feed speed : *Vf* (ipm)	18	57
	Depth of cut : *ap* (in)	0.157	0.079
	Width of cut : *ae* (in)	0.236	1.378
	Process	Face milling	Face milling
	Coolant	Air blast	Air blast
	Machine	Vertical M/C, CAT50	Vertical M/C, CAT40
Results		 Thanks to dense number of teeth and robust cutting edge, TungForce-Rec offered high productivity without chipping.	 Dense number of teeth and large rake angle allowed TungForce-Rec to offer high productivity without chattering.

Workpiece type		3. Machine parts	4. Machine parts
Cutter		EPAV12U0.75W0.75R04 (ø0.750", z = 4)	TPAV12U2.00B0.75R12 (ø2.000", z = 12)
Insert		AVMT120408PDER-MM	AVGT120408PDER-MA
Grade		AH3225	KS05F
Workpiece material		4340	Cast aluminum
		 P	 N
Cutting conditions	Cutting speed : *Vc* (sfm)	515	3117
	Feed per tooth: *fz* (ipt)	0.005	0.006
	Feed speed : *Vf* (ipm)	47	236
	Depth of cut : *ap* (in)	0.079	0.236
	Width of cut : *ae* (in)	0.787	1.378
	Process	Slotting	Face milling
	Coolant	Air blast	External supply
	Machine	Vertical M/C, CAT40	Vertical M/C, CAT50
Results		 Dense number of teeth and rigid tool design allowed TungForce-Rec to offer high productivity in slotting operation.	 Dense number of teeth and rigid tool design allowed TungForce-Rec to offer high productivity in cast aluminum machining.

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Feb. 2022 (TJ)