Member IMC Group Tungaloy

MillLine

For more information

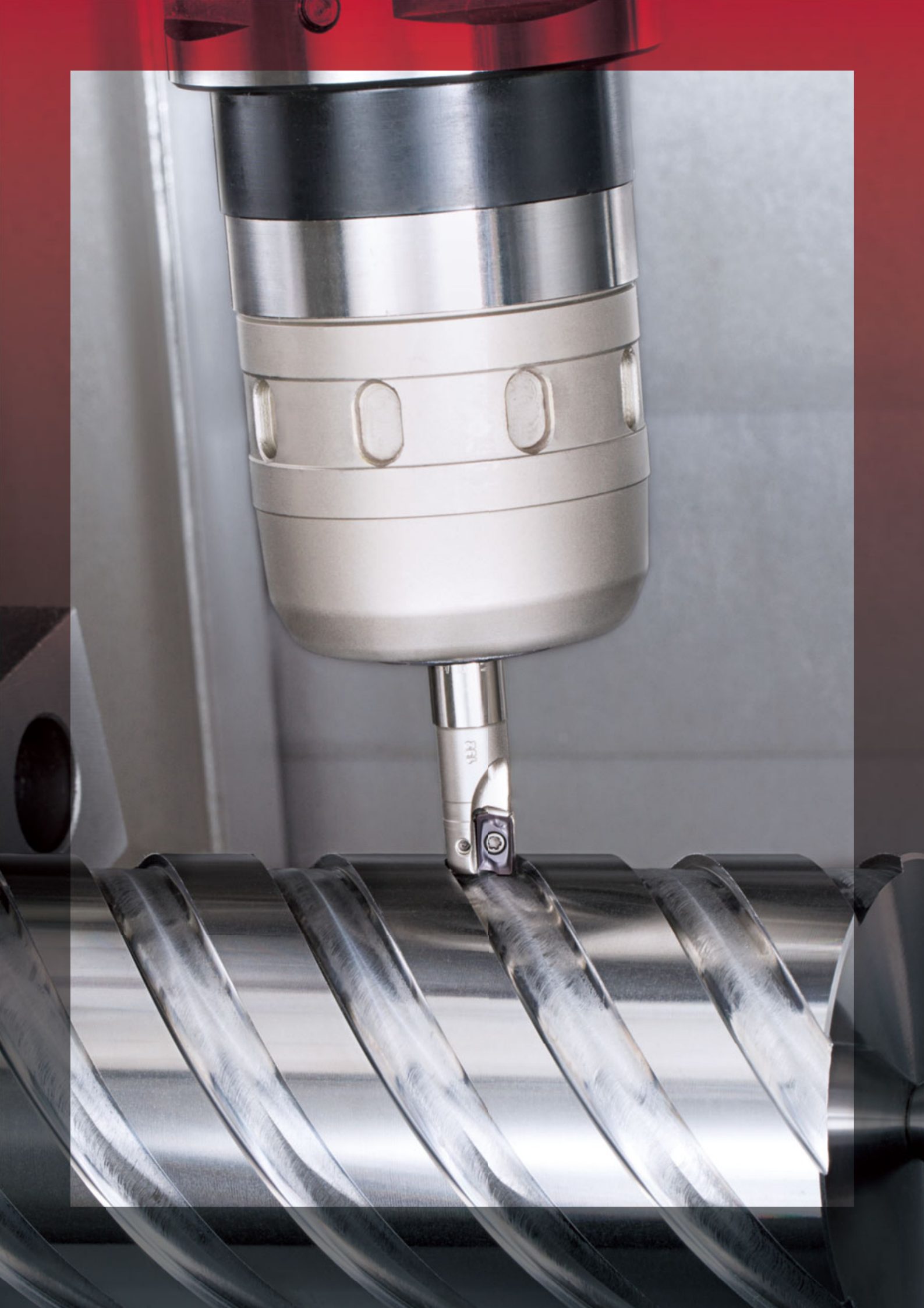
Square shoulder milling cutter

TUNGFORCE TREC

Tungaloy Report No. 506-G

Shoulder milling cutter with unique V-shaped bottom inserts for maximum efficiency — **Introducing robust Size 18 insert with outstanding stability and productivity**

TUNGALOY ADDFORCE ACCELERATED LINES



TUNGALOY

ADDFORCE MILL

ACCELERATED MILLING

TUNGFORCE REC

Unique insert clamping ensures high reliability and efficiency machining

A wider application range with four insert sizes

Insert size 04

First-choice indexable solution for
6 - 10 mm diameter endmills

APMX:
4 mm

Tool diameter: ø6 - ø16 mm

P.6 -

Insert size 06

Provides superior surface quality
as solid carbide endmills

APMX:
6 mm

Tool diameter: ø8 - ø40 mm

P.10 -

Insert size 12

Extreme productivity and part quality

APMX:
11.5 mm

Tool diameter: ø12 - ø63 mm

P.18 -

New

Insert size 18

Introducing strong Size 18 insert
for unparalleled stability

APMX:
16.5 mm

Tool diameter: ø25 - ø160 mm

P.26 -

Tool diameters and number of teeth for each insert size

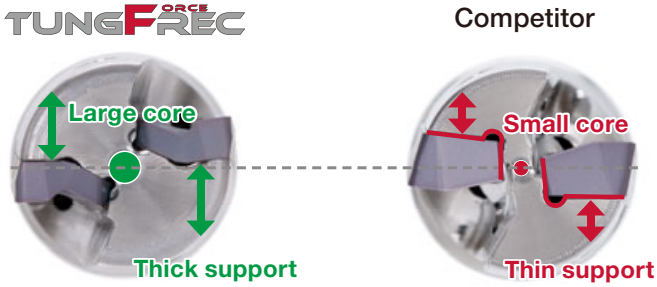
Insert size	Max. depth of cut (mm)	Corner radius (mm)	Workpiece material	Tool diameter (mm)																
				ø6	ø8	ø10	ø12	ø14	ø16	ø18	ø20	ø25	ø30	ø32	ø40	ø50	ø63	ø80	ø100	ø125	ø160
04	4	0.4, 0.8	P M K S H	1	2	3 2	4 3		5 4												
06	6	0, 0.2 0.4, 0.8	P M K N S H		1	2	3 2	3 2	4 3	4 3	5 4	6 5 4		8 6	10						
12	11.5	0.4, 0.8 1.2, 1.6 2, 3	P M K N S H				1		3 2		4 3	6 4 3		8 6 3	8 6	12 8	14 8				
New 18	16.5	0.4, 0.8 1.2, 1.6 2, 2.4 3.1	P M K N S H									2	3 2	3 2	5 3	7 6 5	8 6	8	10	10	12

Note: Numbers in the table indicate the number of teeth.

Unique V-shaped bottom insert for machining security

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

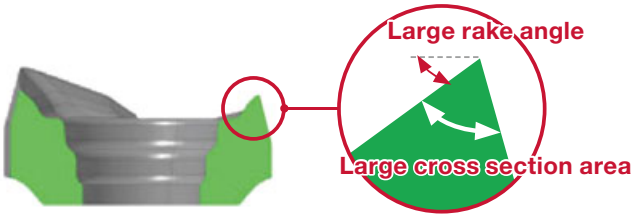
Ensures high productivity and stability.



Sharp and strong cutting edge for increased productivity

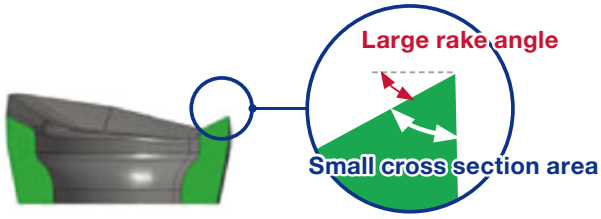
TUNGFREC

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.

Lineup of versatile grades for a wide range of materials

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

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

AH8015 H K S

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

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

T1215 K

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

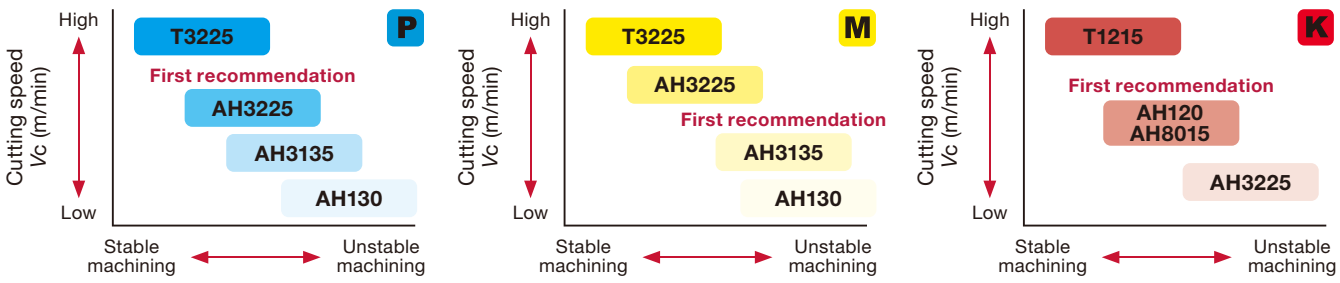
T3225 P M

- CVD grade with high chipping and fracture resistance

KS05F N

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

APPLICATION AREAS



TUNGFORCE-REC

Insert size 04

First-choice indexable solution for 6 - 10 mm diameter endmills

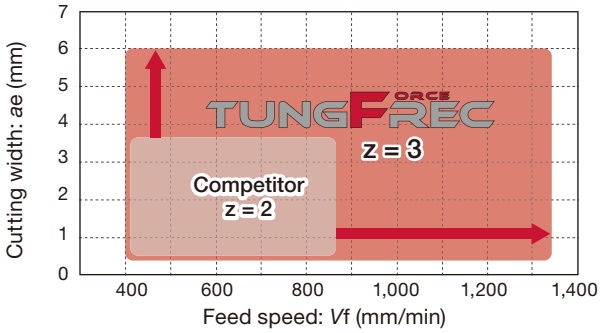
Small diameter endmill with high stiffness

Thanks to unique V-bottom design, the smallest inserts available for the series can provide maximum productivity during shoulder milling operations

Comparison of core thickness

CUTTING PERFORMANCE

Comparison with the competitor's tool (ø10 mm)



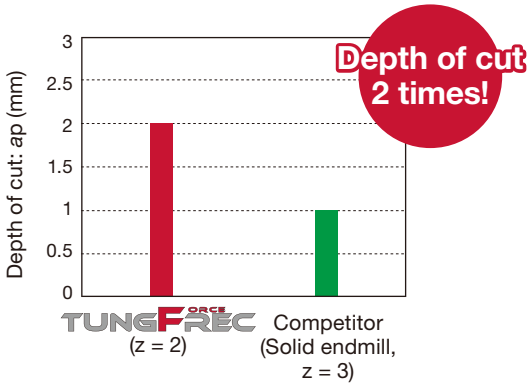
Shoulder milling

P

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

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

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



Slotting

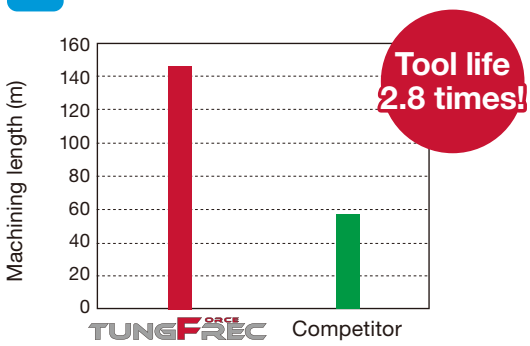
P

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

Highly rigid cutter body allows more productivity compared to solid carbide endmill.

■ Tool life comparison

P S55C / C55



Damage on cutting edges at the same machining time

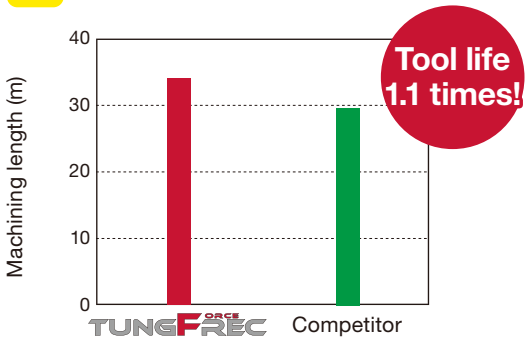
No chipping　　Chipping

Shoulder milling

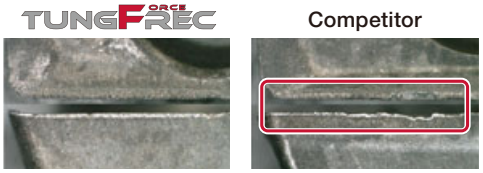
Cutter	: EPAV04M010C10.0R03 (ø10 mm, z = 3)
Insert	: AVMT040204PPER-MM AH3225
Cutting speed	: *Vc* = 200 m/min
Feed per tooth	: *fz* = 0.07 mm/t
Depth of cut	: *ap* = 3 mm
Cutting width	: *ae* = 2.7 mm
Coolant	: Air blast

Obtuse flank surface prevents chipping and achieves stable tool life.

M SUS304 / X5CrNi18-9



Damage on cutting edges at the same machining time



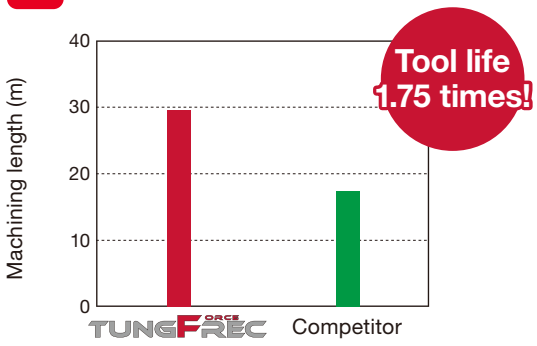
No chipping　　Chipping

Shoulder milling

Cutter	: EPAV04M010C10.0R03 (ø10 mm, z = 3)
Insert	: AVMT040208PPER-MM AH3225
Cutting speed	: *Vc* = 120 m/min
Feed per tooth	: *fz* = 0.07 mm/t
Depth of cut	: *ap* = 3 mm
Cutting width	: *ae* = 2.7 mm
Coolant	: Air blast

Robust cutting edge due to obtuse flank surface provides stable and long tool life.

K FC250 / 250



Damage on cutting edges at the same machining time

No chipping　　Chipping

Shoulder milling

Cutter	: EPAV04M010C10.0R03 (ø10 mm, z = 3)
Insert	: AVMT040208PPER-MM AH120
Cutting speed	: *Vc* = 300 m/min
Feed per tooth	: *fz* = 0.07 mm/t
Depth of cut	: *ap* = 3 mm
Cutting width	: *ae* = 2.7 mm
Coolant	: Air blast

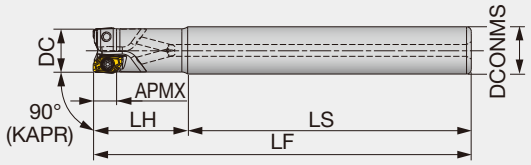
Low cutting force and obtuse flank surface offers long and stable tool life.

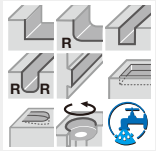
Insert size 04

EPAV04

Square shoulder endmill, shank type, with screw clamp system

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





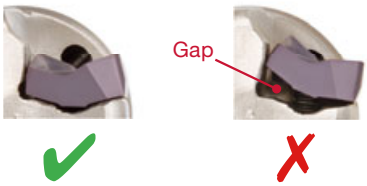
Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPAV04M006C06.0R01	4	6	1	6	48	12	60	0.01	With	AVMT04...
EPAV04M008C08.0R02	4	8	2	8	48	12	60	0.02	With	AVMT04...
EPAV04M008C08.0R02L	4	8	2	8	60	20	80	0.03	With	AVMT04...
EPAV04M010C10.0R02	4	10	2	10	60	20	80	0.04	With	AVMT04...
EPAV04M010C10.0R03	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

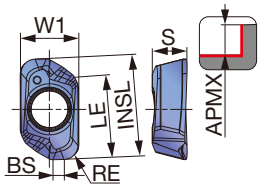
*Recommended clamping torque (N·m): CSPB-1.8L3.3, CSPB-1.8L3.6 = 0.5

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



INSERT

AVMT04-MM (for general purpose)



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

★ : First choice
☆ : Second choice

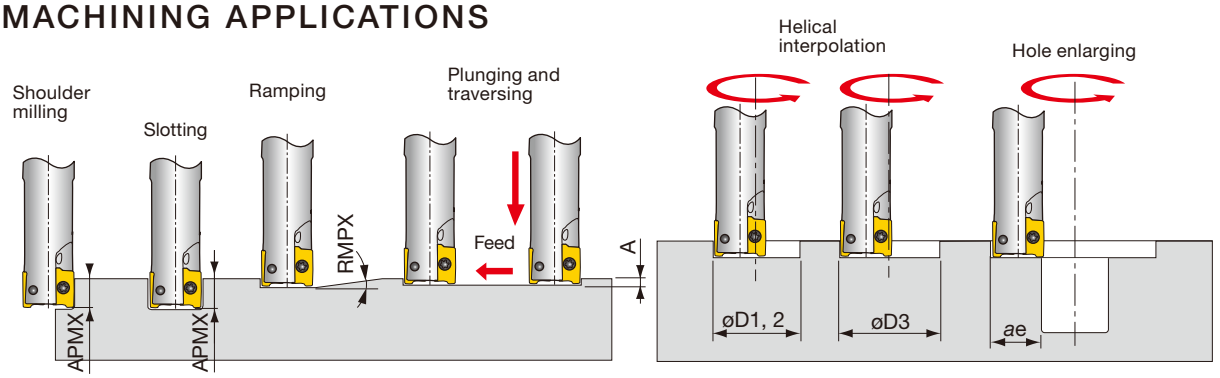
Chipbreaker	Designation	RE	APMX	Coated AH120	Coated AH3225		W1	INSL	S	BS	LE
General-purpose **MM**	AVMT040204PPER-MM	0.4	4	●	●		3.5	6.05	2.1	1	4.4
	AVMT040208PPER-MM	0.8	4	●	●		3.5	6.05	2.1	0.6	4.4

● : Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials		Hardness	Priority	Grades	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	Low carbon steel S15C, SS400, etc. C15E, C15E4, E275A, etc.		- 200 HB	First choice	AH3225	100 - 300	0.05 - 0.12
P	Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.		- 300 HB	First choice	AH3225	100 - 250	0.05 - 0.12
P	Prehardened steel NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3225	100 - 200	0.05 - 0.1
M	Stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-3, etc.		-	First choice	AH3225	80 - 180	0.05 - 0.1
K	Grey cast iron FC250, FC300, etc. GG25, GG30, etc. 250, 300, etc.		150 - 250 HB	First choice	AH120	100 - 300	0.05 - 0.12
K	Ductile cast iron FCD400, FCD600, etc. GGG60, 600-3, etc.		150 - 250 HB	First choice	AH120	100 - 250	0.05 - 0.12
S	Titanium alloys Ti-6Al-4V, etc.		-	First choice	AH3225	20 - 60	0.04 - 0.07
S	Superalloys Inconel 718, etc.		-	First choice	AH120	20 - 40	0.04 - 0.07
H	Hardened steel	SKD61, X40CrMoV5-1, etc.	40 - 50 HRC	First choice	AH120	50 - 150	0.04 - 0.07
H	Hardened steel	SKD11, X153CrMoV12, etc.	50 - 60 HRC	First choice	AH120	40 - 70	0.04 - 0.07

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*
EPAV04M006...	6	4	0.4°	0.03	9.3	11.6	9.9	5.5
EPAV04M008...	8	4	0.5°	0.04	12.7	15.6	13.6	7.5
EPAV04M010**R02, R02L	10	4	4.1°	0.4	15.3	19.6	17.5	9.5
EPAV04M010**R03	10	4	1.7°	0.2	16.1	19.6	17.5	9.5
EPAV04M012**R03, R03L	12	4	2.7°	0.4	19.3	23.6	21.5	11.5
EPAV04M012**R04	12	4	1.3°	0.2	20.1	23.6	21.5	11.5
EPAV04M016...	16	4	2°	0.4	27.2	31.6	29.5	15.5

*Flat bottom hole

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

Recommended chip thickness

	Cutting width (%): *ae* (mm) / Tool dia.: DC (mm)														
Feed per tooth *fz* (mm/t)	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.03	0.006	0.008	0.009	0.01	0.012	0.013	0.018	0.021	0.024	0.026	0.027	0.029	0.029	0.03	0.03
0.05	0.01	0.014	0.016	0.017	0.02	0.022	0.03	0.036	0.04	0.043	0.046	0.048	0.049	0.05	0.05
0.08	0.016	0.022	0.025	0.027	0.031	0.035	0.048	0.057	0.064	0.069	0.073	0.076	0.078	0.08	0.08
0.1	0.02	0.028	0.031	0.034	0.039	0.044	0.06	0.071	0.08	0.087	0.092	0.095	0.098	0.099	0.1
0.12	0.024	0.034	0.037	0.041	0.047	0.052	0.072	0.086	0.096	0.104	0.11	0.114	0.118	0.119	0.12
0.15	0.03	0.042	0.047	0.051	0.059	0.065	0.09	0.107	0.12	0.13	0.137	0.143	0.147	0.149	0.15
0.18	0.036	0.05	0.056	0.061	0.071	0.078	0.108	0.129	0.144	0.156	0.165	0.172	0.176	0.179	0.18
0.2	0.04	0.056	0.062	0.068	0.078	0.087	0.12	0.143	0.16	0.173	0.183	0.191	0.196	0.199	0.2
0.22	0.044	0.062	0.069	0.075	0.086	0.096	0.132	0.157	0.176	0.191	0.202	0.21	0.216	0.219	0.22
0.25	0.05	0.07	0.078	0.085	0.098	0.109	0.15	0.179	0.2	0.217	0.229	0.238	0.245	0.249	0.25
0.28	0.056	0.078	0.087	0.096	0.11	0.122	0.168	0.2	0.224	0.242	0.257	0.267	0.274	0.279	0.28
0.3	0.06	0.084	0.094	0.102	0.118	0.131	0.18	0.214	0.24	0.26	0.275	0.286	0.294	0.298	0.3
0.4	0.08	0.112	0.125	0.136	0.157	0.174	0.24	0.286	0.32	0.346	0.367	0.382	0.392	0.398	0.4

TUNGFORCE-REC

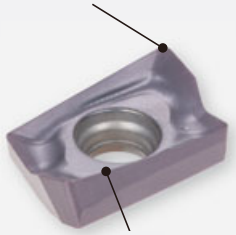
Insert size 06

Provides superior surface quality as solid carbide endmills

High machining accuracy

1 High precision insert

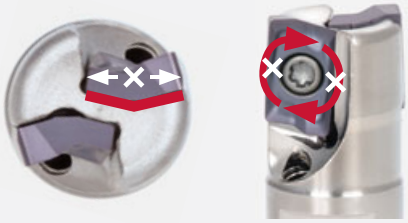
All nose radii are ground to precision



Up-sharp cutting edge preparation

2 Extremely secure insert clamping

- V shape design prevents insert movement during machining.

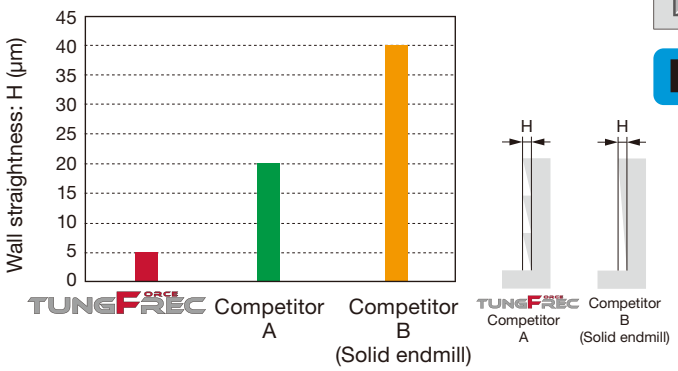


- M2 screws reduce screw neck shears under high cutting forces. Large-sized screws enhances insert fixture and facilitates handlings.

TUNGFORCE-REC (M2) Competitor (M1.8)

CUTTING PERFORMANCE

Wall straightness: Carbon steel



Shoulder milling

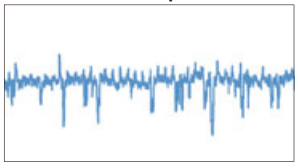
P

Cutter	: EPAV06M012C12.0R03 (ø12 mm, z = 3)
Insert	: AVGT060304PBER-MJ AH3135
Workpiece material	: S55C / C55 (180HB)
Cutting speed	: *Vc* = 330 m/min (Competitor B: 60 m/min)
Feed per tooth	: *fz* = 0.1 mm/t (Competitor B: 0.04 mm/t)
Depth of cut	: *ap* = 4 mm x 3 pass (Competitor B: 12 mm)
Cutting width	: *ae* = 2 mm
Coolant	: Dry
Machine	: Vertical M/C, BT40

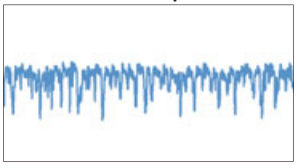
TungForce-Rec has achieved the best wall finish quality.

Surface roughness comparison (in machining steel)

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

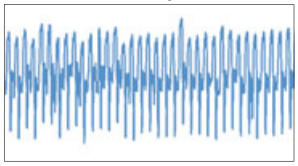


TUNGFORCE-REC
(ø10 mm, z = 2, **Corner R0.4**)
Ra: 0.41 µm



Competitor's solid endmill

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



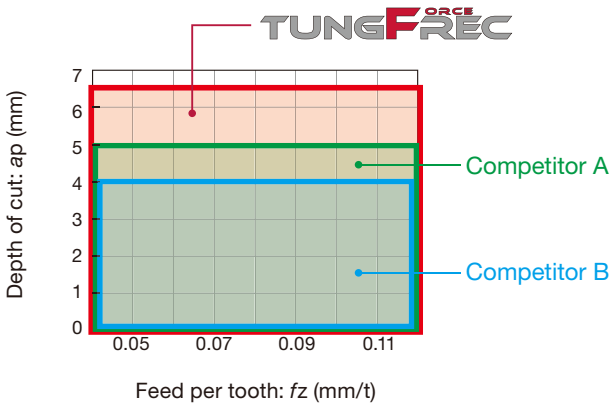
Face milling

P

Cutter	: HPAV06M010S06R02 (ø10 mm, z = 2)
Insert	: AVGT060300PBER-MJ AH3135 AVGT060304PBER-MJ AH3135
Shank	: VER16CL010S06-S
Workpiece material	: S45C / C45
Cutting speed	: *Vc* = 60 m/min
Feed	: *f* = 0.1 mm/rev
Feed speed	: *Vf* = 191 mm/min
Depth of cut	: *ap* = 1 mm
Width of cut	: *ae* = 4 mm
Machine	: Swiss lathe

R0 insert achieved better surface quality than solid endmill.

■ Performance comparison - Depth of cut vs Table feed (ø10 mm)



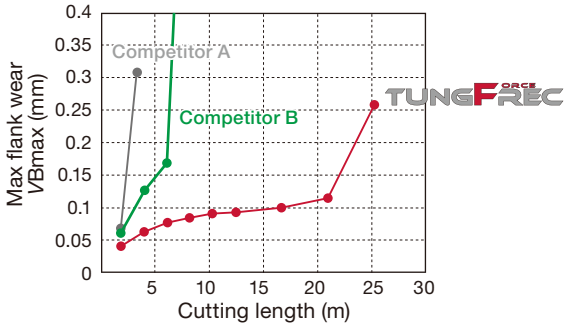
Slotting

Cutter	: EPAV06M010C10.0R02 (ø10 mm)
Insert	: AVGT060302PBER-MJ AH3135
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 270 m/min
Cutting width	: *ae* = 10 mm
Coolant	: Dry
Machine	: Vertical M/C, BT40 18.5kW

TungForce-Rec is applicable for a wider range of cutting condition than competitors'.

■ Tool life comparison

M SUS304 / X5CrNi18-9

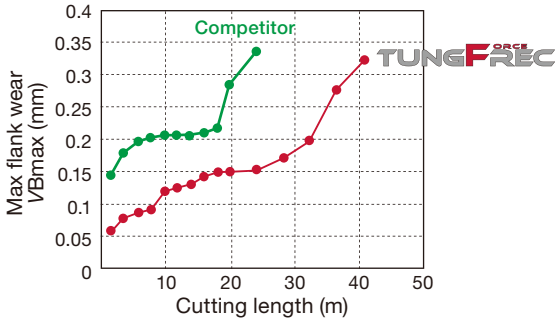


Shoulder milling

Cutter	: EPAV06M010C10.0R02 (ø10 mm, z = 2)
Insert	: AVGT060302PBER-MJ AH3135
Cutting speed	: *Vc* = 260 m/min
Feed per tooth	: *fz* = 0.07 mm/t
Depth of cut	: *ap* = 3 mm
Cutting width	: *ae* = 2.9 mm
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



Shoulder milling

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

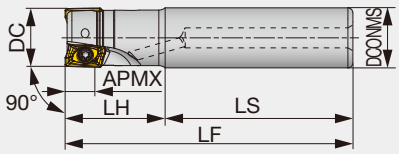
Highly wear resistant in a wet cutting, AH130 has dramatically improved the tool life.

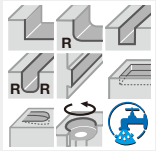
Insert size 06

EPAV06

Square shoulder endmill, shank type, with screw clamp system

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





Designation	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



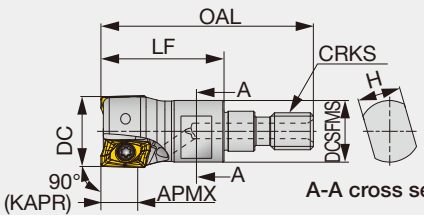
Designation	Clamping screw	Lubricant	Wrench
EPAV06M...	CSPB-2H	M-1000	IP-6DB

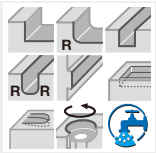
*Recommended clamping torque (N·m): CSPB-2H = 0.7

HPAV06-M

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

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





Designation	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...

See page **34 - 36** for TungFlex shank.

SPARE PARTS



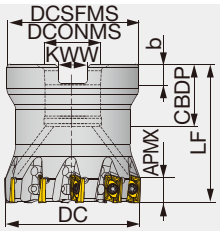
Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

*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°



Designation	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

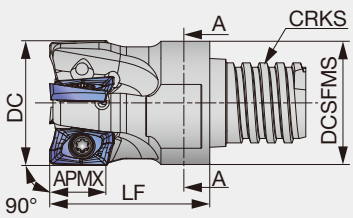
*Recommended clamping torque (N·m): CSPB-2H = 0.7

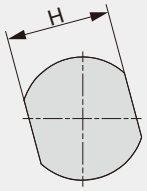
Insert size 06

HPAV06-S

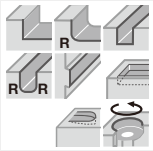
Square shoulder endmill, modular type (TungMeister), with screw clamp system

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





A-A cross section



Designation	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

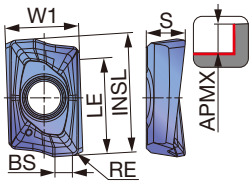


Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

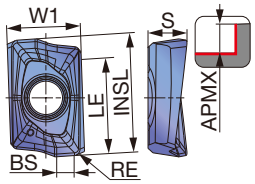
*Recommended clamping torque (N·m): CSPB-2H = 0.7

INSERT

AVGT06-MJ (for general purpose)



AVGT06-AJ (for non-ferrous machining)



		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

Chipbreaker	Designation	RE	APMX	Coated AH120	Coated AH130	Coated AH3135	Coated AH3225	Carbide KS05F			W1	INSL	S	BS	LE
General-purpose **MJ**	AVGT060300PBER-MJ	0.0	6			●	●				5	8	2.7	1.6	6.5
	AVGT060302PBER-MJ	0.2	6	●	●	●	●				5	8	2.7	1.5	6.5
	AVGT060304PBER-MJ	0.4	6	●	●	●	●				5	8	2.7	1.3	6.5
	AVGT060308PBER-MJ	0.8	6	●	●	●	●				5	8	2.6	0.9	6.5
Non-ferrous machining **AJ**	AVGT060300PBFR-AJ	0.0	6					●			5	8	2.7	1.6	6.5
	AVGT060302PBFR-AJ	0.2	6					●			5	8	2.7	1.5	6.5
	AVGT060304PBFR-AJ	0.4	6					●			5	8	2.7	1.3	6.5
	AVGT060308PBFR-AJ	0.8	6					●			5	8	2.6	0.9	6.5

● : Line up

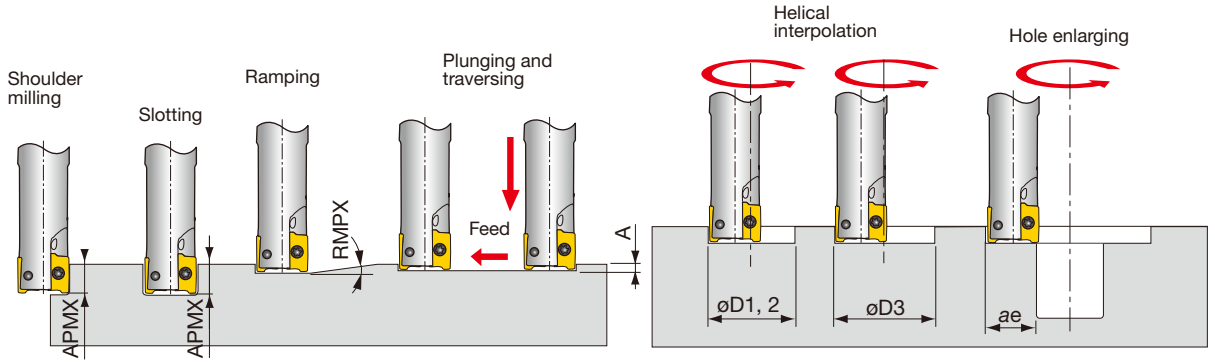
STANDARD CUTTING CONDITIONS

ISO	Workpiece materials		Hardness	Priority	Grades	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	Low carbon steel S15C, SS400, etc. C15E, C15E4, E275A, etc.		- 200 HB	First choice	AH3225	230 - 430	0.07 - 0.12
	Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.		- 300 HB	First choice	AH3225	150 - 350	0.07 - 0.12
	Prehardened steel NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3225	100 - 230	0.07 - 0.12
M	Stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-3, etc.		-	First choice	AH3135	150 - 220	0.06 - 0.1
K	Grey cast iron FC250, FC300, etc. GG25, GG30, etc. 250, 300, etc.		150 - 250 HB	First choice	AH120	200 - 330	0.07 - 0.12
	Ductile cast iron FCD400, FCD600, etc. GGG60, 600-3, etc.		150 - 250 HB	First choice	AH120	150 - 240	0.07 - 0.12
N	Aluminium alloys Si < 13%		-	First choice	KS05F	650 - 1000	0.07 - 0.12
	Aluminium alloys Si ≥ 13%		-	First choice	KS05F	100 - 230	0.04 - 0.12
S	Titanium alloys Ti-6Al-4V, etc.		-	First choice	AH130	40 - 90	0.04 - 0.1
	Superalloys Inconel 718, etc.		-	First choice	AH130	45 - 65	0.04 - 0.09
H	Hardened steel	SKD61, X40CrMoV5-1, etc.	40 - 50 HRC	First choice	AH120	45 - 70	0.04 - 0.08
		SKD11, X153CrMoV12, etc.	50 - 60 HRC	First choice	AH120	40 - 65	0.04 - 0.06

TUNGFORCE-REC

Insert size 06

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
EPAV06M008…	8	6	-	-	-	-	-	-
EPAV/HPAV06M010…	10	6	3°	0.3	15	19	18	9.5
EPAV/HPAV06M012…	12	6	3°	0.3	18	23	22	11.5
EPAV/HPAV06M014…	14	6	2.3°	0.3	22	27	26	13.5
EPAV/HPAV06M016…	16	6	2°	0.3	28	31	30	15.5
EPAV/HPAV06M018…	18	6	1.6°	0.3	30	35	34	17.5
EPAV/HPAV06M020…	20	6	1.4°	0.3	34	39	38	19.5
EPAV/HPAV06M025…	25	6	1.1°	0.3	44	49	48	24.5
EPAV/HPAV06M032…	32	6	0.8°	0.3	58	63	62	31.5
TPAV06M040…	40	6	0.6°	0.3	74	79	78	39.5

*Flat bottom hole

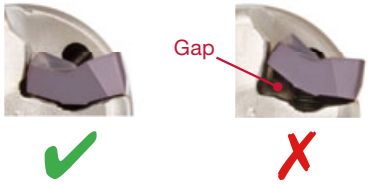
Estimation of chip thickness - calculated from feed per tooth (*fz*) and cutting width (*ae*) data

Recommended chip thickness

Feed per tooth *fz* (mm/t)	Cutting width (%): *ae* (mm) / Tool dia.: DC (mm)														
	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.03	0.006	0.008	0.009	0.01	0.012	0.013	0.018	0.021	0.024	0.026	0.027	0.029	0.029	0.03	0.03
0.05	0.01	0.014	0.016	0.017	0.02	0.022	0.03	0.036	0.04	0.043	0.046	0.048	0.049	0.05	0.05
0.08	0.016	0.022	0.025	0.027	0.031	0.035	0.048	0.057	0.064	0.069	0.073	0.076	0.078	0.08	0.08
0.1	0.02	0.028	0.031	0.034	0.039	0.044	0.06	0.071	0.08	0.087	0.092	0.095	0.098	0.099	0.1
0.12	0.024	0.034	0.037	0.041	0.047	0.052	0.072	0.086	0.096	0.104	0.11	0.114	0.118	0.119	0.12
0.15	0.03	0.042	0.047	0.051	0.059	0.065	0.09	0.107	0.12	0.13	0.137	0.143	0.147	0.149	0.15
0.18	0.036	0.05	0.056	0.061	0.071	0.078	0.108	0.129	0.144	0.156	0.165	0.172	0.176	0.179	0.18
0.2	0.04	0.056	0.062	0.068	0.078	0.087	0.12	0.143	0.16	0.173	0.183	0.191	0.196	0.199	0.2
0.22	0.044	0.062	0.069	0.075	0.086	0.096	0.132	0.157	0.176	0.191	0.202	0.21	0.216	0.219	0.22
0.25	0.05	0.07	0.078	0.085	0.098	0.109	0.15	0.179	0.2	0.217	0.229	0.238	0.245	0.249	0.25
0.28	0.056	0.078	0.087	0.096	0.11	0.122	0.168	0.2	0.224	0.242	0.257	0.267	0.274	0.279	0.28
0.3	0.06	0.084	0.094	0.102	0.118	0.131	0.18	0.214	0.24	0.26	0.275	0.286	0.294	0.298	0.3
0.4	0.08	0.112	0.125	0.136	0.157	0.174	0.24	0.286	0.32	0.346	0.367	0.382	0.392	0.398	0.4

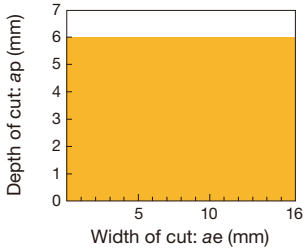
CAUTION

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



- 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	: EPAV06M016C16.0R04 (ø16 mm, z = 4)
Insert	: AVGT060304PBER-MJ AH3135
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 250 m/min
Feed per tooth	: *fz* = 0.07 mm/t
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	: EPAV06M032C32.0R08 (ø32 mm, z = 8)
Insert	: AVGT060304PBER-MJ AH3135
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 250 m/min
Feed per tooth	: *fz* = 0.07 mm/t
Coolant	: Dry
Machine	: Vertical M/C, BT40, 18.5 kW

Insert size 12

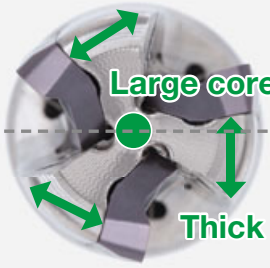
Extreme productivity and part quality

High productivity and stability

Robust and high-density cutter body design

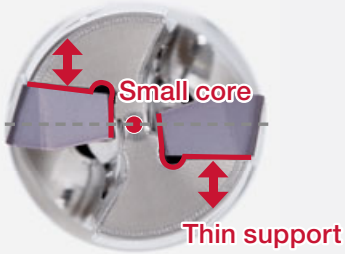
TUNGFORCE-REC

The use of V-shaped insert bottom allows the cutter to retain a **large core and thick supporting material** for high tool rigidity



Conventional

Small core diameter and thin supporting material leads to tool vibration and chatter



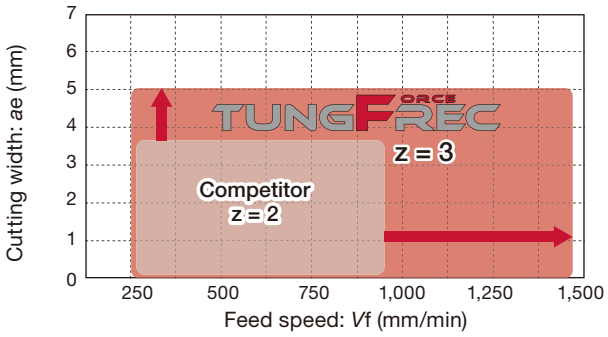
High cutter density x high rigidity tool design = super high feed shouldering

Comparison of cutters' insert-per-diameter density

Tool dia. (mm)	No. of inserts			Productivity improvement compared to competitor
	TUNGFORCE-REC		Competitor	
	Coarse pitch	Close pitch		
ø16	2	3	2	1.5 times
ø20	3	4	3	1.33 times
ø25	4	6	4	1.5 times
ø32	6	8	6	1.33 times
ø40	6	8	6	1.33 times
ø50	8	12	8	1.5 times
ø63	8	14	8	1.75 times

CUTTING PERFORMANCE

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



Shoulder milling

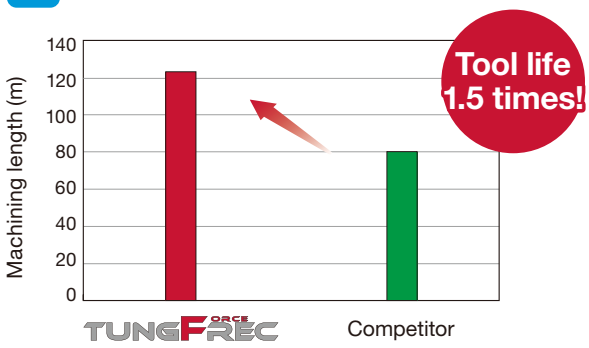
P

Cutter	: EPAV12M016C16.0R03 (ø16 mm, z = 3)
Insert	: AVMT120408PBER-MM AH3225
Workpiece material	: S55C / C55
Cutting speed	: *Vc* = 160 m/min
Feed per tooth	: *fz* = 0.12 mm/t
Depth of cut	: *ap* = 9 mm
Overhang length	: 35 mm
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.

■ Tool life comparison

P S55C / C55



Insert wear modes after machining 80 meters

No chipping

Chipping due to low cutting edge rigidity

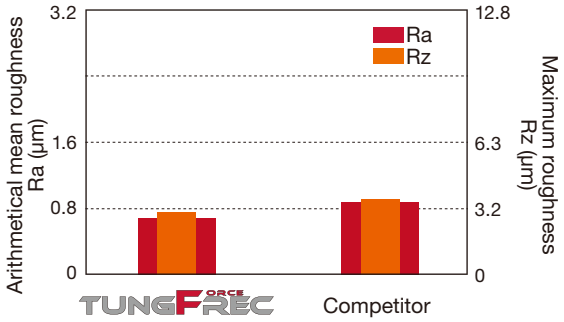
Shoulder milling

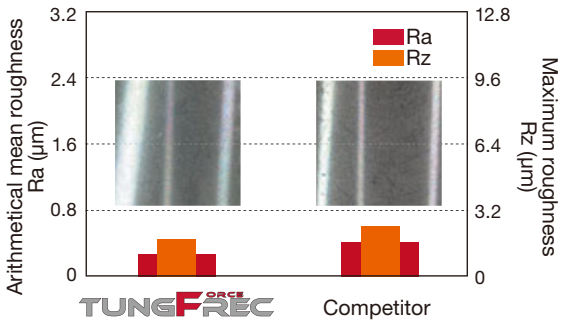
Cutter : EPAV12M020C20.0R03 (ø20 mm, z = 3)
Insert : AVMT120408PBER-MM AH3225
Cutting speed : *Vc* = 180 m/min
Feed per tooth : *fz* = 0.12 mm/t
Depth of cut : *ap* = 6 mm
Cutting width : *ae* = 6 mm
Coolant : Dry
Performed with only one insert on the cutter

Low cutting force and obtuse flank surface offers long and stable tool life.

■ Performance comparison - Precision machining

Surface finishing





Face milling

P

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

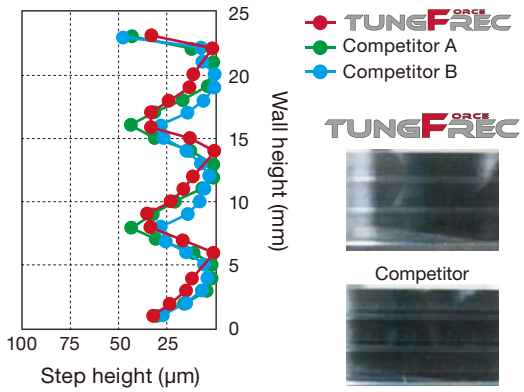
Better surface quality vs the competitor.

N

Cutter : EPAV12M020C20.0R03 (ø20 mm, z = 3)
Insert : AVGT120408PDFR-AM KS05F
Workpiece material : ADC12
Cutting speed : *Vc* = 800 m/min
Feed per tooth : *fz* = 0.1 mm/t
Depth of cut : *ap* = 2 mm
Cutting width : *ae* = 16 mm
Coolant : Wet (Internal)

Better surface quality vs the competitor.

Wall finishing



Shoulder milling

P

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

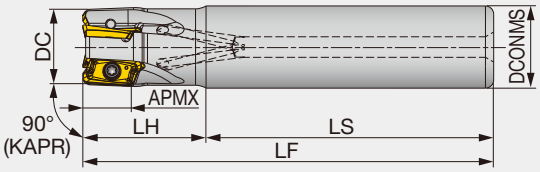
Equal or better wall step than competitors.

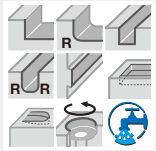
Insert size 12

EPAV12

Square shoulder endmill, shank type, with screw clamp system

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





Designation	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

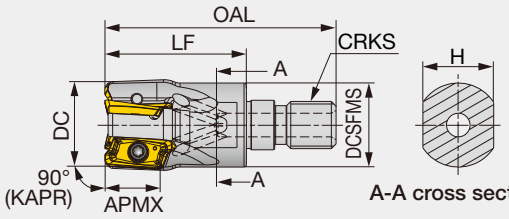
Designation	Clamping screw	Wrench
EPAV12M012C12.0R01	CSPB-2.5	IP-8D
EPAV12M016C16.0R02	CSPB-2.5	IP-8D
EPAV12M016C16.0R03	CSPB-2.5S	IP-8D
EPAV12M016C16.0R02L	CSPB-2.5	IP-8D
EPAV12M020C20.0R03	CSPB-2.5	IP-8D
EPAV12M020C20.0R04	CSPB-2.5S	IP-8D
EPAV12M020C20.0R02L	CSPB-2.5	IP-8D
EPAV12M025C25.0R04	CSPB-2.5	IP-8D
EPAV12M025C25.0R06	CSPB-2.5S	IP-8D
EPAV12M025C25.0R03L	CSPB-2.5	IP-8D
EPAV12M032C32.0R06	CSPB-2.5	IP-8D
EPAV12M032C32.0R08	CSPB-2.5S	IP-8D
EPAV12M032C32.0R03L	CSPB-2.5	IP-8D

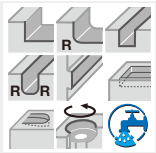
*Recommended clamping torque (N·m): CSPB-2.5, CSPB-2.5S = 1.3

HPAV12-M

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

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





Designation	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...

See page **34 - 36** for TungFlex shank.

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

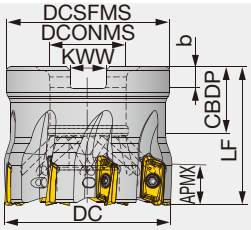
*Recommended clamping torque (N·m): CSPB-2.5, CSPB-2.5S = 1.3

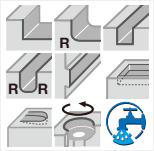
Insert size 12

TPAV12

Square shoulder mill, bore type, with screw clamp system

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





Designation	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
TPAV12M...	CSPB-2.5	IP-8D	CM10x30H

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

AVMT12-MM (for general purpose)

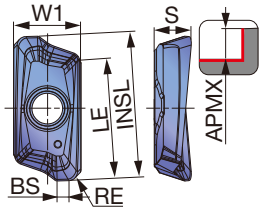


Fig. 1

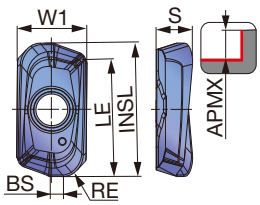


Fig. 2

AVGT12-AM (for non-ferrous machining)

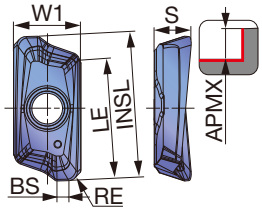


Fig. 3

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

★ : First choice
☆ : Second choice

Chipbreaker	Designation	RE	APMX	Coated				Carbide			W1	INSL	S	BS	LE	Fig.
				AH120	AH3225	T1215	T3225	KS05F								
General-purpose **MM**	AVMT120404PDER-MM	0.4	11.5	●	●	●	●				6.6	14.2	3.6	1.5	11.8	1
	AVMT120408PDER-MM	0.8	11.5	●	●	●	●				6.6	14.2	3.6	1.1	11.8	1
	AVMT120412PDER-MM	1.2	11.5	●	●	●	●				6.6	14.2	3.6	0.7	11.8	1
	AVMT120416PDER-MM	1.6	11.5	●	●	●	●				6.6	14.2	3.6	0.3	11.8	1
	AVMT120420PDER-MM	2	10.5	●	●	●	●				6.6	12.7	3.4	1.2	11.1	2
	AVMT120430PDER-MM	3	10.5	●	●	●	●				6.6	12.7	3.4	0.2	11.1	2
Non-ferrous machining **AM**	AVGT120404PDFR-AM	0.4	11.5					●			6.6	14.2	3.6	1.5	11.8	3
	AVGT120408PDFR-AM	0.8	11.5					●			6.6	14.2	3.6	1.1	11.8	3

● : Line up

TUNGFORCE-REC

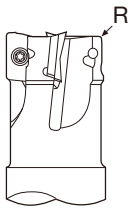
Insert size 12

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials		Hardness	Priority	Grades	Cutting speed *Vc* (m/min)	Feed per tooth *fz* (mm/t)
P	Low carbon steel S15C, SS400, etc. C15E, C15E4, E275A, etc.		- 200 HB	First choice	AH3225	100 - 300	0.06 - 0.22
			- 200 HB	Wear resistance	T3225	200 - 400	0.06 - 0.18
	Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.		- 300 HB	First choice	AH3225	100 - 250	0.06 - 0.22
			- 300 HB	Wear resistance	T3225	200 - 400	0.06 - 0.18
	Prehardened steel NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3225	100 - 200	0.06 - 0.22
			30 - 40 HRC	Wear resistance	T3225	200 - 400	0.06 - 0.15
M	Stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-3, etc.		-	First choice	AH3225	80 - 180	0.07 - 0.2
K	Grey cast iron FC250, FC300, etc. GG25, GG30, etc. 250, 300, etc.		150 - 250 HB	First choice	AH120	100 - 300	0.05 - 0.18
			150 - 250 HB	Wear resistance	T1215	200 - 400	0.05 - 0.12
	Ductile cast iron FCD400, FCD600, etc. GGG60, 600-3, etc.		150 - 250 HB	First choice	AH120	100 - 250	0.05 - 0.18
			150 - 250 HB	Wear resistance	T1215	150 - 300	0.05 - 0.12
N	Aluminium alloys Si < 13%		-	First choice	KS05F	300 - 1500	0.05 - 0.32
	Aluminium alloys Si ≥ 13%		-	First choice	KS05F	100 - 200	0.05 - 0.32
S	Titanium alloys Ti-6Al-4V, etc.		- 40 HRC	First choice	AH3225	20 - 60	0.04 - 0.15
	Superalloys Inconel 718, etc.		- 40 HRC	First choice	AH120	20 - 40	0.04 - 0.15
H	Hardened steel	SKD61, X40CrMoV5-1, etc.	40 - 50 HRC	First choice	AH120	50 - 150	0.04 - 0.07
		SKD11, X153CrMoV12, etc.	50 - 60 HRC	First choice	AH120	40 - 70	0.04 - 0.07

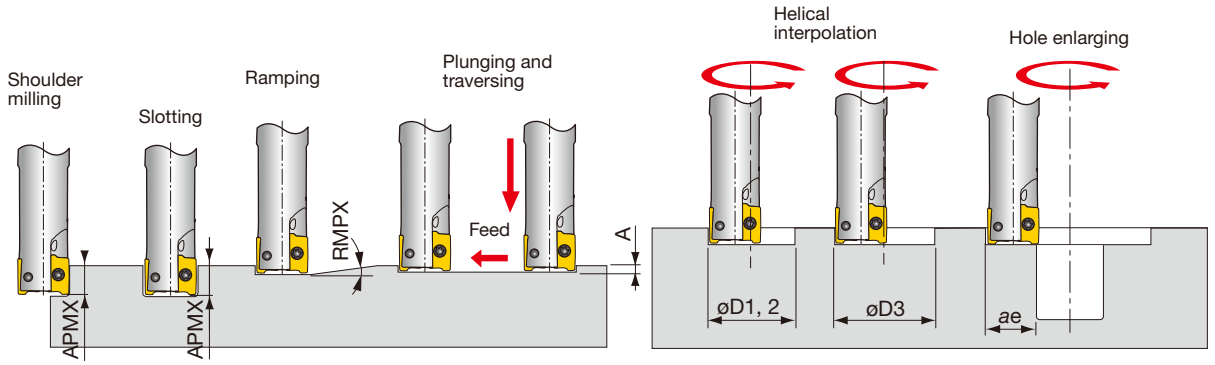
Cautionary point in modifying cutter bodies

When using inserts with corner radius RE ≥ 2 mm, standard cutter bodies have to be modified “R”. (EPAV12, TPAV12, HPAV12)



Corner radius RE (mm)	The dimension of modifying (mm)
0.4 - 1.6	Unnecessary
2 - 3	2

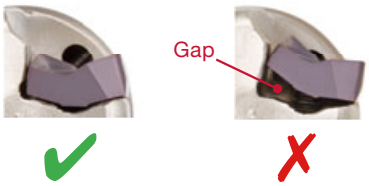
MACHINING APPLICATIONS



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*
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

Feed per tooth *fz* (mm/t)	Cutting width (%): *ae* (mm) / Tool dia.: DC (mm)														
	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.03	0.006	0.008	0.009	0.01	0.012	0.013	0.018	0.021	0.024	0.026	0.027	0.029	0.029	0.03	0.03
0.05	0.01	0.014	0.016	0.017	0.02	0.022	0.03	0.036	0.04	0.043	0.046	0.048	0.049	0.05	0.05
0.08	0.016	0.022	0.025	0.027	0.031	0.035	0.048	0.057	0.064	0.069	0.073	0.076	0.078	0.08	0.08
0.10	0.02	0.028	0.031	0.034	0.039	0.044	0.06	0.071	0.08	0.087	0.092	0.095	0.098	0.099	0.1
0.12	0.024	0.034	0.037	0.041	0.047	0.052	0.072	0.086	0.096	0.104	0.11	0.114	0.118	0.119	0.12
0.15	0.03	0.042	0.047	0.051	0.059	0.065	0.09	0.107	0.12	0.13	0.137	0.143	0.147	0.149	0.15
0.18	0.036	0.05	0.056	0.061	0.071	0.078	0.108	0.129	0.144	0.156	0.165	0.172	0.176	0.179	0.18
0.20	0.04	0.056	0.062	0.068	0.078	0.087	0.12	0.143	0.16	0.173	0.183	0.191	0.196	0.199	0.2
0.22	0.044	0.062	0.069	0.075	0.086	0.096	0.132	0.157	0.176	0.191	0.202	0.21	0.216	0.219	0.22
0.25	0.05	0.07	0.078	0.085	0.098	0.109	0.15	0.179	0.2	0.217	0.229	0.238	0.245	0.249	0.25
0.28	0.056	0.078	0.087	0.096	0.11	0.122	0.168	0.2	0.224	0.242	0.257	0.267	0.274	0.279	0.28
0.30	0.06	0.084	0.094	0.102	0.118	0.131	0.18	0.214	0.24	0.26	0.275	0.286	0.294	0.298	0.3
0.40	0.08	0.112	0.125	0.136	0.157	0.174	0.24	0.286	0.32	0.346	0.367	0.382	0.392	0.398	0.4

TUNGFORCE-REC

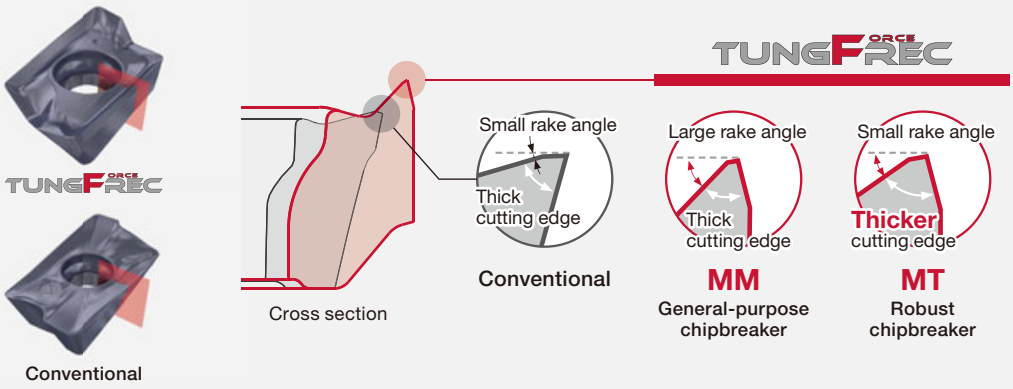
New Insert size 18

Introducing strong Size 18 insert for unparalleled stability

Enhanced tool stiffness

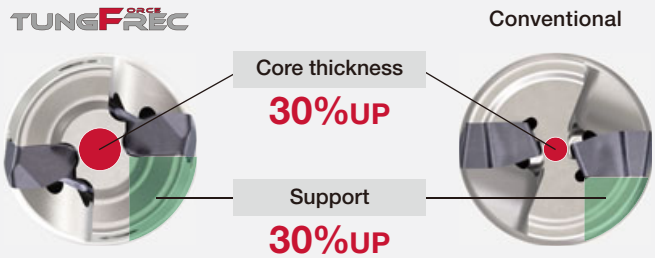
1 Strong insert design

Now available with MT geometry, TungForce-Rec ensures stability and long tool life during demanding machining with heavy cutting loads.



2 Thicker core diameter and insert support

The use of unique V bottom inserts allows the cutter to have a thicker core diameter and more support material that supports the inserts.

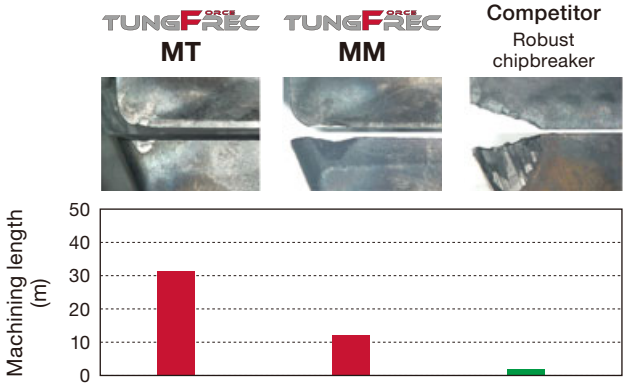


3 Secure insert clamping

Large-sized screws (M5) enhances insert fixture and facilitates handlings.

CUTTING PERFORMANCE

Cutting edge strength comparison

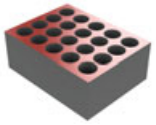


Shoulder milling

P

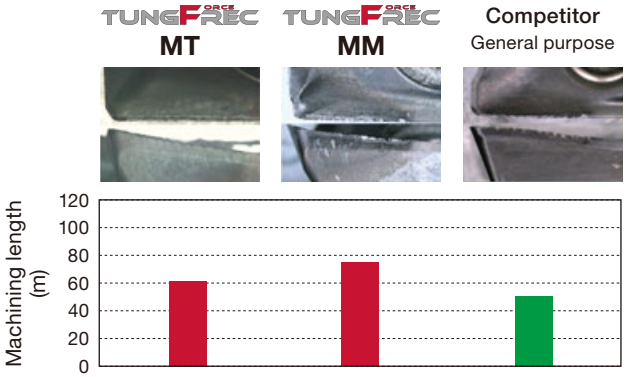
Cutter	: TPAV18M050B22.0R05 (ø50 mm, z = 5)
Insert	: AVMT180708PDER-MM AH3225 AVMT180708PDER-MT AH3225
Workpiece material	: SCM440 / 42CrMo4 (250 HB), Interrupted cuts
Cutting speed	: *Vc* = 160 m/min
Feed per tooth	: *fz* = 0.2 mm/t
Depth of cut	: *ap* = 2 mm
Width of cut	: *ae* = 35 mm
Coolant	: Dry

Performed with only one insert on the cutter



MM provided 10x tool life increase, while MT 26x increase. The competitor's insert was fractured so severely that it could not be securely fixed in the pocket when indexed for the second edge. MM and MT inserts were both left undamaged and completed the cuts.

■ Tool life comparison

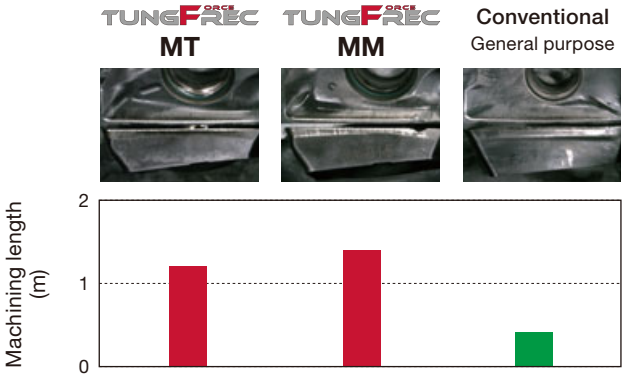


Shoulder milling

P

Cutter : TPAV18M050B22.0R05 (ø50 mm, z = 5)
Insert : AVMT180708PDER-MM AH3225
AVMT180708PDER-MT AH3225
Workpiece material: S55C / C55
Cutting speed : *Vc* = 160 m/min
Feed per tooth : *fz* = 0.2 mm/t
Depth of cut : *ap* = 2 mm
Width of cut : *ae* = 35 mm
Coolant : Dry
Performed with only one insert on the cutter

MM chipbreaker provided 1.5x tool life increase, MT 1.2x.



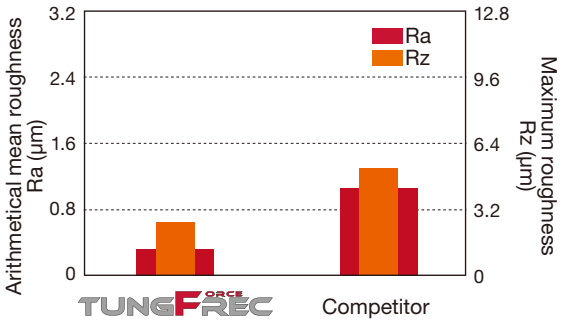
S

Cutter : TPAV18M050B22.0R05 (ø50 mm, z = 5)
Insert : AVMT180708PDER-MM AH8015
AVMT180708PDER-MT AH8015
Workpiece material: Inconel 718 (38 HRC)
Cutting speed : *Vc* = 15 m/min
Feed per tooth : *fz* = 0.08 mm/t
Depth of cut : *ap* = 15 mm
Width of cut : *ae* = 10 mm
Coolant : Wet
Performed with only one insert on the cutter

MM chipbreaker provided 3.5x tool life increase, MT 3.0x.

■ Performance comparison - Precision machining

Surface finishing



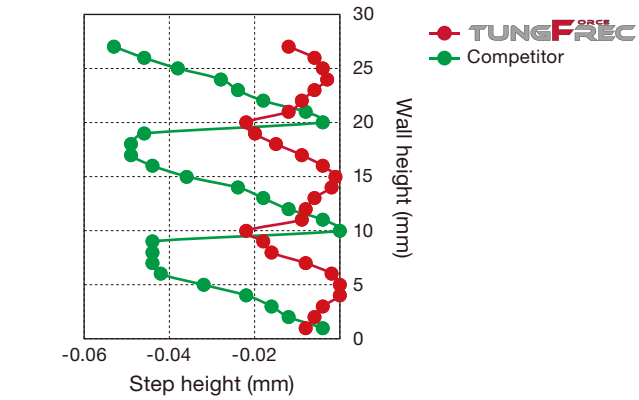
Face milling

P

Cutter : TPAV18M050B22.0R05 (ø50 mm, z = 5)
Insert : AVMT180708PDER-MM AH3225
Workpiece material : S55C / C55
Cutting speed : *Vc* = 120 m/min
Feed per tooth : *fz* = 0.15 mm/t
Depth of cut : *ap* = 15 mm
Cutting width : *ae* = 20 mm
Coolant : Dry

Better surface quality vs the competitor.

Wall finishing



Shoulder milling

P

Cutter : TPAV18M050B22.0R05 (ø50 mm, z = 5)
Insert : AVMT180708PDER-MM AH3225
Workpiece material : S55C / C55
Cutting speed : *Vc* = 120 m/min
Feed per tooth : *fz* = 0.15 mm/t
Depth of cut : *ap* = 15 mm
Cutting width : *ae* = 20 mm
Coolant : Dry

Better wall step than the competitor.

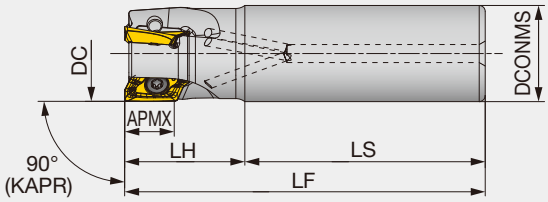
Insert size 18

New

EPAV18

Square shoulder endmill, shank type, with screw clamp system

GAMP = +12.2°~ +12.1°, GAMF = -35.7°~ -29.2°



Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPAV18M025C25.0R02	16.5	25	2	25	80	35	115	0.38	With	AVM/GT18...
EPAV18M025C25.0R02L	16.5	25	2	25	150	70	220	0.74	With	AVM/GT18...
EPAV18M030C25.0R03	16.5	30	3	25	80	40	120	0.42	With	AVM/GT18...
EPAV18M030C25.0R02L	16.5	30	2	25	175	80	255	0.91	With	AVM/GT18...
EPAV18M032C32.0R02	16.5	32	2	32	80	40	120	0.68	With	AVM/GT18...
EPAV18M032C32.0R03	16.5	32	3	32	80	40	120	0.66	With	AVM/GT18...
EPAV18M032C32.0R02L	16.5	32	2	32	175	80	255	1.47	With	AVM/GT18...
EPAV18M040C32.0R03	16.5	40	3	32	80	40	120	0.72	With	AVM/GT18...
EPAV18M040C32.0R05	16.5	40	5	32	80	40	120	0.72	With	AVM/GT18...
EPAV18M040C32.0R03L	16.5	40	3	32	205	50	255	1.53	With	AVM/GT18...
EPAV18M050C32.0R06	16.5	50	6	32	80	40	120	0.85	With	AVM/GT18...
EPAV18M050C32.0R07	16.5	50	7	32	80	40	120	0.85	With	AVM/GT18...
EPAV18M063C32.0R06	16.5	63	6	32	80	45	125	1.07	With	AVM/GT18...
EPAV18M063C32.0R08	16.5	63	8	32	80	45	125	1.11	With	AVM/GT18...

SPARE PARTS



Designation	Clamping screw	Grip (Optional)	Torx bit (Optional)
EPAV18M025C25.0R02	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M025C25.0R02L	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M030C25.0R03	CSTB-5L085	(H-TB2W)	(BT20S)
EPAV18M030C25.0R02L	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M032C32.0R02	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M032C32.0R03	CSTB-5S	(H-TB2W)	(BT20S)
EPAV18M032C32.0R02L	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M040C32.0R03	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M040C32.0R05	CSTB-5S	(H-TB2W)	(BT20S)
EPAV18M040C32.0R03L	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M050C32.0R06	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M050C32.0R07	CSTB-5S	(H-TB2W)	(BT20S)
EPAV18M063C32.0R06	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M063C32.0R08	CSTB-5	(H-TB2W)	(BT20S)

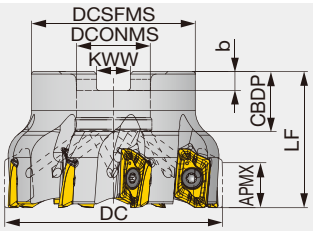
*Recommended clamping torque (N·m): CSTB-5, CSTB-5L085 = 5

New

TPAV18

Square shoulder mill, bore type, with screw clamp system

GAMP = +12.2°~ +12.1°, GAMF = -35.7°~ -29.2°



Designation	APMX	DC	CICT	DCSFMS	DCONMS	CBDP	LF	KWW	b	WT(kg)	Air hole	Insert
TPAV18M040B16.0R05	16.5	40	5	38	16	18	40	8.4	5.6	0.23	With	AVM/GT18...
TPAV18M050B22.0R05	16.5	50	5	47	22	20	40	10.4	6.3	0.32	With	AVM/GT18...
TPAV18M050B22.0R07	16.5	50	7	47	22	20	40	10.4	6.3	0.34	With	AVM/GT18...
TPAV18M063B22.0R06	16.5	63	6	47	22	20	40	10.4	6.3	0.57	With	AVM/GT18...
TPAV18M063B22.0R08	16.5	63	8	47	22	20	40	10.4	6.3	0.52	With	AVM/GT18...
TPAV18M080B27.0R08	16.5	80	8	60	27	22	50	12.4	7	1.07	With	AVM/GT18...
TPAV18J080B25.4R08	16.5	80	8	50	25.4	26	50	9.5	6	0.97	With	AVM/GT18...
TPAV18M100B32.0R10	16.5	100	10	66	32	28.5	50	14.4	8	1.49	With	AVM/GT18...
TPAV18J100B31.7R10	16.5	100	10	64	31.75	32	50	12.7	8	1.53	With	AVM/GT18...
TPAV18M125B40.0R10	16.5	125	10	85	40	32	63	16.4	9	3.02	With	AVM/GT18...
TPAV18J125B38.1R10	16.5	125	10	80	38.1	38	63	15.9	10	3.04	With	AVM/GT18...
TPAV18M160B40.0R12N	16.5	160	12	100	40	29	63	16.4	9	4.91	Without	AVM/GT18...
TPAV18J160B50.8R12N	16.5	160	12	100	50.8	46	63	19	11	5.1	Without	AVM/GT18...

SPARE PARTS




Designation	Clamping screw	Grip (Optional)	Torx bit (Optional)	Shell locking bolt
TPAV18M040B16.0R05	CSTB-5S	(H-TB2W)	(BT20S)	FSHM8-30H
TPAV18M050B22.0R05	CSTB-5	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M050B22.0R07	CSTB-5S	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M063B22.0R06	CSTB-5	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M063B22.0R08	CSTB-5	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M080B27.0R08	CSTB-5	(H-TB2W)	(BT20S)	CM12x30H
TPAV18J080B25.4R08	CSTB-5	(H-TB2W)	(BT20S)	CM12x30H
TPAV18M100B32.0R10	CSTB-5	(H-TB2W)	(BT20S)	TMBA-M16H
TPAV18J100B31.7R10	CSTB-5	(H-TB2W)	(BT20S)	TMBA-M16H
TPAV18M125B40.0R10	CSTB-5	(H-TB2W)	(BT20S)	TMBA-M20H
TPAV18J125B38.1R10	CSTB-5	(H-TB2W)	(BT20S)	TMBA-M20H
TPAV18M160B40.0R12N	CSTB-5	(H-TB2W)	(BT20S)	-
TPAV18J160B50.8R12N	CSTB-5	(H-TB2W)	(BT20S)	-

*Recommended clamping torque (N·m): CSTB-5, CSTB-5S = 5

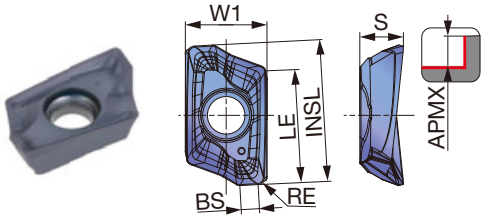
TUNGFORCE-REC

Insert size 18

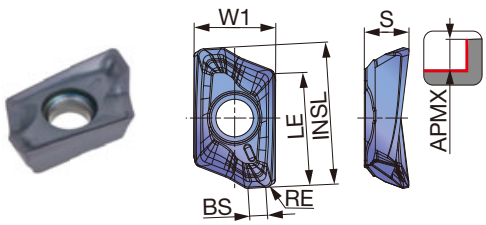
New

INSERT

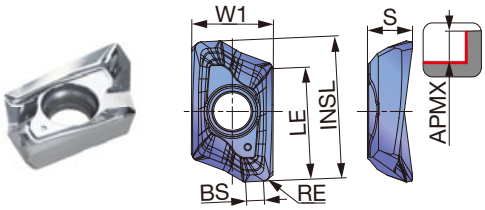
AVMT18-MM (for general purpose)



AVMT18-MT (Robust chipbreaker)



AVGT18-AM (for non-ferrous machining)



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

★ : First choice
☆ : Second choice

Chipbreaker	Designation	RE	APMX	Coated AH3225	Coated AH8015	Coated T1215	Carbide KS05F	W1	INSL	S	BS	LE
General-purpose **MM**	AVMT180704PDER-MM	0.4	16.5	●	●			12.4	21.6	6.7	3.1	17.1
	AVMT180708PDER-MM	0.8	16.5	●	●	●		12.4	21.6	6.6	2.7	17.1
	AVMT180712PDER-MM	1.2	16.5	●				12.4	21.6	6.6	2.2	17.1
	AVMT180716PDER-MM	1.6	16.5	●	●			12.4	21.6	6.5	1.8	17.1
	AVMT180720PDER-MM	2	16.5	●	●			12.4	21.6	6.5	1.4	17.1
	AVMT180724PDER-MM	2.4	16.5	●				12.4	21.6	6.5	1	17.1
	AVMT180731PDER-MM	3.1	16.5	●	●			12.4	21.6	6.4	0.2	17.1
Robust chipbreaker **MT**	AVMT180704PDER-MT	0.4	16.5	●	●			12.4	21.6	6.7	3.1	17.1
	AVMT180708PDER-MT	0.8	16.5	●	●			12.4	21.6	6.6	2.7	17.1
Non-ferrous machining **AM**	AVGT180704PDFR-AM	0.4	16.5				●	12.4	21.6	6.7	3.1	17.1
	AVGT180708PDFR-AM	0.8	16.5				●	12.4	21.6	6.6	2.7	17.1

● : New product

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials		Hardness	Priority	Grades	Cutting speed *Vc* (m/min)	Feed per tooth: *fz* (mm/t)		
							MM	MT	AM
P	Low carbon steel S15C, SS400, etc. C15E, C15E4, E275A, etc.		- 200 HB	First choice	AH3225	100 - 300	0.06 - 0.22	0.07 - 0.28	-
	Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.		- 300 HB	First choice	AH3225	100 - 250	0.06 - 0.22	0.07 - 0.28	-
	Prehardened steel NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3225	100 - 200	0.06 - 0.22	0.07 - 0.28	-
M	Stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-3, etc.		-	First choice	AH3225	80 - 180	0.07 - 0.2	0.07 - 0.25	-
K	Grey cast iron FC250, FC300, etc. GG25, GG30, etc. 250, 300, etc.		150 - 250 HB	First choice	AH8015	100 - 300	0.05 - 0.22	0.06 - 0.28	-
			150 - 250 HB	Wear resistance	T1215	200 - 400	0.05 - 0.18	-	-
	Ductile cast iron FCD400, FCD600, etc. GGG60, 600-3, etc.		150 - 250 HB	First choice	AH8015	100 - 250	0.05 - 0.22	0.06 - 0.28	-
			150 - 250 HB	Wear resistance	T1215	150 - 300	0.05 - 0.18	-	-
N	Aluminium alloys Si < 13%		-	First choice	KS05F	300 - 1500	-	-	0.05 - 0.32
	Aluminium alloys Si ≥ 13%		-	First choice	KS05F	100 - 200	-	-	0.05 - 0.32
S	Titanium alloys Ti-6Al-4V, etc.		-	First choice	AH8015	20 - 60	0.04 - 0.15	-	-
	Superalloys Inconel 718, etc.		-	First choice	AH8015	20 - 40	0.04 - 0.15	0.05 - 0.18	-
H	Hardened steel	SKD61, X40CrMoV5-1, etc.	40 - 50 HRC	First choice	AH8015	50 - 150	0.04 - 0.07	0.05 - 0.1	-
		SKD11, X153CrMoV12, etc.	50 - 60 HRC	First choice	AH8015	40 - 70	0.04 - 0.07	0.05 - 0.1	-

TUNGFORCE-REC

Insert size 18

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

MM chipbreaker

Recommended chip thickness

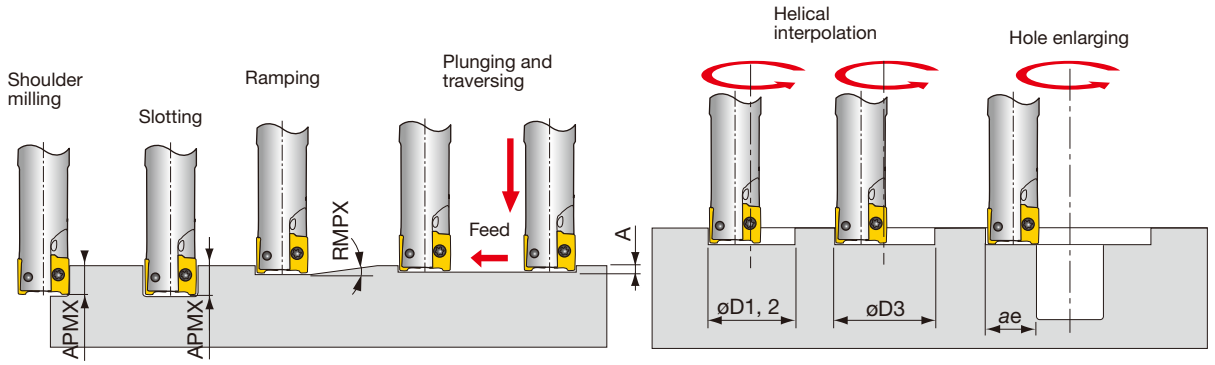
	Cutting width (%): *ae* (mm) / Tool dia.: DC (mm)														
Feed per tooth *fz* (mm/t)	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.03	0.006	0.008	0.009	0.01	0.012	0.013	0.018	0.021	0.024	0.026	0.027	0.029	0.029	0.03	0.03
0.05	0.01	0.014	0.016	0.017	0.02	0.022	0.03	0.036	0.04	0.043	0.046	0.048	0.049	0.05	0.05
0.08	0.016	0.022	0.025	0.027	0.031	0.035	0.048	0.057	0.064	0.069	0.073	0.076	0.078	0.08	0.08
0.1	0.02	0.028	0.031	0.034	0.039	0.044	0.06	0.071	0.08	0.087	0.092	0.095	0.098	0.099	0.1
0.12	0.024	0.034	0.037	0.041	0.047	0.052	0.072	0.086	0.096	0.104	0.11	0.114	0.118	0.119	0.12
0.15	0.03	0.042	0.047	0.051	0.059	0.065	0.09	0.107	0.12	0.13	0.137	0.143	0.147	0.149	0.15
0.18	0.036	0.05	0.056	0.061	0.071	0.078	0.108	0.129	0.144	0.156	0.165	0.172	0.176	0.179	0.18
0.2	0.04	0.056	0.062	0.068	0.078	0.087	0.12	0.143	0.16	0.173	0.183	0.191	0.196	0.199	0.2
0.22	0.044	0.062	0.069	0.075	0.086	0.096	0.132	0.157	0.176	0.191	0.202	0.21	0.216	0.219	0.22
0.25	0.05	0.07	0.078	0.085	0.098	0.109	0.15	0.179	0.2	0.217	0.229	0.238	0.245	0.249	0.25
0.28	0.056	0.078	0.087	0.096	0.11	0.122	0.168	0.2	0.224	0.242	0.257	0.267	0.274	0.279	0.28
0.3	0.06	0.084	0.094	0.102	0.118	0.131	0.18	0.214	0.24	0.26	0.275	0.286	0.294	0.298	0.3
0.4	0.08	0.112	0.125	0.136	0.157	0.174	0.24	0.286	0.32	0.346	0.367	0.382	0.392	0.398	0.4

MT chipbreaker

Recommended chip thickness

	Cutting width (%): *ae* (mm) / Tool dia.: DC (mm)														
Feed per tooth *fz* (mm/t)	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.03	0.006	0.008	0.009	0.01	0.012	0.013	0.018	0.021	0.024	0.026	0.027	0.029	0.029	0.03	0.03
0.05	0.01	0.014	0.016	0.017	0.02	0.022	0.03	0.036	0.04	0.043	0.046	0.048	0.049	0.05	0.05
0.08	0.016	0.022	0.025	0.027	0.031	0.035	0.048	0.057	0.064	0.069	0.073	0.076	0.078	0.08	0.08
0.1	0.02	0.028	0.031	0.034	0.039	0.044	0.06	0.071	0.08	0.087	0.092	0.095	0.098	0.099	0.1
0.12	0.024	0.034	0.037	0.041	0.047	0.052	0.072	0.086	0.096	0.104	0.11	0.114	0.118	0.119	0.12
0.15	0.03	0.042	0.047	0.051	0.059	0.065	0.09	0.107	0.12	0.13	0.137	0.143	0.147	0.149	0.15
0.18	0.036	0.05	0.056	0.061	0.071	0.078	0.108	0.129	0.144	0.156	0.165	0.172	0.176	0.179	0.18
0.2	0.04	0.056	0.062	0.068	0.078	0.087	0.12	0.143	0.16	0.173	0.183	0.191	0.196	0.199	0.2
0.22	0.044	0.062	0.069	0.075	0.086	0.096	0.132	0.157	0.176	0.191	0.202	0.21	0.216	0.219	0.22
0.25	0.05	0.07	0.078	0.085	0.098	0.109	0.15	0.179	0.2	0.217	0.229	0.238	0.245	0.249	0.25
0.28	0.056	0.078	0.087	0.096	0.11	0.122	0.168	0.2	0.224	0.242	0.257	0.267	0.274	0.279	0.28
0.3	0.06	0.084	0.094	0.102	0.118	0.131	0.18	0.214	0.24	0.26	0.275	0.286	0.294	0.298	0.3
0.4	0.08	0.112	0.125	0.136	0.157	0.174	0.24	0.286	0.32	0.346	0.367	0.382	0.392	0.398	0.4

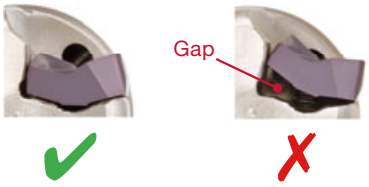
MACHINING APPLICATIONS



		Max. depth of cut	Max. ramping angle	Max. plunging	Min. machining	Max. machining		Max. cutting width in enlarging
Designation	**DC**	**APMX**	**RMPX**	**A**	**øD1**	**øD2**	**øD3***	***ae***
EPAV18M025...	25	16.5	4.5	1	40	49	48	24
EPAV18M030...	30	16.5	3	1	50	59	58	29
EPAV18M032...	32	16.5	3	1	54	63	62	31
E/TPAV18M040...	40	16.5	2.4	1	70	79	78	39
E/TPAV18M050...	50	16.5	1.5	1	90	99	98	49
E/TPAV18M063...	63	16.5	1.2	1	116	125	124	62
TPAV18J, M080...	80	16.5	1	1	150	159	158	79
TPAV18J, M100...	100	16.5	0.8	1	190	199	198	99
TPAV18J, M125...	125	16.5	0.6	1	240	249	248	124
TPAV18J, M160...	160	16.5	0.5	1	310	319	318	159

*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.

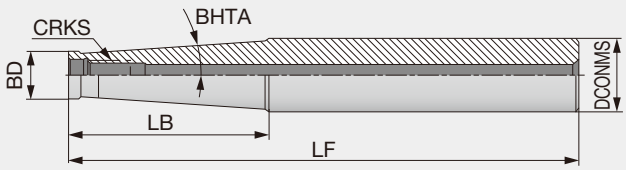


TUNGFORCE-REC

TUNGFLEX

SM

TungFlex - Modular shank

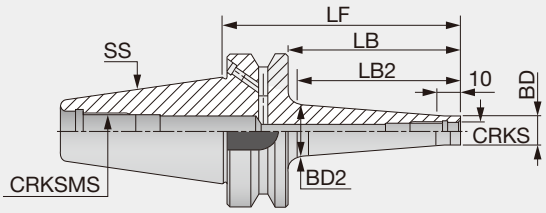


Designation	DCONMS	BD	LF	LB	BHTA	CRKS
SM06-L60C10	10	9.7	60	20	0°	M6
SM06-L105-C12	12	9.7	105	60	1.2°	M6
SM06-L125-C16	16	9.7	125	60	3.3°	M6
SM08-L73C16	16	13	73	25	0°	M8
SM08-L128-C16	16	13	128	80	0.9°	M8
SM08-L170-C20	20	13	170	66.8	3.3°	M8
SM10-L80-C20	20	18	80	30	0°	M10
SM10-L130-C20	20	18	130	80	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



Designation	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

SM-C-H

Carbide modular shank

Fig. 1

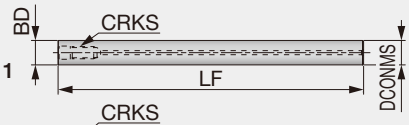


Fig. 2

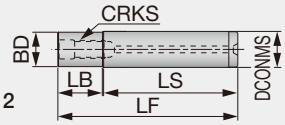
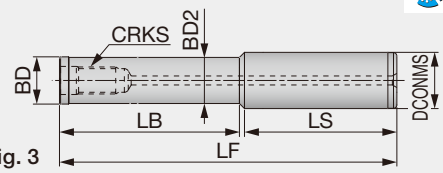


Fig. 3

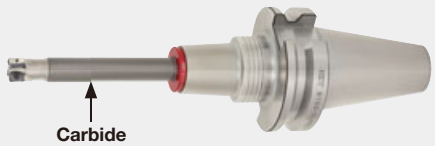


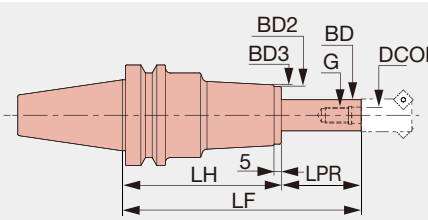
Designation	CRKS	DCONMS	LF	LB	LS	BD	BD2	Fig.
SM06-L100-C10-C-H	M6	10	100	-	-	10	-	1
SM06-L150-C10-C-H	M6	10	150	-	-	10	-	1
SM06-L100-C12-C-H	M6	12	100	-	-	12	-	1
SM06-L150-C12-C-H	M6	12	150	-	-	12	-	1
SM08-L80-20-C16-C-H	M8	16	80	20	59.6	15.3	-	2
SM08-L100-40-C16-C-H	M8	16	100	40	59.6	15.3	-	2
SM08-L150-80-C16-C-H	M8	16	150	80	69.6	15.3	-	2
SM08-L200-100-C16-C-H	M8	16	200	100	98.2	13	12.5	3
SM08-L200-140-C16-C-H	M8	16	200	140	59.6	15.3	-	2
SM08-L250-180-C16-C-H	M8	16	250	180	69.6	15.3	-	2
SM10-L80-20-C20-C-H	M10	20	80	20	59.2	18.5	-	2
SM10-L100-40-C20-C-H	M10	20	100	40	59.2	18.5	-	2
SM10-L150-80-C20-C-H	M10	20	150	80	69.2	18.5	-	2
SM10-L200-100-C20-C-H	M10	20	200	100	99.2	18.5	-	2
SM10-L200-140-C20-C-H	M10	20	200	140	58.7	18	17.5	3
SM10-L200-140-C20-C-H-N	M10	20	200	140	59.2	18.5	-	2
SM10-L250-130-C20-C-H	M10	20	250	130	118.7	18	17.5	3
SM10-L250-180-C20-C-H	M10	20	250	180	68.7	18	17.5	3
SM10-L250-180-C20-C-H-N	M10	20	250	180	69.2	18.5	-	2
SM10-L300-180-C20-C-H	M10	20	300	180	118.7	18	17.5	3
SM10-L300-230-C20-C-H	M10	20	300	230	68.7	18	17.5	3
SM12-L100-40-C25-C-H	M12	25	100	40	59.5	24	-	2
SM12-L150-80-C25-C-H	M12	25	150	80	67.7	21	20.5	3
SM12-L150-80-C25-C-H-N	M12	25	150	80	69.5	24	-	2
SM12-L200-100-C25-C-H	M12	25	200	100	97.7	21	20.5	3
SM12-L200-100-C25-C-H-N	M12	25	200	100	99.5	24	-	2
SM12-L200-140-C25-C-H	M12	25	200	140	57.7	21	20.5	3
SM12-L250-130-C25-C-H	M12	25	250	130	117.7	21	20.5	3
SM12-L250-180-C25-C-H	M12	25	250	180	69.5	24	-	2
SM12-L300-180-C25-C-H	M12	25	300	180	117.7	21	20.5	3
SM12-L300-180-C25-C-H-N	M12	25	300	180	119.5	24	-	2
SM12-L300-230-C25-C-H	M12	25	300	230	67.7	21	20.5	3
SM16-L100-40-C32-C-H	M16	32	100	40	58.5	29	-	2
SM16-L150-80-C32-C-H	M16	32	150	80	68.5	29	-	2
SM16-L200-100-C32-C-H	M16	32	200	100	98.5	29	-	2
SM16-L200-140-C32-C-H	M16	32	200	140	58.5	29	-	2
SM16-L250-130-C32-C-H	M16	32	250	130	118.5	29	-	2
SM16-L250-180-C32-C-H	M16	32	250	180	68.5	29	-	2
SM16-L300-180-C32-C-H	M16	32	300	180	118.5	29	-	2
SM16-L300-230-C32-C-H	M16	32	300	230	68.5	29	-	2
SM16-L350-230-C32-C-H	M16	32	350	230	118.5	29	-	2
SM16-L350-280-C32-C-H	M16	32	350	280	68.5	29	-	2

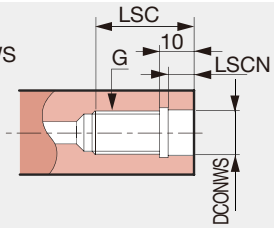
TUNGFLEX

BT-RSG (Screw clamping head holder)

TungFlex modular tooling system with BT shank







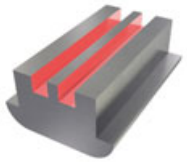
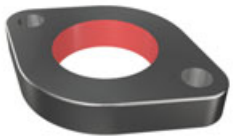
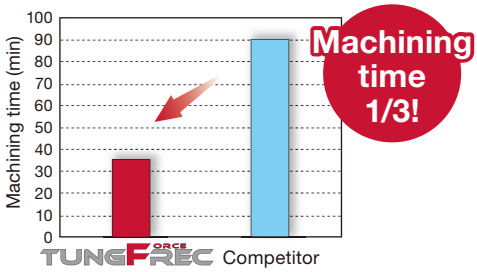
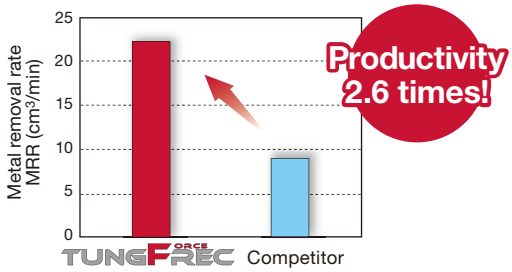
Designation	DCONWS	LSC	LSCN	BD	LF	LPR	LH	BD2	BD3	WT (kg)	G
BT40-RSG 8-105-M 25	8.5	18	6.5	15	105	25	80	30	32	1.4	M8
BT40-RSG 8-135-M 25	8.5	18	6.5	15	135	25	110	30	32	1.8	M8
BT40-RSG 8-130-M 50	8.5	18	6.5	15	130	50	80	30	32	1.4	M8
BT40-RSG 8-160-M 50	8.5	18	6.5	15	160	50	110	30	32	1.8	M8
BT40-RSG 8-155-M 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

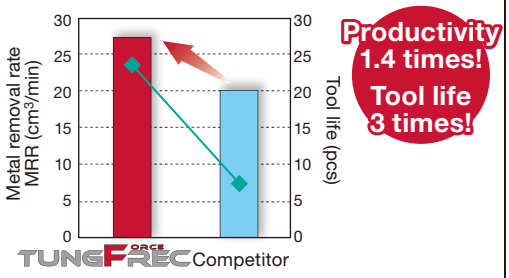
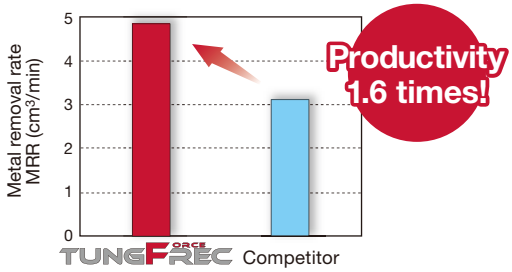
Manufactured by: MST corporation

For more modular products.

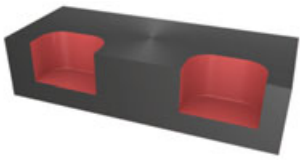
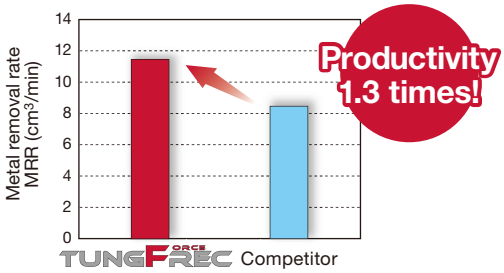
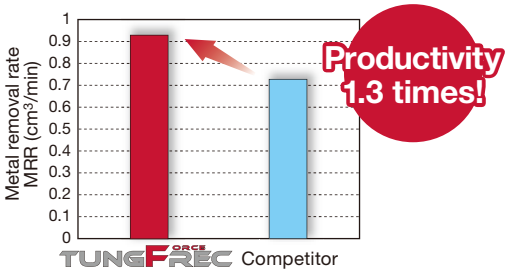
e-catalog

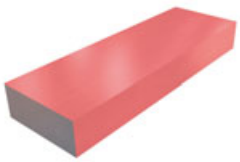
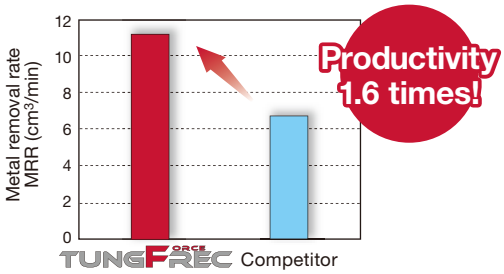
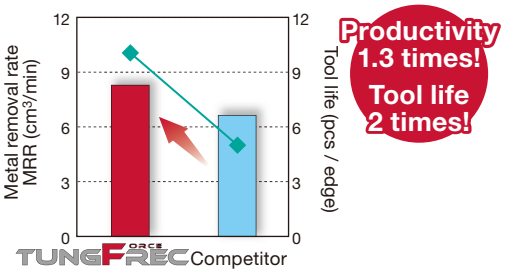
PRACTICAL EXAMPLES

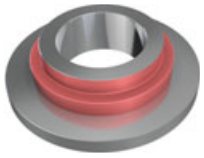
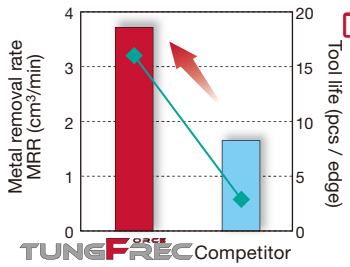
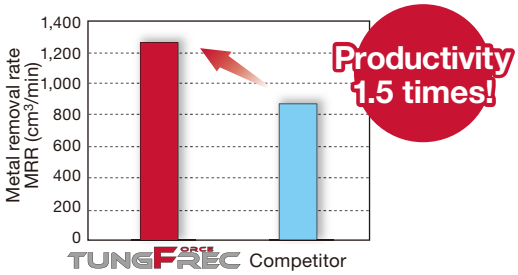
Workpiece type		Machine parts	Machine parts
Cutter		EPAV04M008C08.0R02 (ø8 mm, z=2)	EPAV04M008C08.0R02L (ø8 mm, z=2)
Insert		AVMT040204PPER-MM	AVMT040204PPER-MM
Grade		AH3225	AH3225
Workpiece material		SUS304 / X5CrNiMo18-9	S50C / C50
		 M	 P
Cutting conditions	Cutting speed : *Vc* (m/min)	150	251
	Feed per tooth : *fz* (mm/t)	0.08	0.07
	Feed speed : *Vf* (mm/min)	895	1,400
	Depth of cut : *ap* (mm)	1.4	2
	Width of cut : *ae* (mm)	8	8
	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.

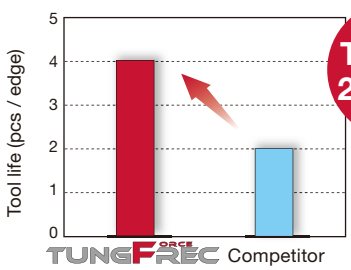
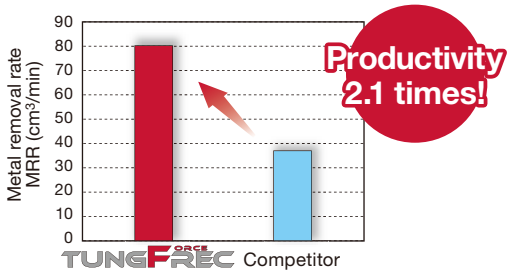
Workpiece type		Machine parts	Spindle shaft
Cutter		EPAV06M014C12.0R03 (ø14 mm, z=3)	EPAV06M012C12.0R03 (ø12 mm, z = 3)
Insert		AVGT060302PBER-MJ	AVGT060304PBER-MJ
Grade		AH3225	AH3135
Workpiece material		SS400 / E275A	Alloy steel (Low carbon, 30HRC)
		 P	 P
Cutting conditions	Cutting speed : *Vc* (m/min)	264	143
	Feed per tooth : *fz* (mm/t)	0.125	0.04
	Feed speed : *Vf* (mm/min)	1,500	601
	Depth of cut : *ap* (mm)	6	1
	Width of cut : *ae* (mm)	3	1.6
	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 compared to the solid endmill, thanks to AH3225 grade with high wear resistance.	 The sharp cutting edge geometry has enabled smoother, vibration-free cutting at higher parameters even on a low rigidity machine.

PRACTICAL EXAMPLES

Workpiece type		Blocks	Machine parts
Cutter		EPAV06M016C16.0R04 (ø16 mm, z = 4)	EPAV06M010C10.0R02 (ø10 mm, z = 2)
Insert		AVGT060308PBER-MJ	AVGT060302PBER-MJ
Grade		AH130	AH3135
Workpiece material		Ti-6Al-4V	SUS304 / X5CrNi18-9
		 S	 M
Cutting conditions	Cutting speed : *Vc* (m/min)	50 (Competitor: *Vc* = 40)	94 (Competitor: *Vc* = 50)
	Feed per tooth : *fz* (mm/t)	0.12	0.05 (Competitor: *fz* = 0.03)
	Feed speed : *Vf* (mm/min)	478	299 (Competitor: *Vf* = 239)
	Depth of cut : *ap* (mm)	1.5 (Competitor: *ap* = 0.5)	0.5
	Width of cut : *ae* (mm)	16	6.3
	Machining	Shoulder milling	Face milling
	Coolant	Wet (Internal)	Wet (External)
	Machine	With angle head, BT50	Lathe (Swiss type)
Results		 High wear and fracture resistant, AH130 has enabled a high M.R.R. with stability, eliminating premature insert failures.	 Enhanced machining stability has improved the MRR at high cutting parameters.

Workpiece type		Plate for mold	Turbine blade
Cutter		EPAV12M20C20.0R04 (ø20 mm, z = 4)	EPAV12M016C16.0R02 (ø16 mm, z = 2)
Insert		AVMT120408PDER-MM	AVMT120412PDER-MM
Grade		AH3225	T3225
Workpiece material		NAK80 / Prehardened steel	SUS316L / 316L
		 P	 M
Cutting conditions	Cutting speed : *Vc* (m/min)	72	130
	Feed per tooth : *fz* (mm/t)	0.1	0.1
	Feed speed : *Vf* (mm/min)	458	517
	Depth of cut : *ap* (mm)	4	1
	Width of cut : *ae* (mm)	6	16
	Machining	Face milling	Slotting
	Coolant	Air blast	Wet (Internal)
	Machine	Vertical M/C, BT50	Turning center, BT50
Results		 Thanks to dense number of teeth and robust cutting edge, TungForce-Rec offered high productivity without chipping.	 Thanks to light cutting action and robust cutting edge, TungForce-Rec offered high productivity without chattering and chipping.

Workpiece type		Parts for power generation	Machine parts
Cutter		EPAV12M025C25.0R06 (ø25 mm, z = 6)	TPAV12M050B22.0R12 (ø50 mm, z = 12)
Insert		AVMT120420PDER-MM	AVGT120408PDFR-AM
Grade		AH120	KS05F
Workpiece material		Hastelloy X	Cast aluminium
		 S	 N
Cutting conditions	Cutting speed : *Vc* (m/min)	45	950
	Feed per tooth : *fz* (mm/t)	0.1	0.15
	Feed speed : *Vf* (mm/min)	344	11,000
	Depth of cut : *ap* (mm)	6	6
	Width of cut : *ae* (mm)	1.8	35
	Machining	Shoulder milling	Face milling
	Coolant	Wet (Internal)	Wet (External)
	Machine	Vertical M/C, BT50	Vertical M/C, BT50
Results		 Thanks to light cutting action and rigid cutter body, TungForce-Rec offered high productivity without chattering and chipping.	 Dense number of teeth and rigid tool design allowed TungForce-Rec to offer high productivity in cast aluminium machining.

Workpiece type		Frame for heavy equipment	Casing
Cutter		New TPAV18M050B22.0R05 (ø50 mm, z = 5)	New TPAV18M100B32.0R10 (ø100 mm, z = 10)
Insert		AVMT180708PDER-MT	AVMT180708PDER-MM
Grade		AH3225	AH3225
Workpiece material		Alloy steel	SS400 / E275A
		 P	 P
Cutting conditions	Cutting speed : *Vc* (m/min)	199.5	251
	Feed per tooth : *fz* (mm/t)	0.16	0.1
	Feed speed : *Vf* (mm/min)	1,000	799
	Depth of cut : *ap* (mm)	3	2
	Width of cut : *ae* (mm)	40	50
	Machining	Shoulder milling	Shoulder milling
	Coolant	Wet (External)	Wet (External)
	Machine	Vertical M/C, BT50	Vertical M/C, BT50
Results		 TungForce-Rec, with its strong cutting edges, provided process security while eliminating edge chipping.	 TungForce-Rec eliminated chatter with its MM chipbreaker, allowing increased number of teeth and higher feed rate. As the result, 2.1x increase in metal removal rate was achieved.

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

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

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

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

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

Tungaloy-NTK Germany GmbH.
Katzbergstr. 3a
D-40764 Langenfeld, Germany
Phone: +49-2173-90420-0
Fax: +49-2173-90420-19
www.tungaloy.com/de

Tungaloy France s.a.s
Les Fjords
19 avenue de Norvège
91140 Villebon Sur Yvette, France
Phone: +33-1-6486-4300
Fax: +33-1-6907-7817
www.tungaloy.com/fr

Tungaloy Italia S.r.l.
Viale Sarca 336/Edificio 13
20126 Milano, Italy
Phone: +39-02-252012-1
Fax: +39-02-252012-65
www.tungaloy.com/it

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

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

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

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

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

Tungaloy-NTK UK Ltd.
Suite 3, Pioneer House, Mill Street,
Cannock, WS11 0EF, UK
Phone: +44 121 4000 231
Fax: +44 121 270 9694
www.tungaloy.com/uk

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

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

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

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

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

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

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

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

Tungaloy-NTK Vietnam LLC
3rd Floor, Licogi 13 Tower, 164 Khuat Duy
Tien, Nhan Chinh, Thanh Xuan District,
Hanoi, Vietnam
Phone: +84 24 63282086
www.tungaloy.com/vn

Tungaloy India Pvt. Ltd.
One International Center,
Unit # 902-A, 9th Floor,
Tower 1, Senapati Bapat Marg,
Elphinstone Road (West),
Mumbai 400013, India
Phone: +91-22-6124-8803
Fax: +91-22-6124-8899
www.tungaloy.com/in

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

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

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

PT. Tungaloy Indonesia
Ruko Blok AA.10 No3&5, Grand Wisata,
Lambangjaya, Tambun Selatan, Bekasi,
17510 Indonesia
Phone: +62-21-8261-5808
Fax: +62-21-8261-5809
www.tungaloy.com/id

Member IMC Group Tungaloy

tungaloy.com
follow us at:
facebook.com/tungaloyjapan
twitter.com/tungaloyjapan
www.youtube.com/tungaloycorporation

Distributed by:

Explore the Tungaloy world!
Tungaloy APP & SNS

FIND US ON THE CLOUD!
machiningcloud.com

AS9100 Certified
78006
2015.11.04

ISO 14001 Certified
EC97J1123
1997.11.26

Produced from Recycled paper Dec. 2024 (TJ)