

# NEW PRODUCT NEWS

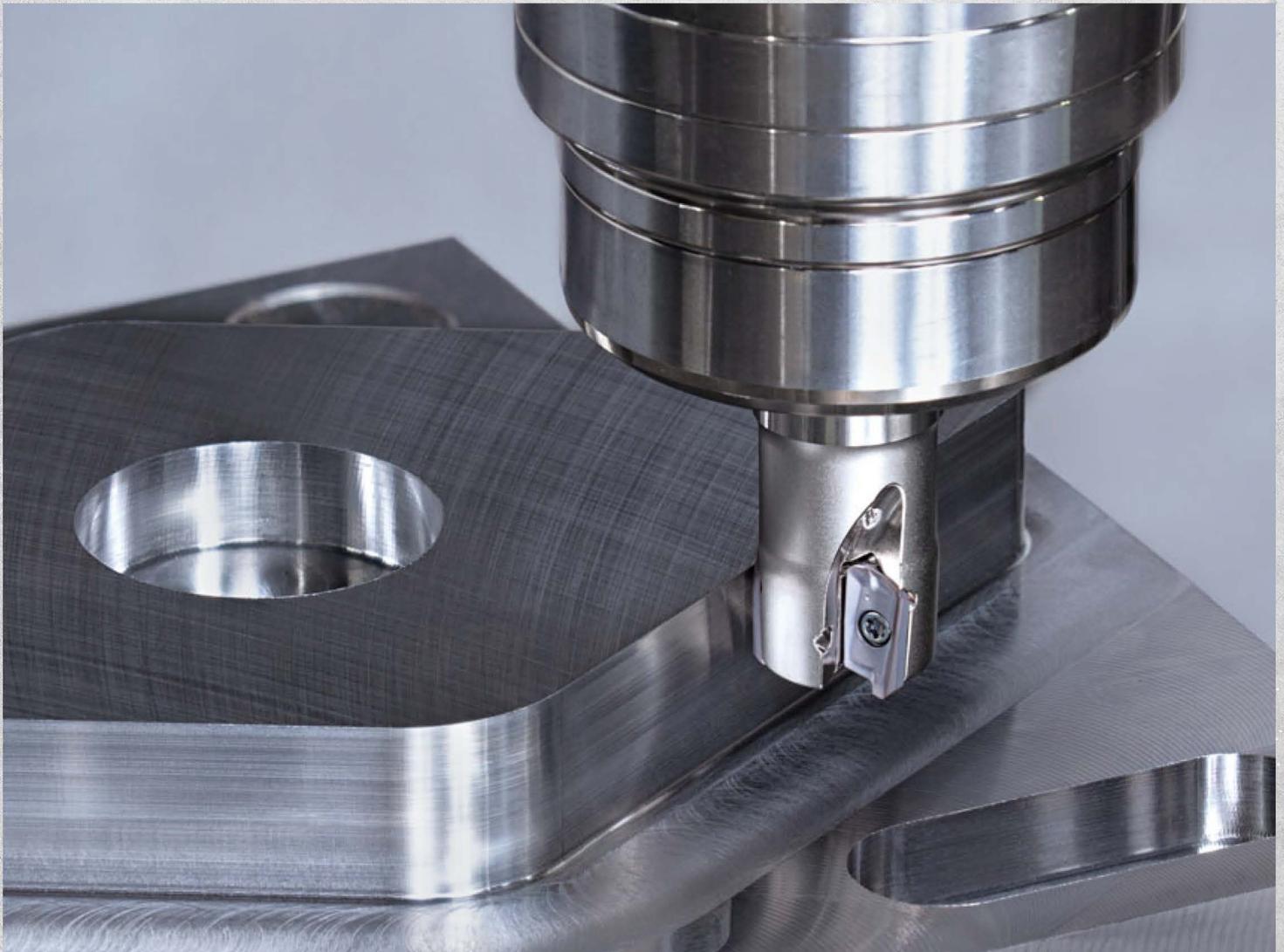
**mgt**  
MEGA TECH  
METALWORK

Tungaloy Report No. 506-G

Square shoulder milling cutter

# TUNGALOY **FORCE** F<sup>ORCE</sup> REC

Shoulder milling cutter with unique V-shaped bottom inserts for Maximum efficiency - **Expanding the corner R1 insert line for enhanced versatility**



# NEW PRODUCT NEWS



Tungaloy Report No. 506-G



## TUNG**FORCE**FREC



Unique insert clamping ensures high reliability and efficiency machining

# TUNG FORCE FREC

## 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:  $\phi 6$  -  $\phi 16$  mm

P.6 -

### Insert size 06

Provides superior surface quality as solid carbide endmills



APMX:  
6 mm

Tool diameter:  $\phi 8$  -  $\phi 40$  mm

P.10 -

**New**

### Insert size 12

Extreme productivity and part quality



APMX:  
11.5 mm

Tool diameter:  $\phi 12$  -  $\phi 63$  mm

P.18 -

### Insert size 18

Introducing strong Size 18 insert for unparalleled stability



APMX:  
16.5 mm

Tool diameter:  $\phi 25$  -  $\phi 160$  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)																	
				$\phi 6$	$\phi 8$	$\phi 10$	$\phi 12$	$\phi 14$	$\phi 16$	$\phi 18$	$\phi 20$	$\phi 25$	$\phi 30$	$\phi 32$	$\phi 40$	$\phi 50$	$\phi 63$	$\phi 80$	$\phi 100$	$\phi 125$	$\phi 160$
04	4	0.4, 0.8	PM KS H	1	2	3 2	4 3		5 4												
06	6	0, 0.2 0.4, 0.8	PM KN SH		1	2	3 2	3	4 3	4 3	5 4	6 5 4	8 6	10							
12	11.5 <b>New</b>	0.4, 0.8 1, 1.2 1.6, 2 3	PM KN SH				1		3 2		4 3	6 4 3	8 6 3	8 6	12 8	14 8					
18	16.5	0.4, 0.8 1.2, 1.6 2, 2.4 3.1	PM KN SH									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.

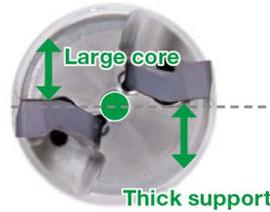
### Unique V-shaped bottom insert for machining security

#### Strong cutter body design

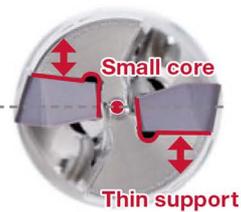
V shape insert design enables the cutter to have a thick core and insert backing.

Ensures high productivity and stability.

TUNG<sup>ORCE</sup>FREC



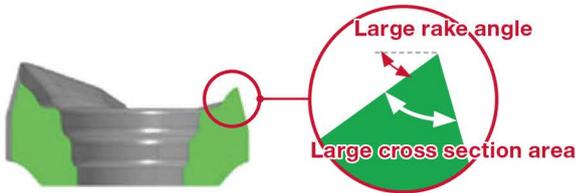
Competitor



### Sharp and strong cutting edge for increased productivity

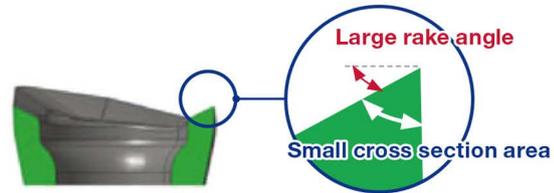
TUNG<sup>ORCE</sup>FREC

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

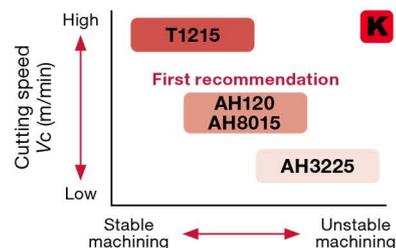
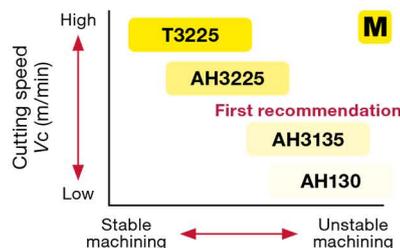
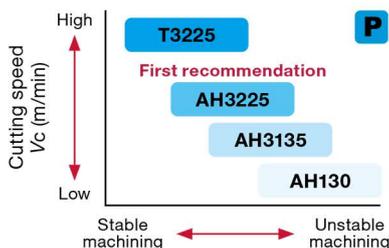
#### T3225 **P M**

- 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

Insert size 04



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

### Small diameter endmill with high stiffness

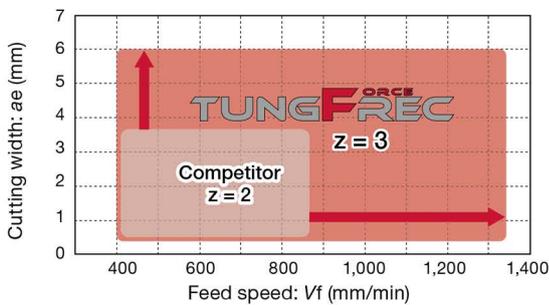
Thanks to unique V-bottom design, the smallest inserts available for the series can provide maximum productivity during shoulder milling operations

#### Comparison of core thickness



## CUTTING PERFORMANCE

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



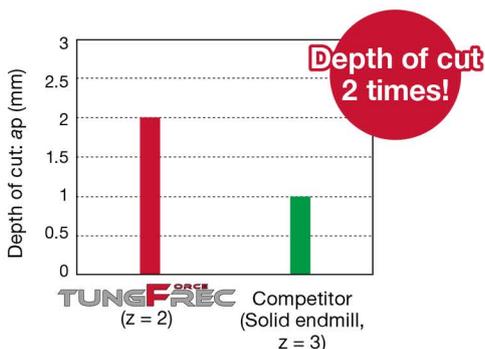
Shoulder milling



Cutter : EPAV04M010C10.0R03 (ø10 mm, z = 3)  
 Insert : AVMT040204PPER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 200$  m/min  
 Feed per tooth :  $f_z = 0.07$  mm/t  
 Depth of cut :  $a_p = 4$  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



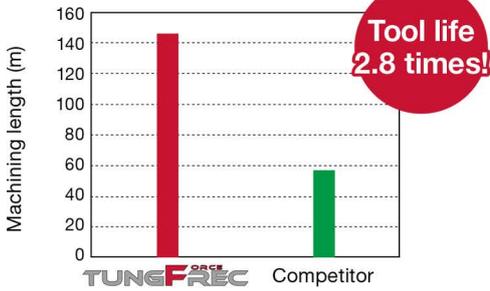
Cutter : EPAV04M008C08.0R02 (ø8 mm, z = 2)  
 Insert : AVMT040204PPER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 100$  m/min  
 Feed speed :  $V_f = 448$  mm/min  
 Overhang length : 20 mm  
 Coolant : Air blast  
 Machine : Vertical M/C, BT30  
 Tool life criteria : Chatter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

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

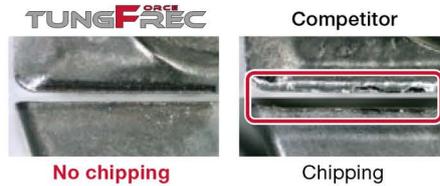
## Tungaloy Report No. 506-G

### ■ Tool life comparison

#### **P** S55C / C55



#### Damage on cutting edges at the same machining time

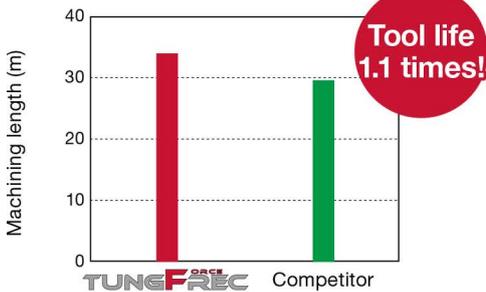


#### Shoulder milling

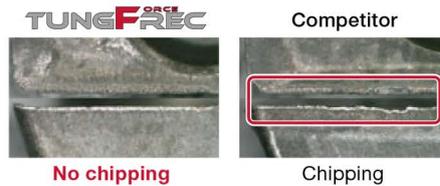
Cutter : EPAV04M010C10.0R03 ( $\phi 10$  mm, z = 3)  
 Insert : AVMT040204PPER-MM AH3225  
 Cutting speed :  $V_c = 200$  m/min  
 Feed per tooth :  $f_z = 0.07$  mm/t  
 Depth of cut :  $a_p = 3$  mm  
 Cutting width :  $a_e = 2.7$  mm  
 Coolant : Air blast

**Obtuse flank surface prevents chipping and achieves stable tool life.**

#### **M** SUS304 / X5CrNi18-9



#### Damage on cutting edges at the same machining time

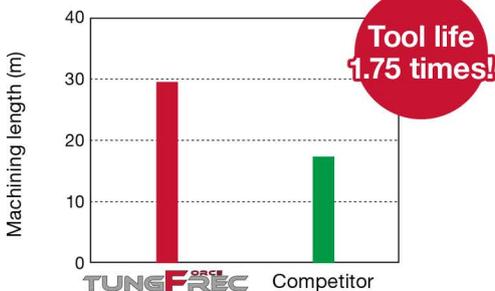


#### Shoulder milling

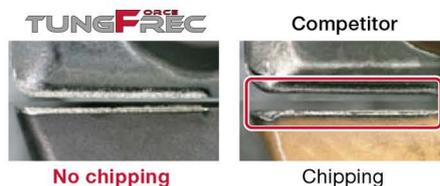
Cutter : EPAV04M010C10.0R03 ( $\phi 10$  mm, z = 3)  
 Insert : AVMT040208PPER-MM AH3225  
 Cutting speed :  $V_c = 120$  m/min  
 Feed per tooth :  $f_z = 0.07$  mm/t  
 Depth of cut :  $a_p = 3$  mm  
 Cutting width :  $a_e = 2.7$  mm  
 Coolant : Air blast

**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



#### Shoulder milling

Cutter : EPAV04M010C10.0R03 ( $\phi 10$  mm, z = 3)  
 Insert : AVMT040208PPER-MM AH120  
 Cutting speed :  $V_c = 300$  m/min  
 Feed per tooth :  $f_z = 0.07$  mm/t  
 Depth of cut :  $a_p = 3$  mm  
 Cutting width :  $a_e = 2.7$  mm  
 Coolant : Air blast

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

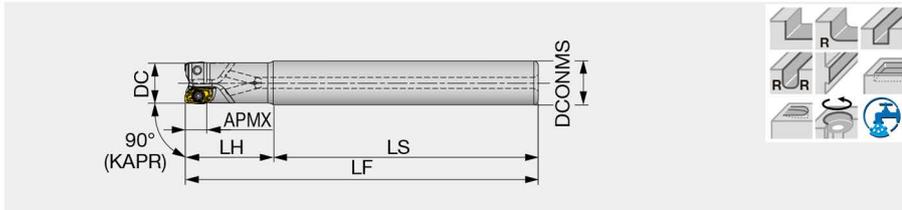
# TUNG FORCE

Insert size 04

### EPAV04

Square shoulder endmill, shank type, with screw clamp system

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



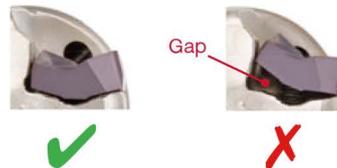
Designation	APMX	DC	CICT	DCONMS	LS	LH	LF	WT(kg)	Air hole	Insert
EPAV04M006C06.0R01	4	6	1	6	48	12	60	0.01	With	AVMT04...
EPAV04M008C08.0R02	4	8	2	8	48	12	60	0.02	With	AVMT04...
EPAV04M008C08.0R02L	4	8	2	8	60	20	80	0.03	With	AVMT04...
EPAV04M010C10.0R02	4	10	2	10	60	20	80	0.04	With	AVMT04...
EPAV04M010C10.0R03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

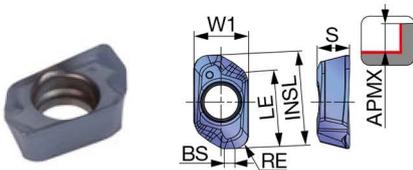
\*Recommended clamping torque (N·m): CSPB-1.8L3.3, CSPB-1.8L3.6 = 0.5

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

★ : First choice  
☆ : Second choice

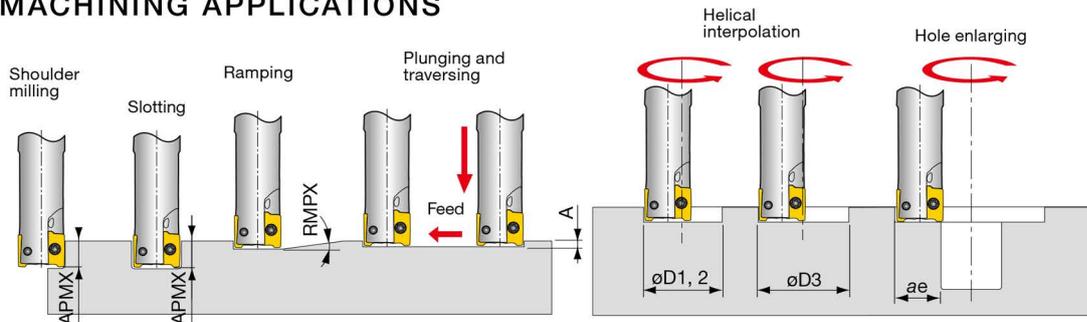
Chipbreaker	Designation	RE	APMX	Coated		W1	INSL	S	BS	LE
				AH120	AH3225					
General-purpose <b>MM</b>	AVMT040204PPER-MM	0.4	4	●	●	3.5	6.05	2.1	1	4.4
	AVMT040208PPER-MM	0.8	4	●	●	3.5	6.05	2.1	0.6	4.4

● : 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. Carbon steel and alloy steel S55C, SCM440, etc. C55, 42CrMo4, etc.	- 200 HB	First choice	AH3225	100 - 300	0.05 - 0.12
		- 300 HB	First choice	AH3225	100 - 250	0.05 - 0.12
	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
	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
	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
		SKD11, X153CrMoV12, etc.	50 - 60 HRC	First choice	AH120	40 - 70

### 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

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

# TUNGFORCE



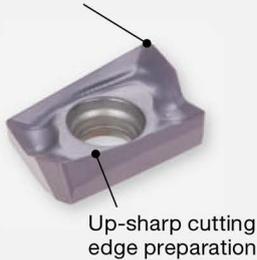
Insert size 06

## Provides superior surface quality as solid carbide endmills

### High machining accuracy

#### 1 High precision insert

All nose radii are ground to precision



#### 2 Extremely secure insert clamping

- V shape design prevents insert movement during machining.

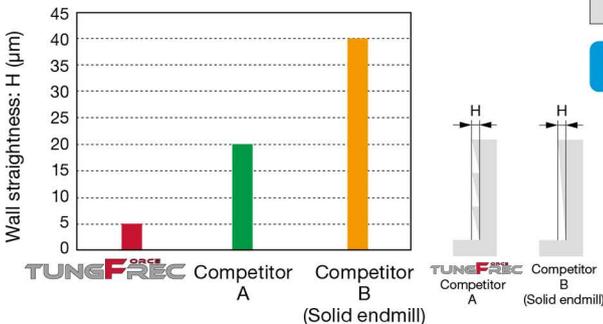


- M2 screws reduce screw neck shears under high cutting forces. Large-sized screws enhances insert fixture and facilitates handlings.



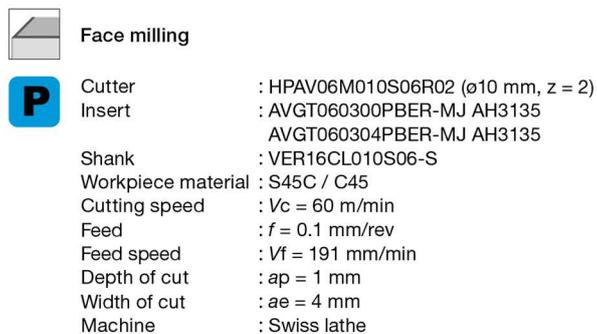
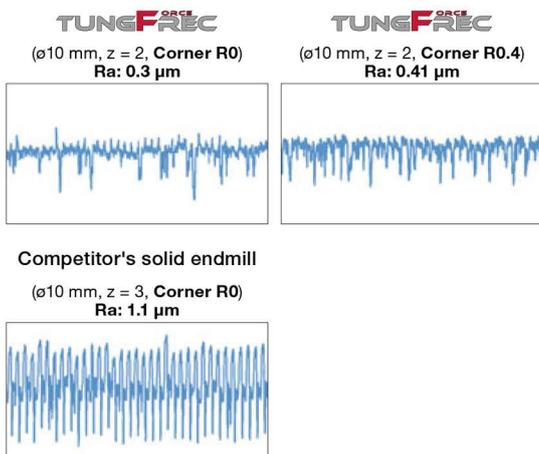
### CUTTING PERFORMANCE

#### Wall straightness: Carbon steel



TungForce-Rec has achieved the best wall finish quality.

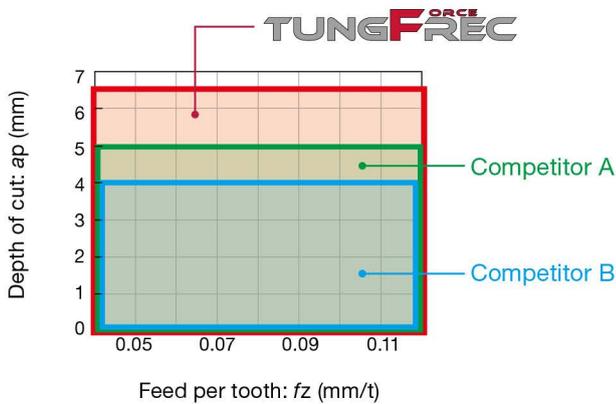
#### Surface roughness comparison (in machining steel)



R0 insert achieved better surface quality than solid endmill.

## Tungaloy Report No. 506-G

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



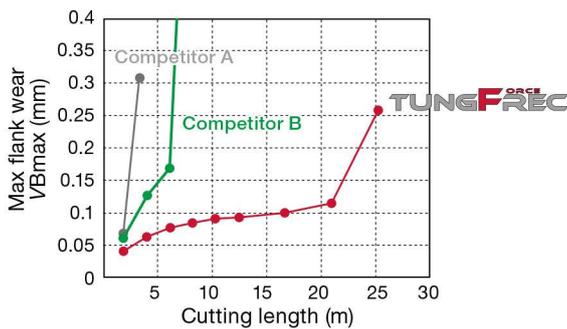
Slotting

Cutter : EPAV06M010C10.0R02 (ø10 mm)  
 Insert : AVGT060302PBER-MJ AH3135  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 270$  m/min  
 Cutting width :  $a_e = 10$  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

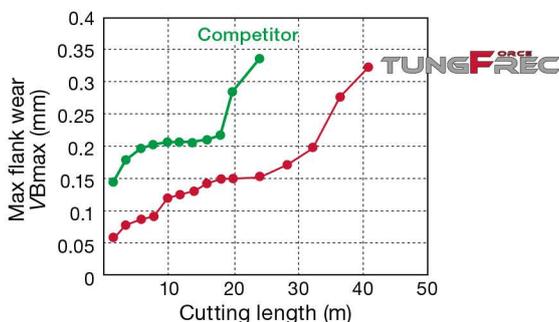


Shoulder milling

Cutter : EPAV06M010C10.0R02 (ø10 mm, z = 2)  
 Insert : AVGT060302PBER-MJ AH3135  
 Cutting speed :  $V_c = 260$  m/min  
 Feed per tooth :  $f_z = 0.07$  mm/t  
 Depth of cut :  $a_p = 3$  mm  
 Cutting width :  $a_e = 2.9$  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 :  $V_c = 80$  m/min  
 Feed per tooth :  $f_z = 0.08$  mm/t  
 Depth of cut :  $a_p = 5$  mm  
 Cutting width :  $a_e = 5$  mm  
 Coolant : Wet  
 Machine : Vertical M/C, BT40, 18.5 kW

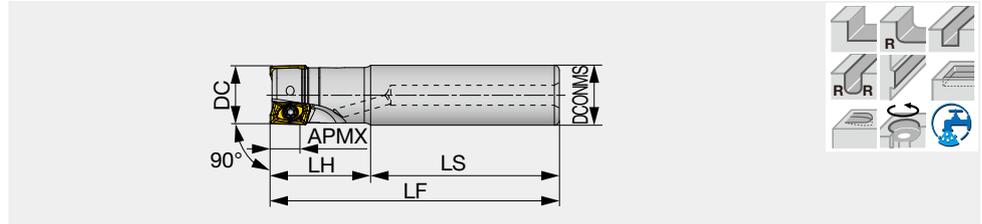
**Highly wear resistant in a wet cutting, AH130 has dramatically improved the tool life.**

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



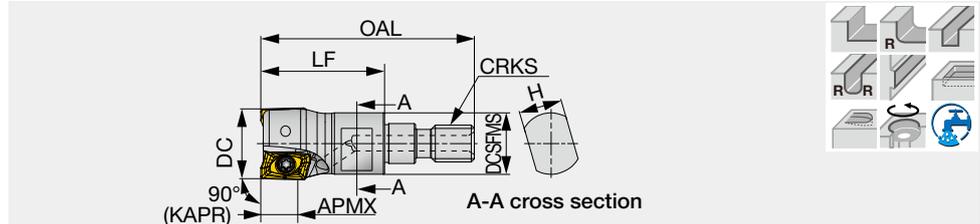
Designation	Clamping screw	Lubricant	Wrench
EPAV06M...	CSPB-2H	M-1000	IP-6DB

\*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



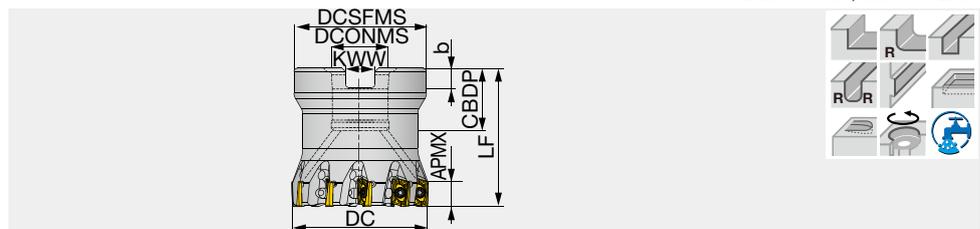
Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

\*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

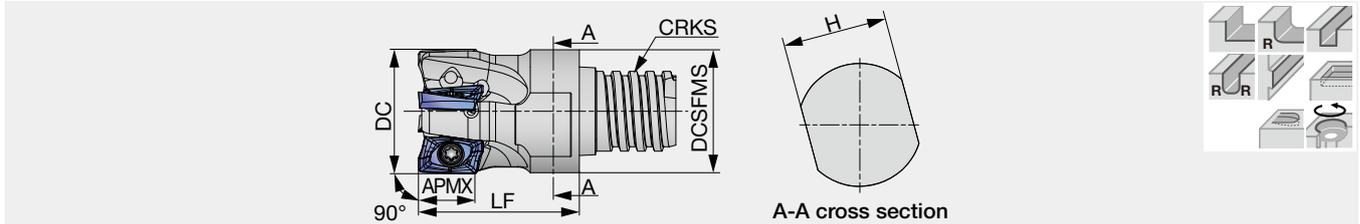
\*Recommended clamping torque (N·m): CSPB-2H = 0.7

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°



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

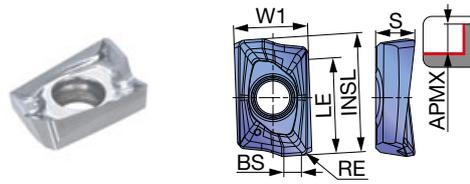
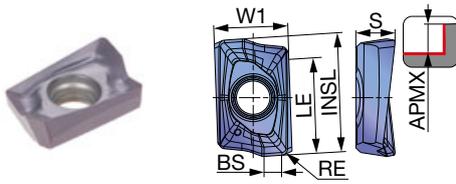
Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

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

## INSERT

### AVGT06-MJ (for general purpose)

### AVGT06-AJ (for non-ferrous machining)



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

★ : First choice  
☆ : Second choice

Chipbreaker	Designation	RE	APMX	Coated				Carbide	W1	INSL	S	BS	LE
				AH120	AH130	AH3135	AH3225	KS05F					
General-purpose <b>MJ</b>	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 <b>AJ</b>	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

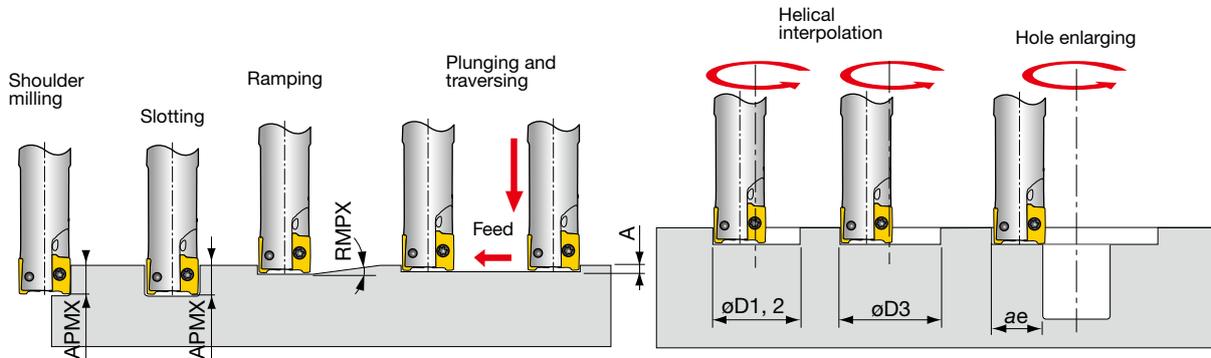
● : Line up

## STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed Vc (m/min)	Feed per tooth fz (mm/t)
<b>P</b>	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
<b>M</b>	Stainless steel SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-3, etc.	-	First choice	AH3135	150 - 220	0.06 - 0.1
<b>K</b>	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
<b>N</b>	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
<b>S</b>	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
<b>H</b>	Hardened steel	SKD61, X40CrMoV5-1, etc.	First choice	AH120	45 - 70	0.04 - 0.08
		SKD11, X153CrMoV12, etc.	First choice	AH120	40 - 65	0.04 - 0.06

Insert size 06

## MACHINING APPLICATIONS



Designation	DC	Max. depth of cut		Max. ramping angle	Max. plunging	Min. machining		Max. machining		Max. cutting width in enlarging
		APMX	RMPX			øD1	øD2	øD3*	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

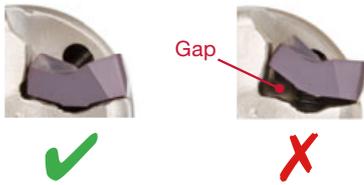
### Estimation of chip thickness - calculated from feed per tooth (fz) and cutting width (ae) data

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

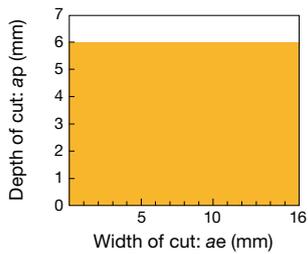
## CAUTION

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



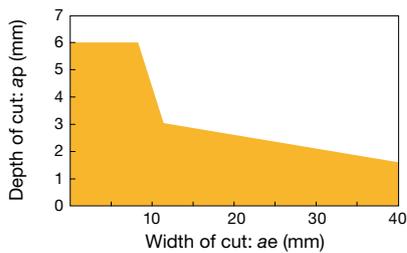
- When using a cutter diameter over 18 mm, please note that the applicable range of cutting depth significantly drops as the cutting width applied increases, thus an additional finishing process may be required.

### Cutting depth in relation to cutting width (for up to $\phi 16$ mm)



Cutter : EPAV06M016C16.0R04 ( $\phi 16$  mm, z = 4)  
Insert : AVGT060304PBER-MJ AH3135  
Workpiece material : S55C / C55  
Cutting speed :  $V_c = 250$  m/min  
Feed per tooth :  $f_z = 0.07$  mm/t  
Machining : Slotting  
Coolant : Dry  
Machine : Vertical M/C, BT40, 18.5 kW

### Cutting depth in relation to cutting width (for $\phi 18$ mm and up)



Cutter : EPAV06M032C32.0R08 ( $\phi 32$  mm, z = 8)  
Insert : AVGT060304PBER-MJ AH3135  
Workpiece material : S55C / C55  
Cutting speed :  $V_c = 250$  m/min  
Feed per tooth :  $f_z = 0.07$  mm/t  
Coolant : Dry  
Machine : Vertical M/C, BT40, 18.5 kW



Insert size 12

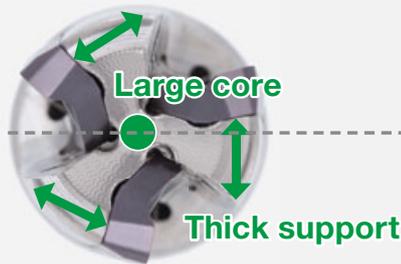
## Extreme productivity and part quality

### High productivity and stability

Robust and high-density cutter body design

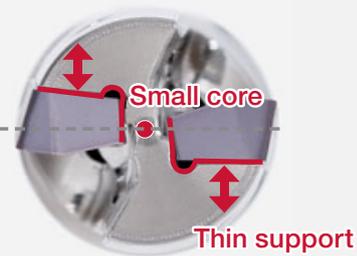


The use of V-shaped insert bottom allows the cutter to retain a **large core and thick supporting material** for high tool rigidity



### Conventional

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



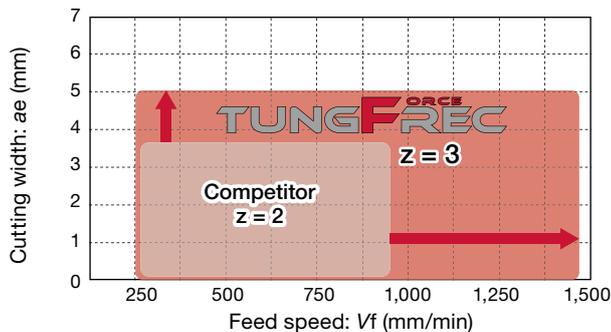
**High cutter density x high rigidity tool design = super high feed shouldering**

### Comparison of cutters' insert-per-diameter density

Tool dia. (mm)	No. of inserts		Competitor	Productivity improvement compared to competitor
	TUNG <sup>ORCE</sup> REC Coarse pitch	TUNG <sup>ORCE</sup> REC 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

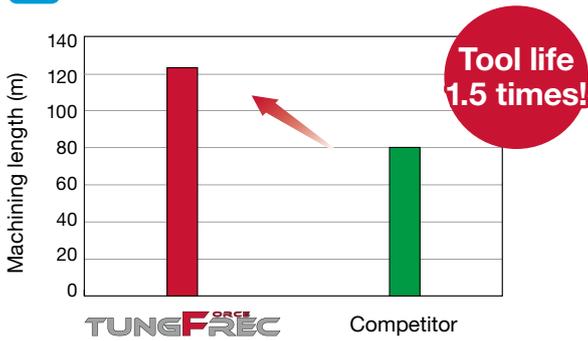


Cutter : EPV12M016C16.0R03 (ø16 mm, z = 3)  
 Insert : AVMT120408PBER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 160$  m/min  
 Feed per tooth :  $f_z = 0.12$  mm/t  
 Depth of cut :  $a_p = 9$  mm  
 Overhang length : 35 mm  
 Coolant : Dry

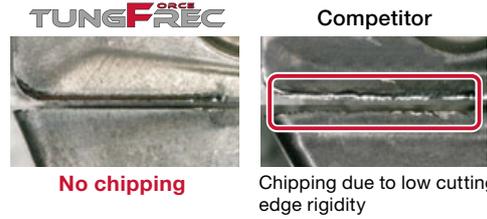
**TungForce-Rec enables high efficiency machining of up to 1.4x greater cutting width at a maximum of 1.5x faster table feed.**

## ■ Tool life comparison

### P S55C / C55



Insert wear modes after machining 80 meters



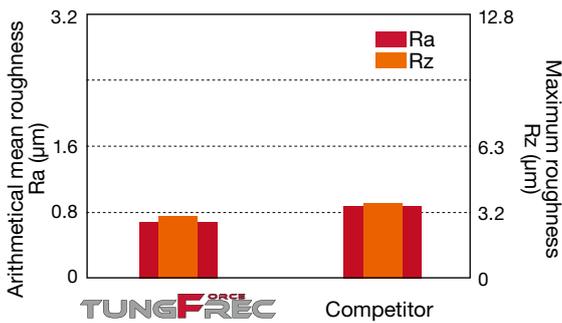
#### Shoulder milling

Cutter : EPAV12M020C20.0R03 ( $\phi 20$  mm,  $z = 3$ )  
 Insert : AVMT120408PBER-MM AH3225  
 Cutting speed :  $V_c = 180$  m/min  
 Feed per tooth :  $f_z = 0.12$  mm/t  
 Depth of cut :  $a_p = 6$  mm  
 Cutting width :  $a_e = 6$  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

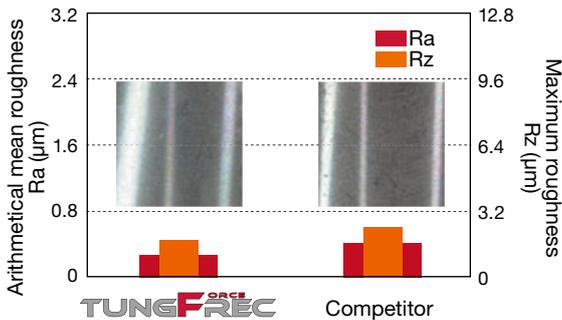
### Surface finishing



#### Face milling

**P** Cutter : EPAV12M020C20.0R03 ( $\phi 20$  mm,  $z = 3$ )  
 Insert : AVMT120408PBER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 180$  m/min  
 Feed per tooth :  $f_z = 0.1$  mm/t  
 Depth of cut :  $a_p = 1$  mm  
 Cutting width :  $a_e = 16$  mm  
 Coolant : Dry

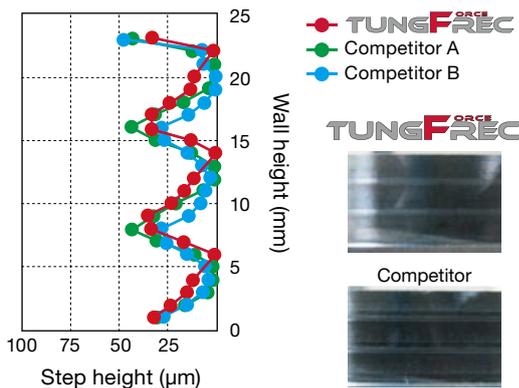
**Better surface quality vs the competitor.**



**N** Cutter : EPAV12M020C20.0R03 ( $\phi 20$  mm,  $z = 3$ )  
 Insert : AVGT120408PDFR-AM KS05F  
 Workpiece material : ADC12  
 Cutting speed :  $V_c = 800$  m/min  
 Feed per tooth :  $f_z = 0.1$  mm/t  
 Depth of cut :  $a_p = 2$  mm  
 Cutting width :  $a_e = 16$  mm  
 Coolant : Wet (Internal)

**Better surface quality vs the competitor.**

### Wall finishing



#### Shoulder milling

**P** Cutter : EPAV12M020C20.0R03 ( $\phi 20$  mm,  $z = 3$ )  
 Insert : AVMT120408PBER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 180$  m/min  
 Feed per tooth :  $f_z = 0.1$  mm/t  
 Depth of cut :  $a_p = 8$  mm  
 Cutting width :  $a_e = 3$  mm  
 Coolant : Dry

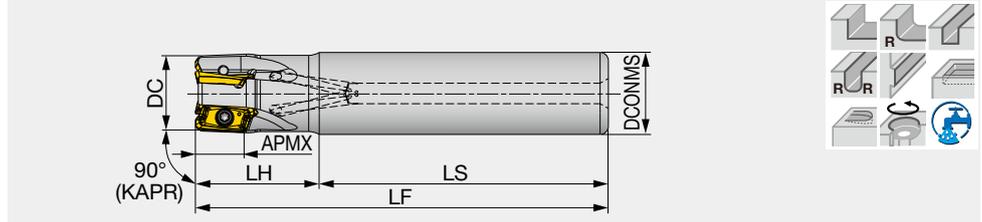
**Equal or better wall step than competitors.**

## 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



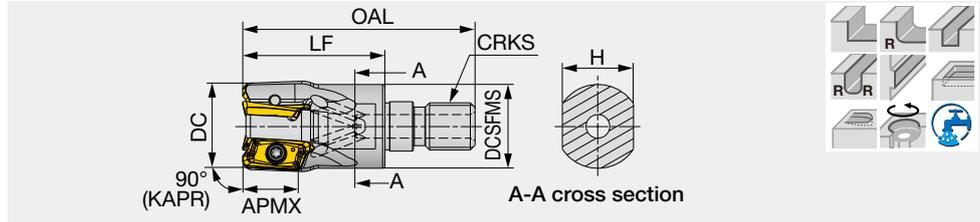
Designation	Clamping screw	Wrench
EPAV12M012C12.0R01	CSPB-2.5	IP-8D
EPAV12M016C16.0R02	CSPB-2.5	IP-8D
EPAV12M016C16.0R03	CSPB-2.5S	IP-8D
EPAV12M016C16.0R02L	CSPB-2.5	IP-8D
EPAV12M020C20.0R03	CSPB-2.5	IP-8D
EPAV12M020C20.0R04	CSPB-2.5S	IP-8D
EPAV12M020C20.0R02L	CSPB-2.5	IP-8D
EPAV12M025C25.0R04	CSPB-2.5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

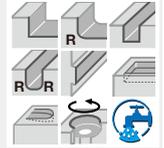
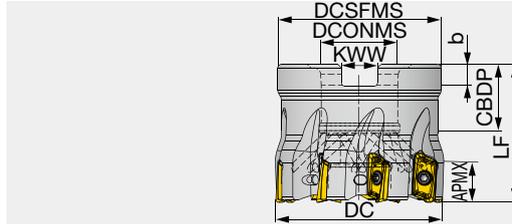
\*Recommended clamping torque (N·m): CSPB-2.5, CSPB-2.5S = 1.3

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

# INSERT

## AVMT12-MM (for general purpose)

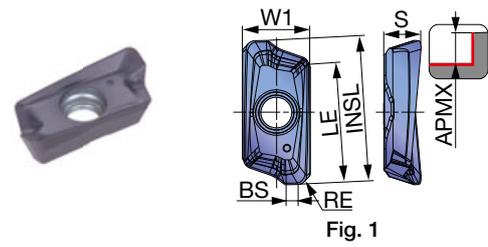


Fig. 1

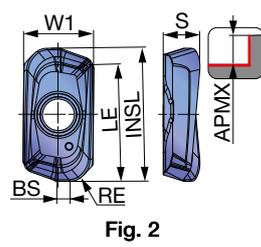


Fig. 2

## AVGT12-AM (for non-ferrous machining)

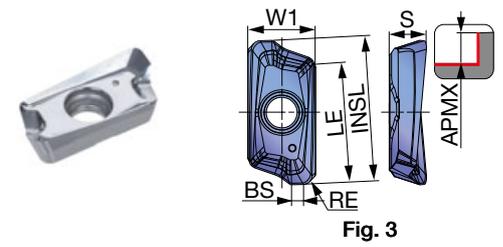


Fig. 3

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

★ : First choice  
☆ : Second choice

Chipbreaker	Designation	RE	APMX	Coated					Carbide		W1	INSL	S	BS	LE	Fig.
				AH120	AH3225	AH8015	T1215	T3225	KS05F							
General-purpose <b>MM</b>	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
	<b>New</b> AVMT120410PDER-MM	1	11.5		●	●					6.6	14.2	3.6	0.9	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 <b>AM</b>	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

● : New product  
● : Line up

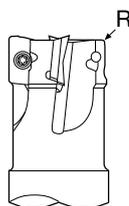
Insert size 12

## 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, AH8015	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, AH8015	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, AH8015	20 - 60	0.04 - 0.15	
	Superalloys Inconel 718, etc.	- 40 HRC	First choice	AH120, AH8015	20 - 40	0.04 - 0.15	
H	Hardened steel	SKD61, X40CrMoV5-1, etc.	40 - 50 HRC	First choice	AH120, AH8015	50 - 150	0.04 - 0.07
		SKD11, X153CrMoV12, etc.	50 - 60 HRC	First choice	AH120, AH8015	40 - 70	0.04 - 0.07

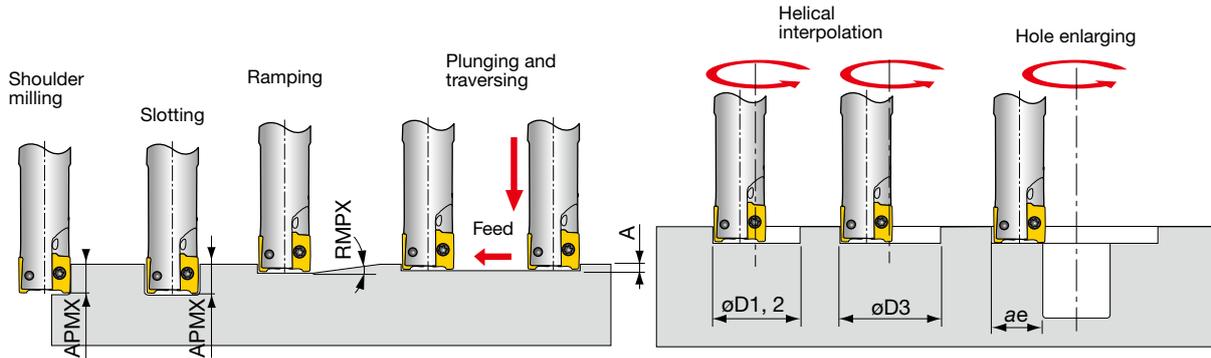
### Cautionary point in modifying cutter bodies

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		Max. plunging	Min. machining	Max. machining		Max. cutting width in enlarging
		APMX	RMPX			$\phi D1$	$\phi D3^*$	
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



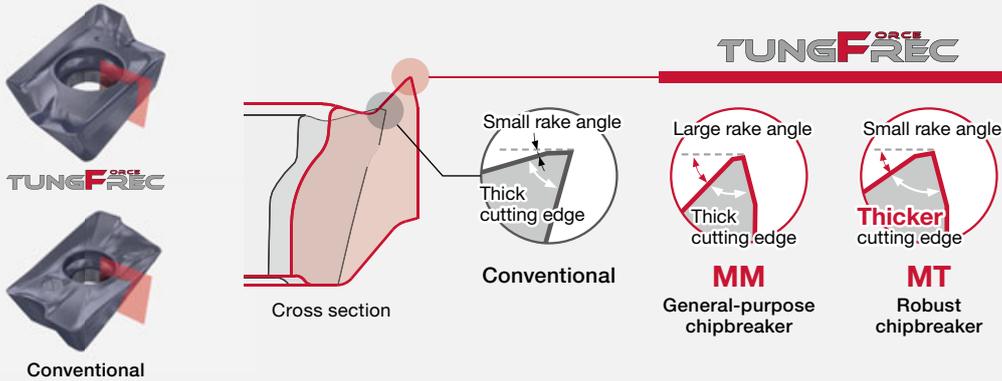
Insert size 18

## Introducing strong Size 18 insert for unparalleled stability

### Enhanced tool stiffness

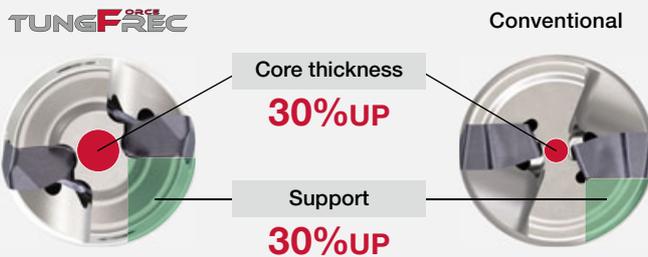
#### 1 Strong insert design

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.



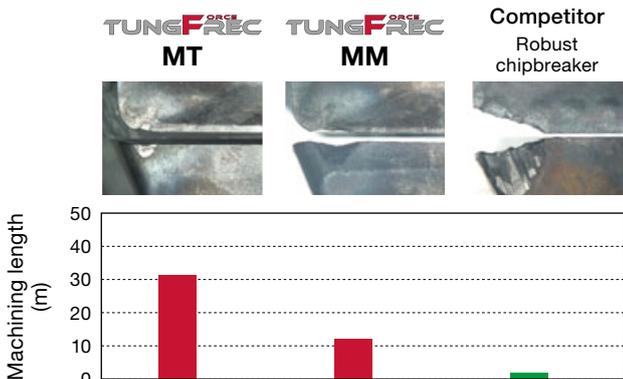
#### 3 Secure insert clamping

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



## CUTTING PERFORMANCE

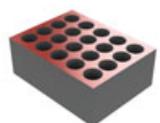
### Cutting edge strength comparison



#### Shoulder milling

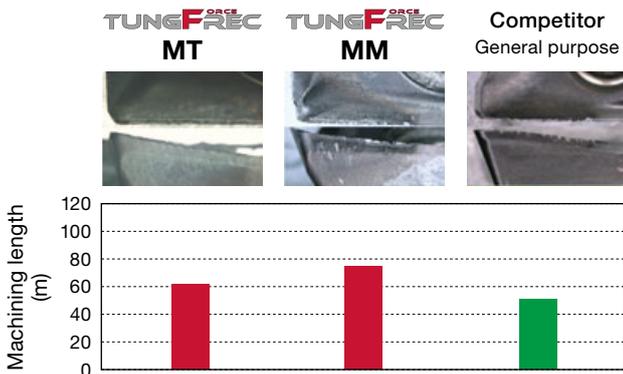


**Cutter** : TPAV18M050B22.0R05 (ø50 mm, z = 5)  
**Insert** : AVMT180708PDER-MM AH3225  
 AVMT180708PDER-MT AH3225  
**Workpiece material** : SCM440 / 42CrMo4 (250 HB), Interrupted cuts  
**Cutting speed** :  $V_c = 160$  m/min  
**Feed per tooth** :  $f_z = 0.2$  mm/t  
**Depth of cut** :  $a_p = 2$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

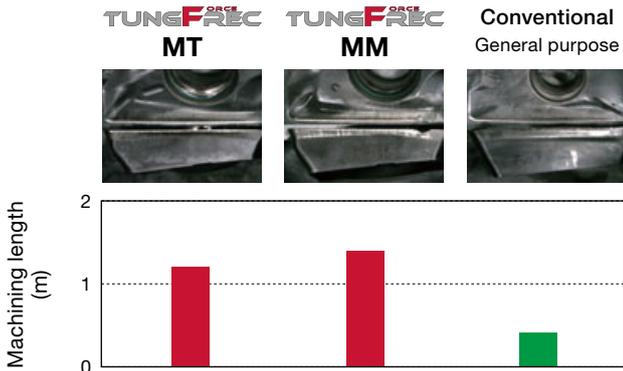


### Shoulder milling



Cutter : TPAV18M050B22.0R05 ( $\phi 50$  mm,  $z = 5$ )  
 Insert : AVMT180708PDER-MM AH3225  
 AVMT180708PDER-MT AH3225  
 Workpiece material: S55C / C55  
 Cutting speed :  $V_c = 160$  m/min  
 Feed per tooth :  $f_z = 0.2$  mm/t  
 Depth of cut :  $a_p = 2$  mm  
 Width of cut :  $a_e = 35$  mm  
 Coolant : Dry  
 Performed with only one insert on the cutter

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

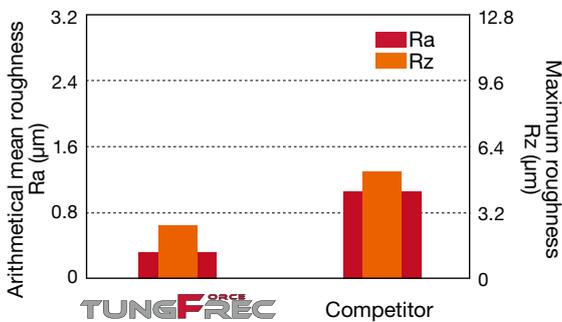


Cutter : TPAV18M050B22.0R05 ( $\phi 50$  mm,  $z = 5$ )  
 Insert : AVMT180708PDER-MM AH8015  
 AVMT180708PDER-MT AH8015  
 Workpiece material: Inconel 718 (38 HRC)  
 Cutting speed :  $V_c = 15$  m/min  
 Feed per tooth :  $f_z = 0.08$  mm/t  
 Depth of cut :  $a_p = 15$  mm  
 Width of cut :  $a_e = 10$  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



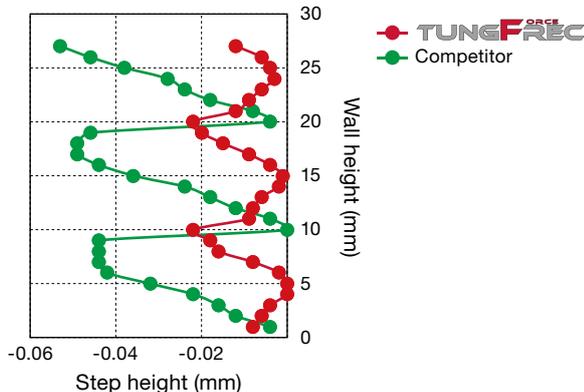
### Face milling



Cutter : TPAV18M050B22.0R05 ( $\phi 50$  mm,  $z = 5$ )  
 Insert : AVMT180708PDER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 120$  m/min  
 Feed per tooth :  $f_z = 0.15$  mm/t  
 Depth of cut :  $a_p = 15$  mm  
 Cutting width :  $a_e = 20$  mm  
 Coolant : Dry

**Better surface quality vs the competitor.**

### Wall finishing



### Shoulder milling



Cutter : TPAV18M050B22.0R05 ( $\phi 50$  mm,  $z = 5$ )  
 Insert : AVMT180708PDER-MM AH3225  
 Workpiece material : S55C / C55  
 Cutting speed :  $V_c = 120$  m/min  
 Feed per tooth :  $f_z = 0.15$  mm/t  
 Depth of cut :  $a_p = 15$  mm  
 Cutting width :  $a_e = 20$  mm  
 Coolant : Dry

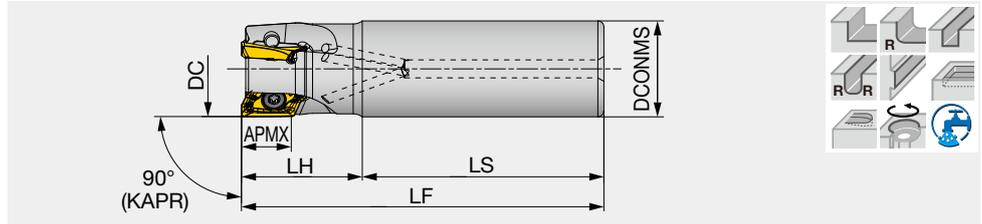
**Better wall step than the competitor.**

## Insert size 18

### 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



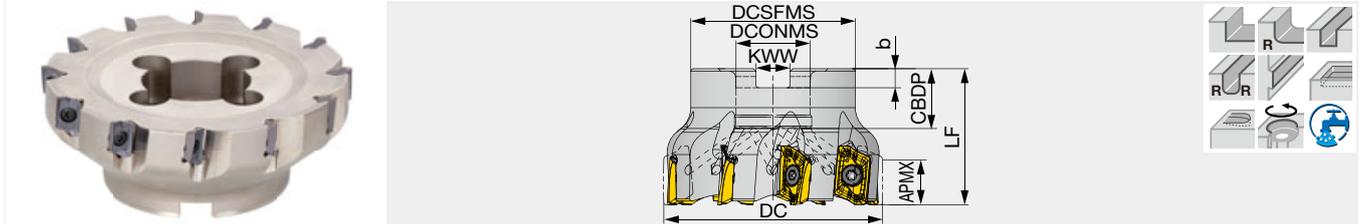
Designation	Clamping screw	Grip (Optional)	Torx bit (Optional)
EPAV18M025C25.0R02	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M025C25.0R02L	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M030C25.0R03	CSTB-5L085	(H-TB2W)	(BT20S)
EPAV18M030C25.0R02L	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M032C32.0R02	CSTB-5	(H-TB2W)	(BT20S)
EPAV18M032C32.0R03	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

## 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

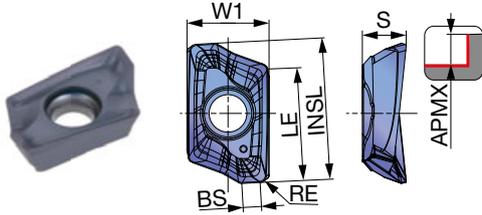
Designation	Clamping screw	Grip (Optional)	Torx bit (Optional)	Shell locking bolt
TPAV18M040B16.0R05	CSTB-5S	(H-TB2W)	(BT20S)	FSHM8-30H
TPAV18M050B22.0R05	CSTB-5	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M050B22.0R07	CSTB-5S	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M063B22.0R06	CSTB-5	(H-TB2W)	(BT20S)	CM10x30H
TPAV18M063B22.0R08	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

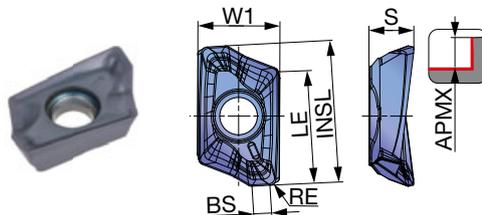
Insert size 18

## INSERT

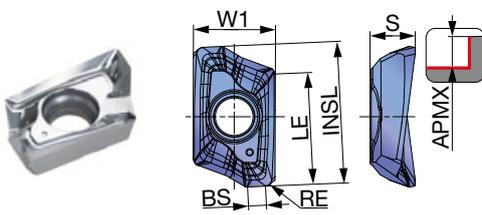
### AVMT18-MM (for general purpose)



### 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			Carbide		W1	INSL	S	BS	LE
				AH3225	AH8015	T1215	KS05F						
General-purpose <b>MM</b>	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 <b>MT</b>	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 <b>AM</b>	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

● : Line up

## 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. SKD11, X153CrMoV12, etc.	40 - 50 HRC	First choice	AH8015	50 - 150	0.04 - 0.07	0.05 - 0.1	-
		50 - 60 HRC	First choice	AH8015	40 - 70	0.04 - 0.07	0.05 - 0.1	-

Insert size 18

Estimation of chip thickness - calculated from feed per tooth ( $f_z$ ) and cutting width ( $a_e$ ) data

## MM chipbreaker

Recommended chip thickness

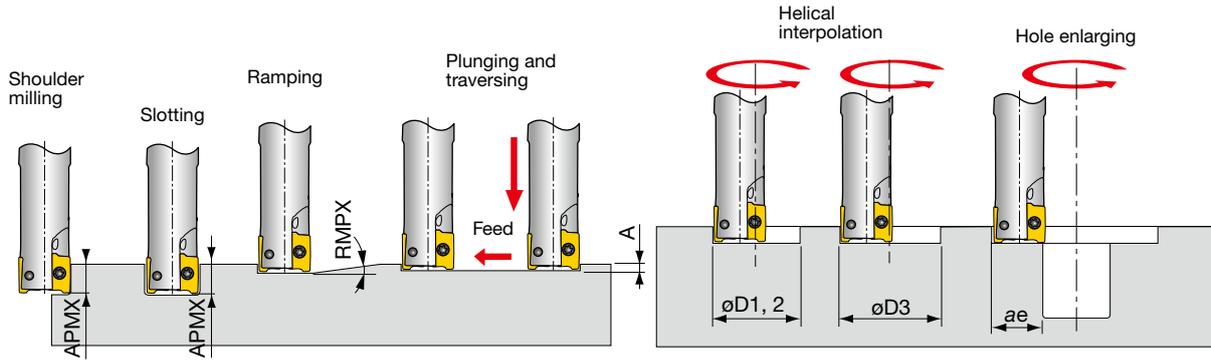
Feed per tooth $f_z$ (mm/t)	Cutting width (%): $a_e$ (mm) / Tool dia.: DC (mm)														
	1%	2%	2.5%	3%	4%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50% -
0.03	0.006	0.008	0.009	0.01	0.012	0.013	0.018	0.021	0.024	0.026	0.027	0.029	0.029	0.03	0.03
0.05	0.01	0.014	0.016	0.017	0.02	0.022	0.03	0.036	0.04	0.043	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

## MT chipbreaker

Recommended chip thickness

Feed per tooth $f_z$ (mm/t)	Cutting width (%): $a_e$ (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

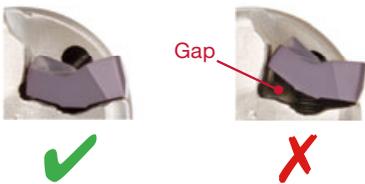
# MACHINING APPLICATIONS

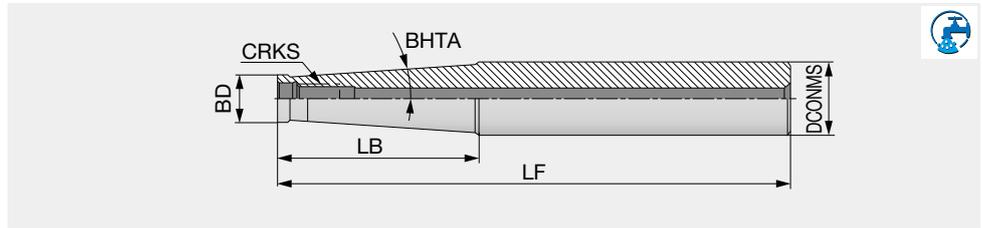


Designation	DC	Max. depth of cut		Max. ramping angle	Max. plunging	Min. machining		Max. machining		Max. cutting width in enlarging
		APMX	RMPX			$\phi D1$	$\phi D2$	$\phi D3^*$	$ae$	
EPAV18M025...	25	16.5	4.5	1	40	49	48	24		
EPAV18M030...	30	16.5	3	1	50	59	58	29		
EPAV18M032...	32	16.5	3	1	54	63	62	31		
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		

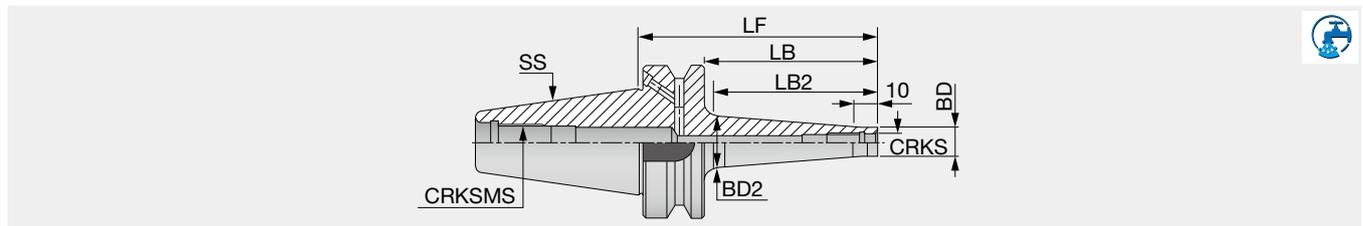
\*Flat bottom hole

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



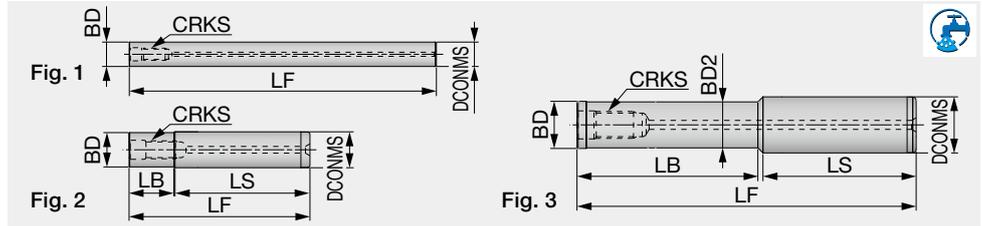


Designation	DCONMS	BD	LF	LB	BHTA	CRKS
SM06-L60C10	10	9.7	60	20	0°	M6
SM06-L105-C12	12	9.7	105	60	1.2°	M6
SM06-L125-C16	16	9.7	125	60	3.3°	M6
SM08-L73C16	16	13	73	25	0°	M8
SM08-L128-C16	16	13	128	80	0.9°	M8
SM08-L170-C20	20	13	170	66.8	3.3°	M8
SM10-L80-C20	20	18	80	30	0°	M10
SM10-L130-C20	20	18	130	80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



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 <sup>(1)</sup>	50	M12	23	40	144	106	100	M24
BT50ODP12X194 <sup>(1)</sup>	50	M12	23	40	194	156	150	M24
BT50ODP12X244 <sup>(1)</sup>	50	M12	23	46	244	206	200	M24
BT50ODP16X94 <sup>(1)</sup>	50	M16	29	34	94	56	50	M24
BT50ODP16X144 <sup>(1)</sup>	50	M16	29	40	144	106	100	M24
BT50ODP16X194 <sup>(1)</sup>	50	M16	29	55	194	156	150	M24
BT50ODP16X244 <sup>(1)</sup>	50	M16	29	60	244	206	200	M24

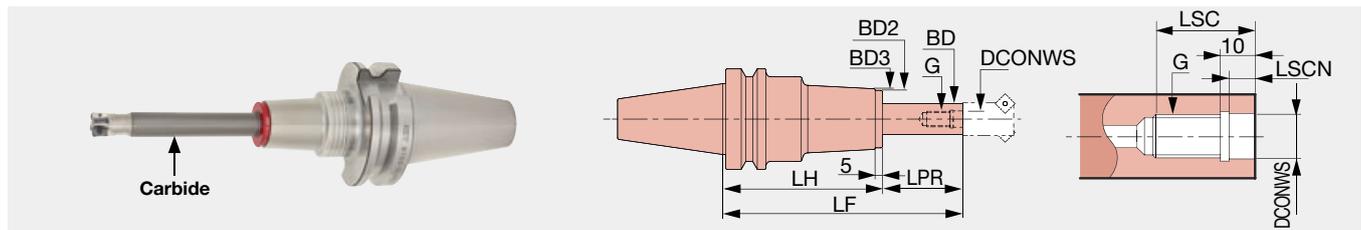
Applicable for 10 MPa pressure coolant  
 (1) Balanced to G6.3 at 12,000 min<sup>-1</sup>



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

## 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

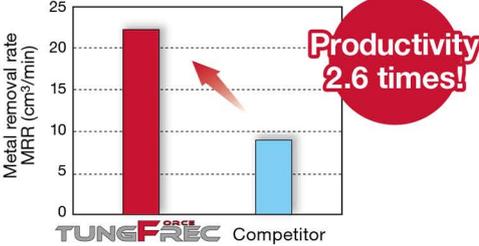
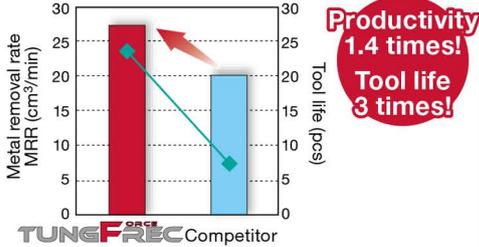
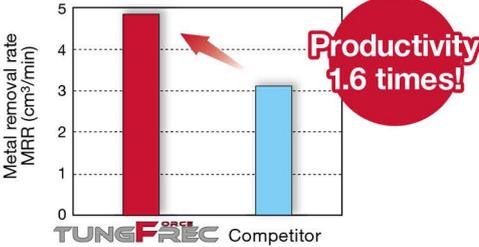
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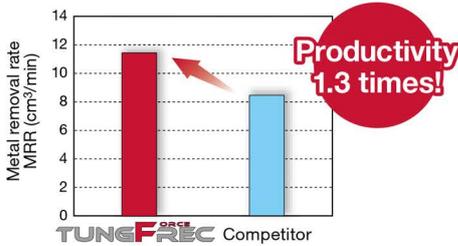
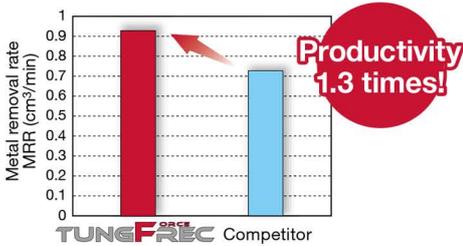
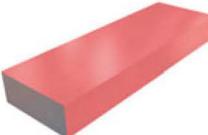
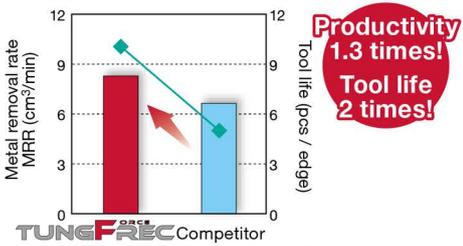
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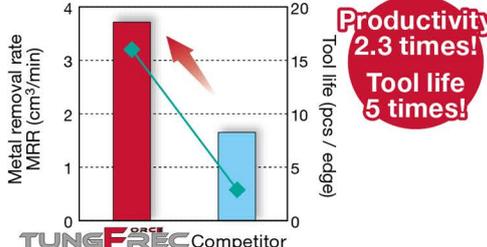
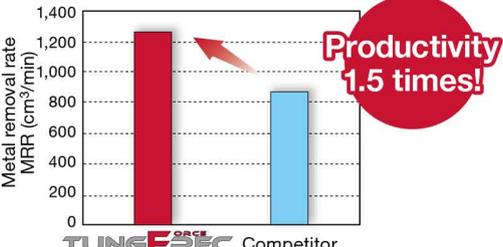
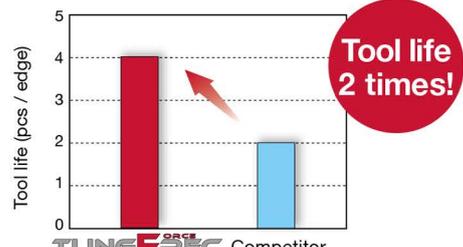
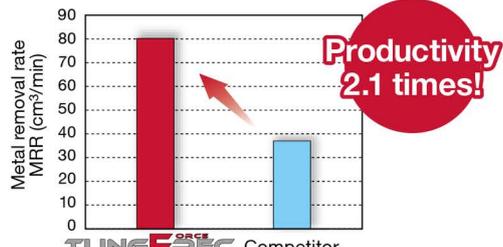
### PRACTICAL EXAMPLES

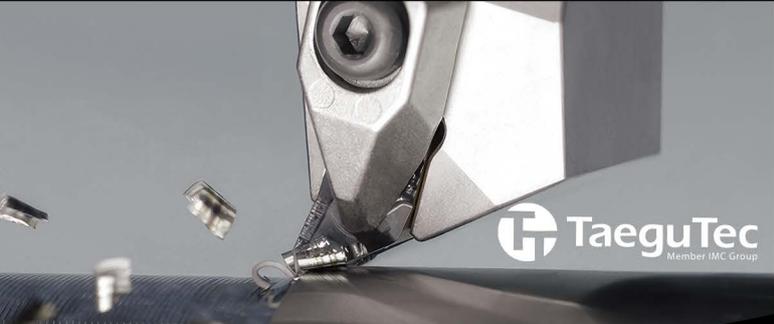
Workpiece type		Machine parts	Machine parts	
Cutter		EPAV04M008C08.0R02 (ø8 mm, z=2)	EPAV04M008C08.0R02L (ø8 mm, z=2)	
Insert		AVMT040204PPER-MM	AVMT040204PPER-MM	
Grade		AH3225	AH3225	
Workpiece material		SUS304 / X5CrNiMo18-9	S50C / C50	
		 <b>M</b>	 <b>P</b>	
Cutting conditions	Cutting speed : Vc (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	 <p><b>Machining time 1/3!</b></p> <p>TungForce-Rec endmill with high rigidity shortened the machining time to 1/3 compared to the solid endmill.</p>		 <p><b>Productivity 2.6 times!</b></p> <p>TungForce-Rec endmill machines with 2.6 times higher productivity due to the incredible rigidity.</p>	
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)	
		 <b>P</b>	 <b>P</b>	
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	 <p><b>Productivity 1.4 times!</b> <b>Tool life 3 times!</b></p> <p>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.</p>		 <p><b>Productivity 1.6 times!</b></p> <p>The sharp cutting edge geometry has enabled smoother, vibration-free cutting at higher parameters even on a low rigidity machine.</p>	

# TUNGFORCE REC

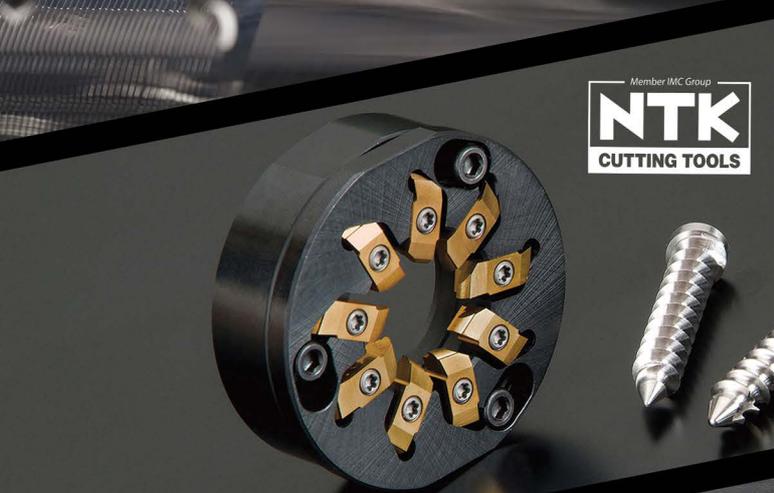
### PRACTICAL EXAMPLES

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	
		 <b>S</b>	 <b>M</b>	
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	 <p>High wear and fracture resistant, AH130 has enabled a high M.R.R. with stability, eliminating premature insert failures.</p>		 <p>Enhanced machining stability has improved the MRR at high cutting parameters.</p>	
	<p>Workpiece type</p> <p>Cutter</p> <p>Insert</p> <p>Grade</p>		<p>Turbine blade</p> <p>Cutter</p> <p>Insert</p> <p>Grade</p>	
Workpiece material		NAK80 / Prehardened steel	SUS316L / 316L	
		 <b>P</b>	 <b>M</b>	
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	 <p>Thanks to dense number of teeth and robust cutting edge, TungForce-Rec offered high productivity without chipping.</p>		 <p>Thanks to light cutting action and robust cutting edge, TungForce-Rec offered high productivity without chattering and chipping.</p>	

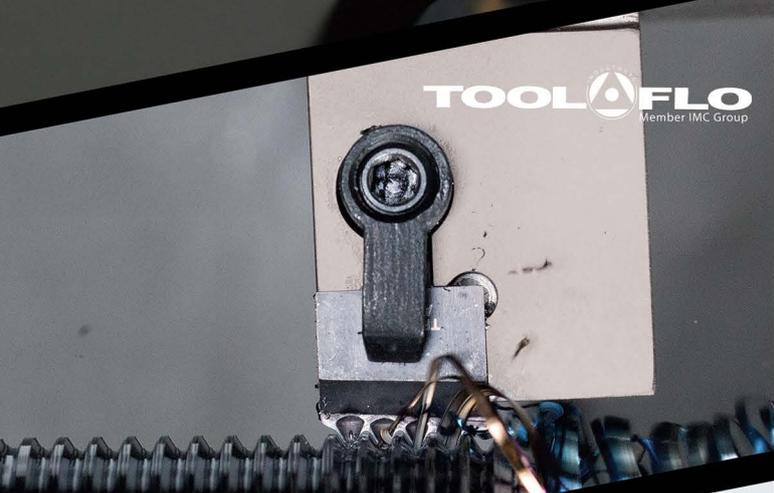
Workpiece type		Parts for power generation	Machine parts
Cutter		EPAV12M025C25.0R06 (ø25 mm, z = 6)	TPAV12M050B22.0R12 (ø50 mm, z = 12)
Insert		AVMT120420PDER-MM	AVGT120408PDFR-AM
Grade		AH120	KS05F
Workpiece material		Hastelloy X	Cast aluminium
		 <b>S</b>	 <b>N</b>
Cutting conditions	Cutting speed : 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		 <p><b>Productivity 2.3 times!</b> <b>Tool life 5 times!</b></p> <p>TUNGFORCE-REC Competitor</p> <p>Thanks to light cutting action and rigid cutter body, TungForce-Rec offered high productivity without chattering and chipping.</p>	 <p><b>Productivity 1.5 times!</b></p> <p>TUNGFORCE-REC Competitor</p> <p>Dense number of teeth and rigid tool design allowed TungForce-Rec to offer high productivity in cast aluminium machining.</p>
		<p>Thanks to light cutting action and rigid cutter body, TungForce-Rec offered high productivity without chattering and chipping.</p> <p>Dense number of teeth and rigid tool design allowed TungForce-Rec to offer high productivity in cast aluminium machining.</p>	
Workpiece type		Frame for heavy equipment	Casing
Cutter		TPAV18M050B22.0R05 (ø50 mm, z = 5)	TPAV18M100B32.0R10 (ø100 mm, z = 10)
Insert		AVMT180708PDER-MT	AVMT180708PDER-MM
Grade		AH3225	AH3225
Workpiece material		Alloy steel	SS400 / E275A
		 <b>P</b>	 <b>P</b>
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		 <p><b>Tool life 2 times!</b></p> <p>TUNGFORCE-REC Competitor</p> <p>TungForce-Rec, with its strong cutting edges, provided process security while eliminating edge chipping.</p>	 <p><b>Productivity 2.1 times!</b></p> <p>TUNGFORCE-REC Competitor</p> <p>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.</p>
		<p>TungForce-Rec, with its strong cutting edges, provided process security while eliminating edge chipping.</p> <p>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.</p>	



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