

w w w . t u n g a l o y . c o m



Multi-functional  
high precision cutter



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**MillLine**



**TUNGREC**  
TUNGALOY

Highly productive semi-finish  
milling cutter with  
accurate 90° shoulders

**Tungaloy**  
Member IMC Group

# TUNGREC

TUNGALOY

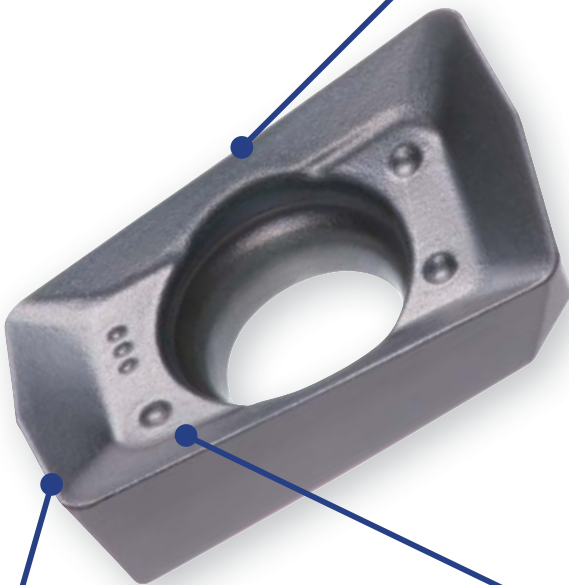
**Highly productive semi-finish milling cutter with accurate 90° shoulders**  
 Helical cutting edges and high axial rake angles provide free cutting.



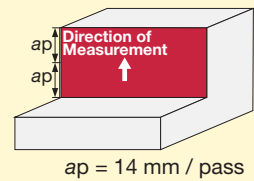
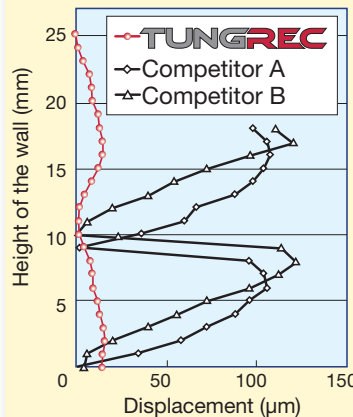
## ● High performance inserts

### Helical cutting edges

**Excellent wall straightness!**



#### ■ Comparison of straightness



Milling cutter : EPO18R025M25.0-02 (ø25, z = 2)  
 Work material : S55C / C55  
 Cutting speed : Vc = 150 m/min  
 Feed per tooth: fz = 0.1 mm/t  
 Depth of cut : ap = 14 mm x 2 passes  
 Width of cut : ae = 5 mm

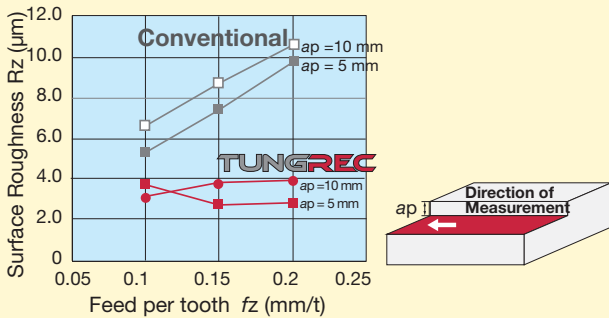
### Wiper edges

**Excellent surface finish!**

### Optimized rake angle

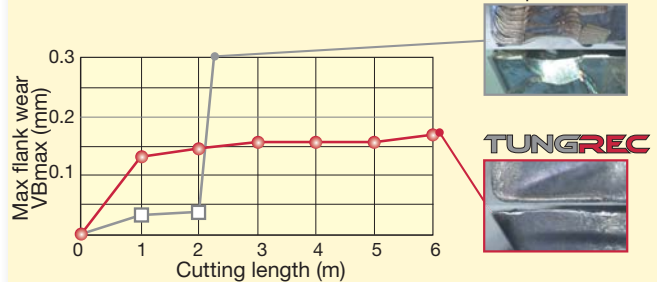
**Provides sharpness and reliability!**

#### ■ Comparison of surface roughness



Milling cutter : EPO18R025M25.0-02 (ø25, z = 2)  
 Work material : S55C / C55  
 Cutting speed : Vc = 150 m/min  
 Depth of cut : ap = 5 mm / 10 mm  
 Width of cut : ae = 20 mm

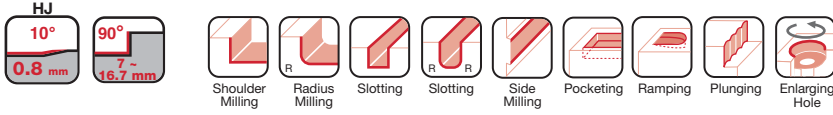
#### ■ Comparison of tool life



Milling cutter : EPO18R025M25.0-02 (ø25, z = 2, only one insert used)  
 Grade : AH140  
 Work material : SUS304 / X5CrNi18-9  
 Cutting speed : Vc = 150 m/min  
 Feed per tooth: fz = 0.15 mm/t  
 Depth of cut : ap = 5 mm  
 Width of cut : ae = 10 mm

## ● High precision shoulder milling cutter

4 types of chipbreakers for a wide range of applications



### ● Chipbreakers

**MJ type**  
for general machining

**P M K S**  
Steel Stainless Cast Iron Superalloys

**MS type**  
for stainless steel machining

**M S**  
Stainless Superalloys

**AJ type**  
for aluminium machining

**N**  
Non-ferrous

**HJ type**  
for high feed machining

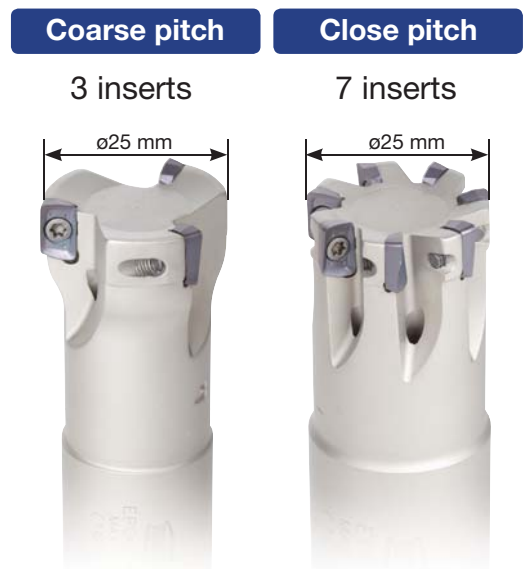
**P M K S**  
Steel Stainless Cast Iron Superalloys

## ● High performance cutter bodies

**Air holes** ➔ For improved chip evacuation!

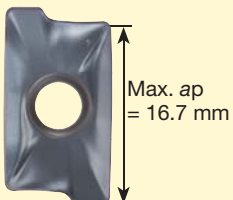
**Coarse pitch, close pitch and long shank cutters available!**

➔ Choice of optimum cutter body for your application!

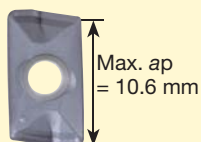


■ Max. depth of cut:  $a_p$  / with MJ chipbreaker

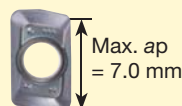
**AOMT18**



**ASMT11**

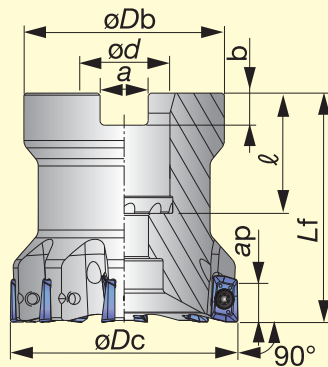


**AOMT07**



## Cutter

### Bore type



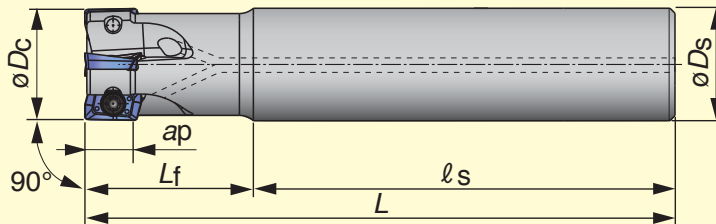
Max. ap:  
MJ = 7 mm  
AJ = 6.4 mm  
HJ = 0.8 mm

#### Parts

Description	Cat. No.
Wrench	T-7DB

Cat. No.	Stock	No. of inserts	Dimensions (mm)							Weight (kg)	Air hole	Center bolt	Clamping screw	Inserts
			* $\phi Dc$	$\phi Db$	$\phi d$	$\ell$	** $L_f$	$b$	$a$					
TPO07R032M16.0E08	●	8	32	30	16	21	40	5.6	8.4	0.1	with	CM8x30H	CSTB-2.5L046	AO□T0702...
TPO07R040M16.0E10	●	10	40	35	16	21	40	5.6	8.4	0.2	with	CM8x30H	CSTB-2.5L046	AO□T0702...
TPO07R050M22.0E12	●	12	50	41	22	22	40	6.3	10.4	0.3	with	CM10x30H	CSTB-2.5L046	AO□T0702...

### Shank type



Max. ap:  
MJ = 7 mm  
AJ = 6.4 mm  
HJ = 0.8 mm

#### Parts

Description	Cat. No.
Wrench	T-7DB

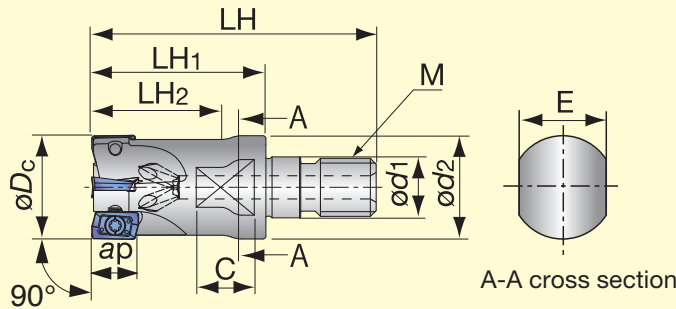
Cat. No.	Stock	No. of inserts	Dimensions (mm)					Weight (kg)	Air hole	Clamping Screw	Inserts
			* $\phi Dc$	$\phi Ds$	$\ell_s$	** $L_f$	** $L$				
EPO07R012M12.0-02	●	2	12	12	50	18	68	0.1	with	CSTB-2.5L046	AO□T0702...
EPO07R012M12.0-02L	●	2	12	12	95	30	125	0.1	with	CSTB-2.5L046	AO□T0702...
EPO07R016M12.0-02	●	2	16	12	50	20	70	0.1	with	CSTB-2.5L046	AO□T0702...
EPO07R016M16.0-02L	●	2	16	16	105	40	145	0.2	with	CSTB-2.5L046	AO□T0702...
EPO07R016M16.0-04	●	4	16	16	60	24	84	0.1	with	CSTB-2.5L046	AO□T0702...
EPO07R018M16.0-02L	●	2	18	16	105	40	145	0.2	with	CSTB-2.5L046	AO□T0702...
EPO07R018M16.0-04	●	4	18	16	60	24	84	0.1	with	CSTB-2.5L046	AO□T0702...
EPO07R020M16.0-03	●	3	20	16	60	30	90	0.1	with	CSTB-2.5L046	AO□T0702...
EPO07R020M20.0-03L	●	3	20	20	135	50	185	0.4	with	CSTB-2.5L046	AO□T0702...
EPO07R020M20.0-05	●	5	20	20	70	30	100	0.2	with	CSTB-2.5L046	AO□T0702...
EPO07R022M20.0-03L	●	3	22	20	135	50	185	0.4	with	CSTB-2.5L046	AO□T0702...
EPO07R022M20.0-05	●	5	22	20	70	30	100	0.2	with	CSTB-2.5L046	AO□T0702...
EPO07R025M20.0-03	●	3	25	20	60	35	95	0.3	with	CSTB-2.5L046	AO□T0702...
EPO07R025M25.0-03L	●	3	25	25	150	70	220	0.7	with	CSTB-2.5L046	AO□T0702...
EPO07R025M25.0-07	●	7	25	25	80	35	115	0.4	with	CSTB-2.5L046	AO□T0702...
EPO07R028M25.0-03L	●	3	28	25	150	70	220	0.7	with	CSTB-2.5L046	AO□T0702...
EPO07R028M25.0-07	●	7	28	25	80	35	115	0.4	with	CSTB-2.5L046	AO□T0702...

\*The  $\phi Dc$  in the above table shows the diameter when MJ and AJ chipbreakers are used. When HJ chipbreaker is used, the tool diameter is equal to the above shown  $\phi Dc + 0.6$  mm.

\*\*The  $L_f$  and  $L$  in the above table show the lengths when MJ chip-breaker is used. When AJ chipbreaker is used, the lengths are equal to  $L_f$ ,  $L + 0.1$  mm. When HJ chipbreaker is used, the lengths are equal to  $L_f$ ,  $L + 0.5$  mm.

● : Stocked items

## Modular type



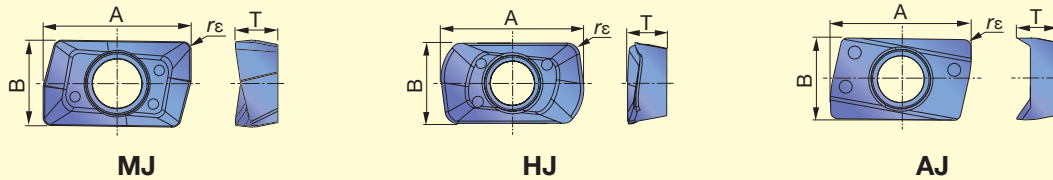
Max. ap:  
 MJ = 7.0 mm  
 HJ = 0.8 mm  
 AJ = 6.4 mm

### Parts

Descriptions	Parts Cat. No.
Clamping screw	<b>CSTB-2.5L046</b>
Wrench	<b>T-7DB</b>

Cat. No.	Stock	No. of Inserts	Dimensions (mm)									Weight (kg)	Air hole	Applicable Insert
			$\phi D_c$	LH	LH1	LH2	C	E	$\phi d_1$	$\phi d_2$	M			
<b>New</b> HPO07R012MM06-02	★	2	12	39.5	25	-	5	7	6.5	9.8	M6	0.01	with	AO□T0702...
HPO07R012MM08-02	●	2	12	42	25	20	8	10	8.5	12.8	M8	0.02	with	AO□T0702...
<b>New</b> HPO07R016MM08-04	★	4	16	42	25	-	8	10	8.5	12.8	M8	0.03	with	AO□T0702...
HPO07R016MM10-04	●	4	16	49	30	20	10	15	10.5	17.8	M10	0.05	with	AO□T0702...
HPO07R020MM10-05	●	5	20	49	30	-	10	15	10.5	17.8	M10	0.06	with	AO□T0702...
HPO07R025MM12-07	●	7	25	57	35	-	10	17	12.5	20.8	M12	0.10	with	AO□T0702...

## Inserts



Cat. No.	Accuracy	Honing	Grades			Dimensions (mm)			
			Coated		Carbide	A	B	T	$r_\epsilon$
			AH725	AH140					
AOMT070202PDPR-MJ	M	with	●	●		8.0	4.7	2.3	0.2
AOMT070204PDPR-MJ	M	with	●	●		8.0	4.7	2.3	0.4
AOMT070208PDPR-MJ	M	with	●	●		8.0	4.7	2.3	0.8
AOMT070216PDPR-MJ	M	with	●	●		8.0	4.7	2.3	1.6
AOMT070208PDPR-HJ	M	with	●	●		8.8	4.9	2.4	0.8
AOGT070204PDFR-AJ	G	without			●	8.1	4.7	2.3	0.4

● : Stocked items  
 ★ : Available in 2015

## Standard cutting conditions

ISO	Workpiece materials	Hardness HB	Grades	Cutting Speed Vc (m/min)	Feed per tooth: fz (mm/t)		
					MJ	HJ	AJ
<b>P</b>	Low carbon steels (S15C / C15E4 etc.)	< 200	<b>AH725</b>	90 - 200	0.05 - 0.1	0.4 - 0.9	-
	High carbon steels and alloyed steels (S55C / C55, SCM440 / 42CrMo4 etc.)	200 - 300	<b>AH725</b>	90 - 150	0.05 - 0.1	0.4 - 0.9	-
	Tool steels (SKD11 / X153CrMoV12 etc.)	150 - 300	<b>AH725</b>	80 - 120	0.05 - 0.1	0.4 - 0.9	-
<b>M</b>	Stainless steels (SUS304 / X5CrNi18-9 etc.)	-	<b>AH140</b>	90 - 150	0.05 - 0.1	0.4 - 0.9	-
<b>K</b>	Grey cast irons (FC250 / 250 etc.)	150 - 250	<b>AH725</b>	100 - 180	0.05 - 0.1	0.4 - 0.9	-
	Ductile cast irons (FCD450 / 450-10S etc.)	150 - 250	<b>AH725</b>	80 - 150	0.05 - 0.1	0.4 - 0.9	-
<b>N</b>	Aluminium alloys (Si < 13%)	-	<b>KS15F</b>	300 - 1000	-	-	0.08 - 0.2
	Aluminium alloys (Si ≥ 13%)	-	<b>KS15F</b>	100 - 200	-	-	0.08 - 0.2
<b>S</b>	Titanium alloys (Ti-6Al-4V etc.)	-	<b>AH725</b>	20 - 50	0.05 - 0.1	0.4 - 0.9	-
	Heat resistant alloys (Inconel718 etc.)	-	<b>AH725</b>	20 - 35	0.05 - 0.08	0.2 - 0.6	-

- To remove excessive chip accumulation use an air blast.
- To avoid build up edge on the cutting edges (aluminium machining), use a water soluble coolant.
- When cutting an interrupted surface or a casted skin, the feed per tooth (fz) should be reduced to the lower recommended value shown in the above table.

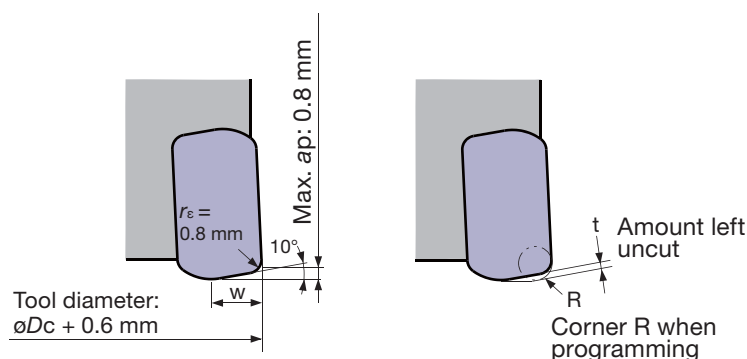
- Cutting conditions are limited by machine power, work piece rigidity, and spindle output. When the cutting width, depth, or overhang length is large, set Vc and fz to the lower recommended values and check the machine power and vibration.

## Cautionary points when using HJ inserts

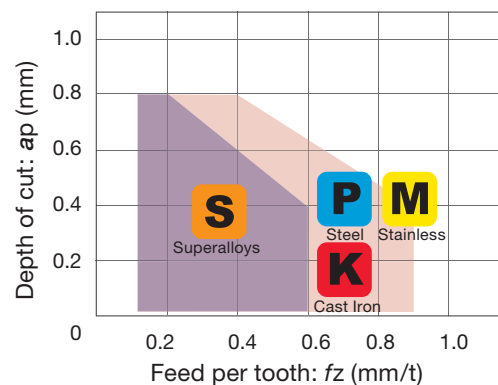
HJ type inserts are designed for high feed machining.

Please note the following when using HJ inserts:

1. The shape of HJ insert differs from that of other inserts (MJ, AJ). However the same insert pocket can be used.
2. When using HJ inserts, all the inserts on the cutter body must be HJ type. Do not use other types of inserts (MJ and AJ types) with HJ inserts on the same cutter body.
3. When using CAD/CAM, please program it as a radius cutter. The table below shows the corner R when programming and the uncut area (t).
4. With HJ inserts, the tool diameter increases by 0.6 mm over the diameter  $\phi D_c$  shown in the table.



## TungRec 07 type HJ inserts Standard conditions



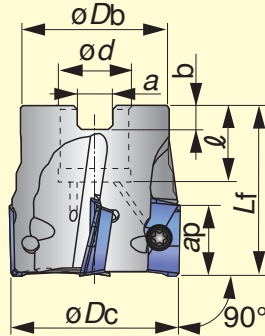
Max. depth of cut max ap (mm)	Main cutting edge length W (mm)	Corner R when programming	Amount left uncut t (mm)
0.8	3.0	R 0.5	0.4
		R 1.0	0.3



# Cutter

Bore type

**NEW**



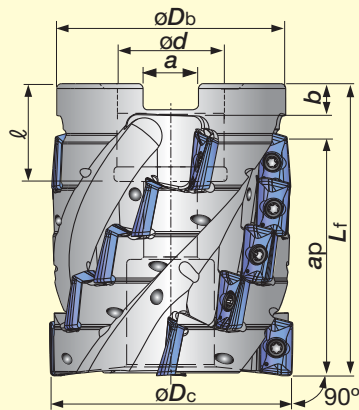
Max.  $ap = 10.6$  mm

Parts

Description	Cat. No.
Wrench	IP-8D

Cat. No.	Stock	No. of inserts	Dimensions (mm)							Weight (kg)	Air hole	Center bolt	Clamping screw	Inserts
			$\phi D_c$	$\phi D_b$	$\phi d$	$\ell$	$L_f$	$b$	$a$					
TPO11R040M16.0E06	★	6	40	35	16	18	40	5.6	8.4	0.21	with	CM8x30H	CSPB-2.5	AS□T11T3...
TPO11R050M22.0E07	★	7	50	45	22	20	40	6.3	10.4	0.35	with	CM10x30H	CSPB-2.5	AS□T11T3...
TPO11R063M22.0E08	★	8	63	47	22	20	45	6.3	10.4	0.59	with	CM10x30H	CSPB-2.5	AS□T11T3...
TPO11R080M25.4-10	★	10	80	58	25.4	26	50	6	9.5	1.07	with	CM12X30H	CSPB-2.5	AS□T11T3...
TPO11R080M27.0E10	★	10	80	58	27	22	50	7	12.4	1.05	with	CM12X30H	CSPB-2.5	AS□T11T3...
TPO11R100M31.75-11	★	11	100	70	31.75	32	63	8	12.7	1.95	with	CM16X40H	CSPB-2.5	AS□T11T3...
TPO11R100M32.0E11	★	11	100	70	32	25	63	8	14.4	2.01	with	CM16X40H	CSPB-2.5	AS□T11T3...
TPS11040RB	▲	6	40	35	16	18	40	5.6	8.2	0.2	with	CM8X30H	CSPB-2.5	AS□T11T3...
TPS11040RB-E	▲	6	40	35	16	19	40	5.6	8.4	0.2	without	CM8X30	CSPB-2.5	AS□T11T3...
TPS11050RB	▲	7	50	41	22	20	40	6	10	0.4	with	CM10X30H	CSPB-2.5	AS□T11T3...
TPS11050RB-E	▲	7	50	41	22	20	40	6.3	10.4	0.4	without	CM10X30	CSPB-2.5	AS□T11T3...
TPS11063RB	▲	8	63	41	22	20	40	6	10	0.6	with	CM10X30H	CSPB-2.5	AS□T11T3...
TPS11063RB-E	▲	8	63	41	22	20	45	6.3	10.4	0.6	without	CM10X30	CSPB-2.5	AS□T11T3...
TPS11080RB	▲	10	80	58	25.4	26	50	6	9.5	1.2	with	CM12X30H	CSPB-2.5	AS□T11T3...
TPS11100RB	▲	11	100	70	31.75	32	63	8	12.7	2.4	with	CM16X40H	CSPB-2.5	AS□T11T3...

Roughing bore type



Parts

Description	Cat. No.	
Cutter	TLS11R...	ELS11R...
Clamping screw	CSPB-2.5	
Wrench	IP-8D	
Center bolt	CM10X40H	-

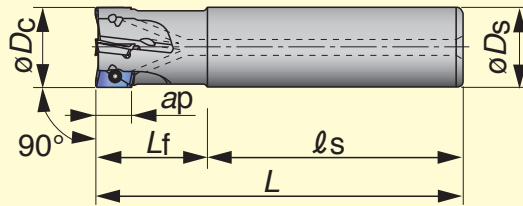
Cat. No.	Stock	No. of eff. edge lines	Dimensions (mm)							Weight (kg)	Air hole	No. of inserts	Inserts	
			$\phi D_c$	$\phi D_b$	$\phi d$	$\ell$	$L_f$	$b$	$a$					Max. $ap$
TLS11R050M22.0E04	●	4	50	47	22	20	60	6.3	10.4	48.8	0.5	with	20	AS□T11T3...

● : Stocked items  
 ★ : Available in 2014  
 ▲ : Discontinued items

## Cutter

### Shank type

**NEW**



Max.  $ap = 10.6$  mm

#### Parts

Description	Cat. No.
Wrench	IP-8D

Cat. No.	Stock	No. of inserts	Dimensions (mm)					Weight (kg)	Air hole	Clamping screw	Inserts
			$\varnothing D_c$	$\varnothing D_s$	$l_s$	$L_f$	$L$				
EPO11R012M16.0-01	●	1	12	16	60	25	85	0.11	with	CSPB-2.5S	AS□T11T3...
EPO11R012M16.0-01L	●	1	12	16	95	30	125	0.16	with	CSPB-2.5S	AS□T11T3...
EPO11R016M16.0-02	●	2	16	16	60	25	85	0.12	with	CSPB-2.5S	AS□T11T3...
EPO11R016M16.0-02L	●	2	16	16	105	40	145	0.2	with	CSPB-2.5S	AS□T11T3...
EPO11R018M16.0-02	★	2	18	16	60	25	85	0.12	with	CSPB-2.5S	AS□T11T3...
EPO11R018M16.0-02L	★	2	18	16	105	40	145	0.21	with	CSPB-2.5S	AS□T11T3...
EPO11R020M20.0-02	●	2	20	20	70	30	100	0.22	with	CSPB-2.5S	AS□T11T3...
EPO11R020M20.0-02L	●	2	20	20	135	50	185	0.41	with	CSPB-2.5S	AS□T11T3...
EPO11R020M20.0-03	●	3	20	20	70	30	100	0.21	with	CSPB-2.5S	AS□T11T3...
EPO11R022M20.0-02	★	2	22	20	70	30	100	0.22	with	CSPB-2.5	AS□T11T3...
EPO11R022M20.0-02L	★	2	22	20	155	30	185	0.42	with	CSPB-2.5	AS□T11T3...
EPO11R022M20.0-03	★	3	22	20	70	30	100	0.22	with	CSPB-2.5	AS□T11T3...
EPO11R025M25.0-02L	●	2	25	25	150	70	220	0.76	with	CSPB-2.5	AS□T11T3...
EPO11R025M25.0-03	●	3	25	25	80	35	115	0.39	with	CSPB-2.5	AS□T11T3...
EPO11R025M25.0-04	●	4	25	25	80	35	115	0.38	with	CSPB-2.5	AS□T11T3...
EPO11R028M25.0-02L	★	2	28	25	185	35	220	0.8	with	CSPB-2.5	AS□T11T3...
EPO11R028M25.0-03	★	3	28	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPO11R028M25.0-04	★	4	28	25	80	35	115	0.39	with	CSPB-2.5	AS□T11T3...
EPO11R030M25.0-02L	★	2	30	25	180	40	220	0.8	with	CSPB-2.5	AS□T11T3...
EPO11R030M25.0-03	★	3	30	25	80	40	120	0.43	with	CSPB-2.5	AS□T11T3...
EPO11R030M25.0-04	★	4	30	25	80	40	120	0.42	with	CSPB-2.5	AS□T11T3...
EPO11R032M32.0-02L	●	2	32	32	175	80	255	1.48	with	CSPB-2.5	AS□T11T3...
EPO11R032M32.0-03	●	3	32	32	80	40	120	0.68	with	CSPB-2.5	AS□T11T3...
EPO11R032M32.0-05	●	5	32	32	80	40	120	0.67	with	CSPB-2.5	AS□T11T3...
EPO11R035M32.0-02L	★	2	35	32	215	40	255	1.49	with	CSPB-2.5	AS□T11T3...
EPO11R035M32.0-03	★	3	35	32	80	40	120	0.69	with	CSPB-2.5	AS□T11T3...
EPO11R035M32.0-05	★	5	35	32	80	40	120	0.67	with	CSPB-2.5	AS□T11T3...
EPO11R040M32.0-02L	★	2	40	32	205	50	255	1.53	with	CSPB-2.5	AS□T11T3...
EPO11R040M32.0-04	●	4	40	32	80	40	120	0.72	with	CSPB-2.5	AS□T11T3...
EPO11R040M32.0-06	●	6	40	32	80	40	120	0.71	with	CSPB-2.5	AS□T11T3...
EPO11R050M32.0-05	●	5	50	32	80	40	120	0.83	with	CSPB-2.5	AS□T11T3...
EPO11R050M32.0-07	●	7	50	32	80	40	120	0.82	with	CSPB-2.5	AS□T11T3...
EPO11R050M42.0-03L	★	3	50	42	310	50	360	3.78	with	CSPB-2.5	AS□T11T3...

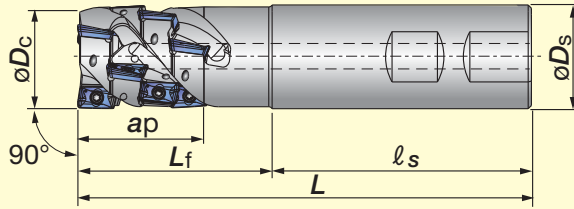
● : Stocked items  
★ : Available in 2014

Cat. No.	Stock	No. of inserts	Dimensions (mm)					Weight (kg)	Air hole	Clamping screw	Inserts
			$\varnothing D_c$	$\varnothing D_s$	$l_s$	$L_f$	$L$				
EPS11012RL	▲	1	12	16	95	30	125	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11012RS	▲	1	12	16	60	25	85	0.1	with	CSPB-2.5S	AS□T11T3...
EPS11012RS-E	▲	1	12	16	55	25	80	0.1	with	CSPB-2.5S	AS□T11T3...
EPS11016RL	▲	2	16	16	105	40	145	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11016RS	▲	2	16	16	60	25	85	0.1	with	CSPB-2.5S	AS□T11T3...
EPS11016RS-E	▲	2	16	16	60	25	85	0.1	with	CSPB-2.5S	AS□T11T3...
EPS11018RL	▲	2	18	16	105	40	145	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11018RS	▲	2	18	16	60	25	85	0.1	with	CSPB-2.5S	AS□T11T3...
EPS11020RL	▲	2	20	20	135	50	185	0.4	with	CSPB-2.5S	AS□T11T3...
EPS11020RS	▲	2	20	20	70	30	100	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11020RSB	▲	3	20	20	70	30	100	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11020RSB-E	▲	3	20	20	60	30	90	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11021RL	▲	2	21	20	135	50	185	0.4	with	CSPB-2.5S	AS□T11T3...
EPS11021RS	▲	2	21	20	70	30	100	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11021RSB	▲	3	21	20	70	30	100	0.2	with	CSPB-2.5S	AS□T11T3...
EPS11025RL	▲	2	25	25	150	70	220	0.8	with	CSPB-2.5	AS□T11T3...
EPS11025RS	▲	3	25	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPS11025RSB	▲	4	25	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPS11025RSB-E	▲	4	25	25	60	35	95	0.4	with	CSPB-2.5	AS□T11T3...
EPS11025RSS20	▲	2	25	20	60	35	95	0.2	with	CSPB-2.5	AS□T11T3...
EPS11026RL	▲	2	26	25	150	70	220	0.8	with	CSPB-2.5	AS□T11T3...
EPS11026RS	▲	3	26	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPS11026RSB	▲	4	26	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPS11030RL	▲	2	30	25	150	70	220	0.9	with	CSPB-2.5	AS□T11T3...
EPS11030RS	▲	3	30	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPS11030RSB	▲	4	30	25	80	35	115	0.4	with	CSPB-2.5	AS□T11T3...
EPS11030RSS20	▲	2	30	20	60	35	95	0.3	with	CSPB-2.5	AS□T11T3...
EPS11032RL	▲	2	32	32	175	80	255	1.5	with	CSPB-2.5	AS□T11T3...
EPS11032RS	▲	3	32	32	80	40	120	0.7	with	CSPB-2.5	AS□T11T3...
EPS11032RSB	▲	5	32	32	80	40	120	0.7	with	CSPB-2.5	AS□T11T3...
EPS11032RSB-E	▲	5	32	32	70	40	110	0.7	with	CSPB-2.5	AS□T11T3...
EPS11032RSS20	▲	2	32	20	60	35	95	0.3	with	CSPB-2.5	AS□T11T3...
EPS11033RL	▲	2	33	32	175	80	255	1.5	with	CSPB-2.5	AS□T11T3...
EPS11033RS	▲	3	33	32	80	40	120	0.7	with	CSPB-2.5	AS□T11T3...
EPS11033RSB	▲	5	33	32	80	40	120	0.7	with	CSPB-2.5	AS□T11T3...
EPS11040RL	▲	2	40	32	205	50	255	1.6	with	CSPB-2.5	AS□T11T3...
EPS11040RS	▲	4	40	32	80	40	120	0.8	with	CSPB-2.5	AS□T11T3...
EPS11040RSB	▲	6	40	32	80	40	120	0.8	with	CSPB-2.5	AS□T11T3...
EPS11040RLS42	▲	2	40	42	210	100	310	3.0	with	CSPB-2.5	AS□T11T3...
EPS11040RSS20	▲	3	40	20	60	35	95	0.4	with	CSPB-2.5	AS□T11T3...
EPS11050RL	▲	3	50	42	310	50	360	3.9	with	CSPB-2.5	AS□T11T3...
EPS11050RS	▲	5	50	32	80	40	120	1.0	with	CSPB-2.5	AS□T11T3...
EPS11050RSB	▲	7	50	32	80	40	120	1.0	with	CSPB-2.5	AS□T11T3...
EPS11050RSS20	▲	3	50	20	60	35	95	0.5	with	CSPB-2.5	AS□T11T3...

▲ : Discontinued items

## Cutter

### Roughing shank type

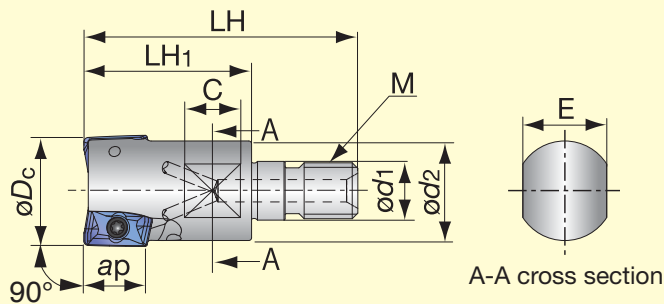


#### Parts

Description	Cat. No.	
Cutter	TLS11R...	ELS11R...
Clamping screw	CSPB-2.5	
Wrench	IP-8D	
Center bolt	CM10X40H	-

Cat. No.	Stock	No. of eff. edge lines	Dimensions (mm)							Weight (kg)	Air hole	No. of inserts	Inserts
			$\phi D_c$	$\phi D_s$	$l_s$	$L_f$	$L$	Max. $ap$					
ELS11R025M25.0W02	●	2	25	25	80	40	120	30.4	0.4	with	6	AS□T11T3...	
ELS11R032M32.0W03	●	3	32	32	80	60	140	39.4	0.8	with	12	AS□T11T3...	
ELS11R040M42.0W03	●	3	40	42	90	60	150	40	1.4	with	12	AS□T11T3...	

### Modular type



Max.  $ap = 10.6$  mm

#### Parts

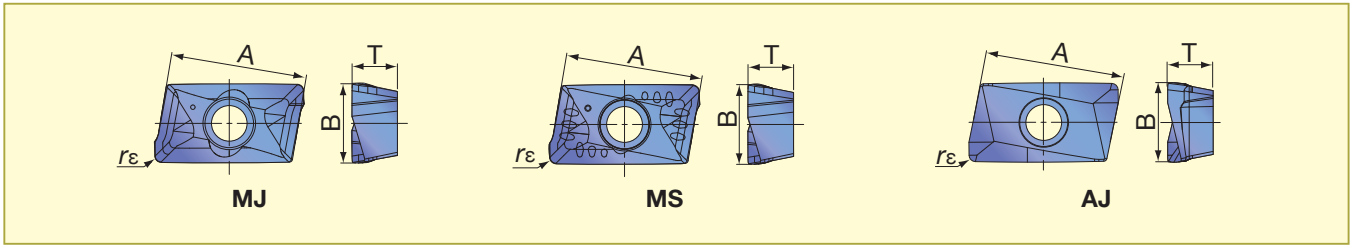
Descriptions	Parts Cat. No.	
Clamping screw	HPO11R020	HPO11R025, HPO11R032
	CSPB-2.5S	CSPB-2.5
Wrench	IP-8D	

Cat. No.	Stock	No. of Inserts	Dimensions (mm)								Weight (kg)	Air hole	Applicable Insert
			$\phi D_c$	LH	LH <sub>1</sub>	C	E	$\phi d_1$	$\phi d_2$	M			
HPO11R020MM10-02	●	2	20	49	30	10	15	10.5	17.8	M10	0.06	with	AS□T11T3...
HPO11R025MM12-03	●	3	25	57	35	10	17	12.5	20.8	M12	0.10	with	AS□T11T3...
HPO11R032MM16-03	●	3	32	63	40	12	22	17.0	28.8	M16	0.20	with	AS□T11T3...

● : Stocked items



# ● Inserts



Cat. No.	Accuracy Honing	Grades									Dimensions (mm)			
		Coated						DLC coated	Cermet	Uncoated	A	B	T	r $\epsilon$
		AH725	AH120	AH130	AH140	T3130	T1115	DS1100	NS740	KS05F				
ASMT11T304PDPR-MJ	M with	●	●			●	●		●		11.6	6.7	3.7	0.4
ASMT11T308PDPR-MJ	M with	●	●			●	●		●		11.6	6.7	3.7	0.8
ASMT11T312PDPR-MJ	M with	●	●			●					11.6	6.7	3.7	1.2
ASMT11T316PDPR-MJ	M with	●	●			●			●		11.6	6.7	3.7	1.6
ASMT11T320PDPR-MJ	M with		●								11.6	6.7	3.7	2.0
ASMT11T330PDPR-MJ	M with		●								11.6	6.7	3.7	3.0
ASMT11T304PDPR-MS	M with			●	●						11.6	6.7	3.7	0.4
ASGT11T304PDFR-AJ	G with						●			●	11.6	6.7	3.7	0.4
ASGT11T308PDFR-AJ	G with						●			●	11.6	6.7	3.7	0.8

● : Stocked items



## ● Standard cutting conditions

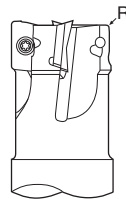
### TPS11 / EPS11, HPO11, TPO11 / EPO11 type

ISO	Workpiece materials	Brinell hardness HB	Priority	Grade	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)		
						MJ	MS	AJ
<b>P</b>	Low carbon steels (S15C / C15E4 etc.)	~ 200	First choice	<b>AH725</b>	100 - 250	0.1 - 0.2	-	-
		~ 200	For wear resistance	<b>T3130</b>	100 - 250	0.1 - 0.2	-	-
		~ 200	For surface appearance	<b>NS740</b>	100 - 250	0.05 - 0.15	-	-
	High carbon steels and Alloyed steels (S55C / C55, SCM440 / 42CrMo4 etc.)	200 ~ 300	First choice	<b>AH725</b>	100 - 200	0.1 - 0.15	-	-
		200 ~ 300	For wear resistance	<b>T3130</b>	100 - 200	0.1 - 0.15	-	-
		200 ~ 300	For surface appearance	<b>NS740</b>	100 - 200	0.05 - 0.12	-	-
Tool Steel (SKD11 / X153CrMoV12 etc.)	150 ~ 300	First choice	<b>AH725</b>	100 - 150	0.1 - 0.15	-	-	
	150 ~ 300	For wear resistance	<b>T3130</b>	100 - 150	0.1 - 0.15	-	-	
<b>M</b>	Stainless steel (SUS304 / X5CrNi18-9 etc.)	-	-	<b>AH130</b>	80 - 200	-	0.08 - 0.2	-
<b>K</b>	Grey cast iron (FC250 / 250 etc.)	150 ~ 250	First choice	<b>AH120</b>	100 - 250	0.12 - 0.2	-	-
		150 ~ 250	For wear resistance	<b>T1115</b>	100 - 250	0.12 - 0.2	-	-
	Ductile cast iron (FCD450 / 450-10S etc.)	150 ~ 250	First choice	<b>AH120</b>	80 - 200	0.12 - 0.2	-	-
		150 ~ 250	For wear resistance	<b>T1115</b>	80 - 200	0.12 - 0.2	-	-
<b>N</b>	Aluminium alloys (Si < 13%)	-	-	<b>DS1100</b>	300 - 1000	-	-	0.05 - 0.2
	Aluminium alloys (Si ≥ 13%)	-	-	<b>DS1100</b>	100 - 200	-	-	0.05 - 0.2
	Copper alloys	-	-	<b>KS05F</b>	200 - 500	-	-	0.05 - 0.2
<b>S</b>	Titanium alloys (Ti-6Al-4V etc.)	-	-	<b>AH130</b>	20 - 60	-	0.08 - 0.15	-
	Heat resistant alloys (Inconel718 etc.)	-	-	<b>AH725</b>	20 - 40	0.08 - 0.13	-	-

### ■ Cautionary point in modifying cutter bodies

When using inserts with corner radius  $r_{\epsilon} \geq 2.0$  mm, standard cutter bodies have to be modified "R". (Only for TPS11, EPS11, TLS11, ELS11, HPO11, EPO11)

- From 2nd row onwards, please use insert with  $r_{\epsilon} = 0.4$  or  $0.8$  mm



Corner radius $r_{\epsilon}$ (mm)	The dimension of modifying (mm)
0.4 ~ 1.6	Unnecessary
2.0 ~ 3.2	2

## Roughing type TLS11 / ELS11

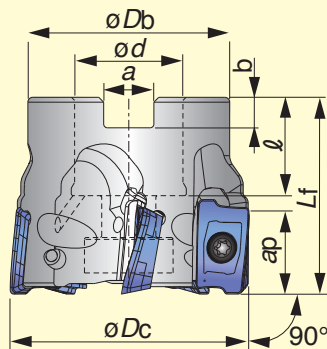
ISO	Workpiece materials	Brinell hardness HB	Priority	Grade	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)		
						MJ	MS	AJ
<b>P</b>	Low carbon steels (S15C / C15E4 etc.)	~ 200	First choice	<b>AH725</b>	100 - 250	0.10 - 0.18	-	-
		~ 200	For wear resistance	<b>T3130</b>	100 - 250	0.10 - 0.18	-	-
	High carbon steels and Alloyed steels (S55C / C55, SCM440 / 42CrMo4 etc.)	200 ~ 300	First choice	<b>AH725</b>	100 - 200	0.08 - 0.14	-	-
		200 ~ 300	For wear resistance	<b>T3130</b>	100 - 200	0.08 - 0.14	-	-
	Tool Steel (SKD11 / X153CrMoV12 etc.)	150 ~ 300	First choice	<b>AH725</b>	100 - 200	0.08 - 0.14	-	-
		150 ~ 300	For wear resistance	<b>T3130</b>	100 - 200	0.08 - 0.14	-	-
<b>M</b>	Stainless steel (SUS304 / X5CrNi18-9 etc.)	-	-	<b>AH130</b>	100 - 150	-	0.08 - 0.15	-
<b>K</b>	Grey cast iron (FC250 / 250 etc.)	150 ~ 250	First choice	<b>AH120</b>	100 - 250	0.10 - 0.18	-	-
		150 ~ 250	For wear resistance	<b>T1115</b>	100 - 250	0.10 - 0.18	-	-
	Ductile cast iron (FCD450 / 450-10S etc.)	150 ~ 250	First choice	<b>AH120</b>	80 - 200	0.10 - 0.18	-	-
		150 ~ 250	For wear resistance	<b>T1115</b>	80 - 200	0.10 - 0.18	-	-
<b>N</b>	Aluminium alloys (Si < 13%)	-	-	<b>DS1100</b>	200 - 500	-	-	0.05 - 0.18
	Aluminium alloys (Si ≥ 13%)	-	-	<b>DS1100</b>	100 - 200	-	-	0.05 - 0.18
<b>S</b>	Titanium alloys (Ti-6Al-4V etc.)	-	-	<b>AH130</b>	20 - 60	-	0.08 - 0.14	-
	Heat resistant alloys (Inconel718 etc.)	-	-	<b>AH725</b>	20 - 40	0.06 - 0.12	-	-

- To remove excessive chip accumulation use an air blast.
- To avoid build up edge on the cutting edges (aluminium machining), use a water soluble coolant.
- When cutting an interrupted surface or a casted skin, the feed per tooth (fz) should be reduced to the lower recommended value shown in the above table.

- Cutting conditions are limited by machine power, work piece rigidity, and spindle output. When the cutting width, depth, or overhang length is large, set Vc and fz to the lower recommended values and check the machine power and vibration.

## Cutter

### Bore type

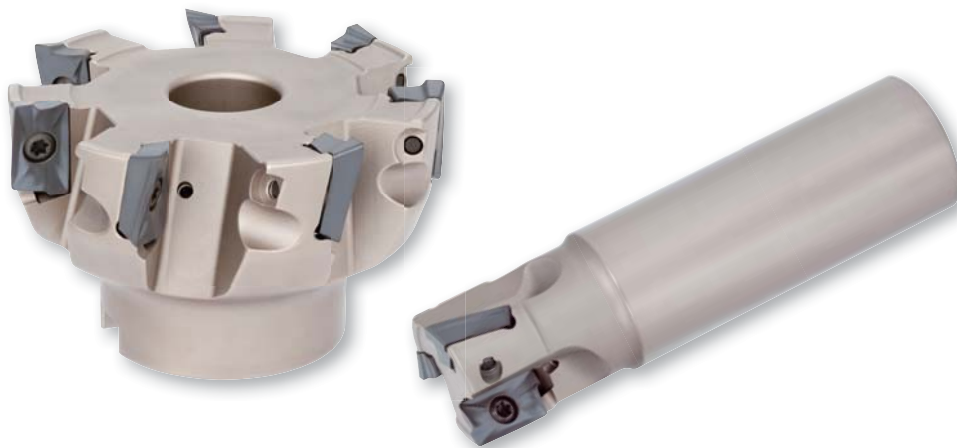


Max.  $ap = 16.7$  mm

#### Parts

Description	Cat. No.	
Applicable cutter	TPO18R...	
Wrench	Torx bit	<b>BT15M</b>
	Grip	<b>H-TBS</b>
Mono block type wrench	-	

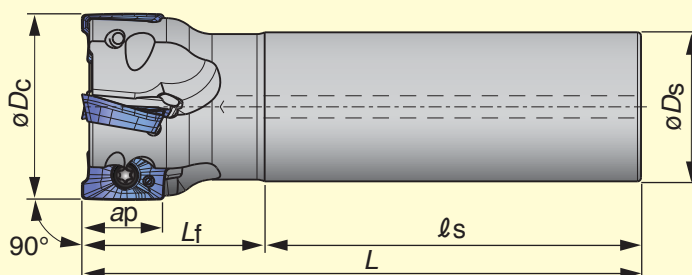
Cat. No.	Stock	No. of inserts	Dimensions (mm)							Weight (kg)	Air hole	Center bolt	Clamping screw	Inserts
			* $\phi D_c$	$\phi D_b$	$\phi d$	$\ell$	** $L_f$	$b$	$a$					
TPO18R040M16.0-04	●	4	40	35	16	18	40	5.6	8.2	0.2	with	FSHM8-30H	CSTB-4L093	AO□T1805...
TPO18R040M16.0E04	●	4	40	35	16	18	40	5.6	8.4	0.2	with	FSHM8-30H	CSTB-4L093	AO□T1805...
TPO18R050M22.0-05	●	5	50	41	22	20	40	6	10	0.2	with	CM10x30H	CSTB-4L093	AO□T1805...
TPO18R050M22.0E05	●	5	50	41	22	20	40	6.3	10.4	0.3	with	CM10x30H	CSTB-4L093	AO□T1805...
TPO18R063M22.0-06	●	6	63	41	22	20	40	6	10	0.4	with	CM10x30H	CSTB-4L093	AO□T1805...
TPO18R063M22.0E06	●	6	63	41	22	20	40	6.3	10.4	0.5	with	CM10x30H	CSTB-4L093	AO□T1805...
TPO18R080M25.4-07	●	7	80	46	25.4	26	50	6	9.5	0.8	with	CM12x30H	CSTB-4L120	AO□T1805...
TPO18R080M27.0E07	●	7	80	50	27	22	50	7	12.4	1.0	with	CM12x30H	CSTB-4L120	AO□T1805...
TPO18R100M31.7-08	●	8	100	60	31.75	32	50	8	12.7	1.2	with	TMBA-M16H	CSTB-4L120	AO□T1805...
TPO18R100M32.0E08	●	8	100	60	32	28.5	50	8	14.4	1.4	with	TMBA-M16H	CSTB-4L120	AO□T1805...
TPO18R125M38.1-09	●	9	125	80	38.1	38	63	10	15.9	2.8	with	TMBA-M20H	CSTB-4L120	AO□T1805...
TPO18R125M40.0E09	●	9	125	71	40	32	63	9	16.4	2.8	with	TMBA-M20H	CSTB-4L120	AO□T1805...
TPO18R160M40.0E10	●	10	160	100	40	29	63	9	16.4	4.9	without	-	CSTB-4L120	AO□T1805...
TPO18R160M50.8-10	●	10	160	100	50.8	46	63	11	19	4.9	without	-	CSTB-4L120	AO□T1805...



● : Stocked items



## Shank type



Max.  $a_p$  = 16.7 mm

### Parts

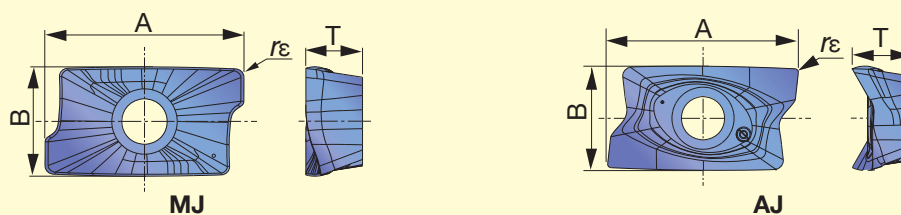
Description	Cat. No.	
Applicable cutter	EPO18R...	
Wrench	Torx bit	-
	Grip	-
Mono block type wrench	<b>T-15DB</b>	

Cat. No.	Stock	No. of inserts	Dimensions (mm)					Weight (kg)	Air hole	Clamping Screw	Inserts
			* $\phi D_c$	$\phi D_s$	$l_s$	$L_f$	$L$				
EPO18R025M25.0-02	●	2	25	25	80	35	115	0.4	with	CSTB-4L085	AO□T1805...
EPO18R025M25.0-02L	●	2	25	25	150	70	220	0.8	with	CSTB-4L085	AO□T1805...
EPO18R028M25.0-02	●	2	28	25	80	35	115	0.4	with	CSTB-4L085	AO□T1805...
EPO18R028M25.0-02L	●	2	28	25	150	70	220	0.8	with	CSTB-4L085	AO□T1805...
EPO18R030M32.0-02	●	2	30	32	80	40	120	0.6	with	CSTB-4L085	AO□T1805...
EPO18R030M32.0-02L	●	2	30	32	175	80	255	1.4	with	CSTB-4L085	AO□T1805...
EPO18R030M32.0-03	●	3	30	32	80	40	120	0.6	with	CSTB-4L085	AO□T1805...
EPO18R032M32.0-02	●	2	32	32	80	40	120	0.7	with	CSTB-4L093	AO□T1805...
EPO18R032M32.0-02L	●	2	32	32	175	80	255	1.5	with	CSTB-4L093	AO□T1805...
EPO18R032M32.0-03	●	3	32	32	80	40	120	0.6	with	CSTB-4L093	AO□T1805...
EPO18R035M32.0-02	●	2	35	32	80	40	120	0.7	with	CSTB-4L093	AO□T1805...
EPO18R035M32.0-02L	●	2	35	32	175	80	255	1.5	with	CSTB-4L093	AO□T1805...
EPO18R035M32.0-03	●	3	35	32	80	40	120	0.7	with	CSTB-4L093	AO□T1805...
EPO18R040M32.0-02L	●	2	40	32	205	50	255	1.6	with	CSTB-4L093	AO□T1805...
EPO18R040M32.0-03	●	3	40	32	80	40	120	0.7	with	CSTB-4L093	AO□T1805...
EPO18R040M32.0-04	●	4	40	32	80	40	120	0.7	with	CSTB-4L093	AO□T1805...
EPO18R040M42.0-02L	●	2	40	42	210	100	310	3.0	with	CSTB-4L093	AO□T1805...
EPO18R050M32.0-03	●	3	50	32	80	40	120	0.8	with	CSTB-4L093	AO□T1805...
EPO18R050M32.0-05	●	5	50	32	80	40	120	0.8	with	CSTB-4L093	AO□T1805...
EPO18R050M42.0-03L	●	3	50	42	310	50	360	3.8	with	CSTB-4L093	AO□T1805...
EPO18R063M32.0-04	●	4	63	32	80	45	125	1.0	with	CSTB-4L120	AO□T1805...
EPO18R063M32.0-06	●	6	63	32	80	45	125	1.1	with	CSTB-4L120	AO□T1805...
EPO18R063M42.0-03L	●	3	63	42	310	50	360	4.0	with	CSTB-4L120	AO□T1805...

\* The  $\phi D_c$  in the above table shows the diameter when MJ chipbreaker is used.  
When AJ chipbreaker is used, the diameter is equal to the above shown  $\phi D_c + 0.2$  mm.

● : Stocked items

## ● Inserts



Cat. No.	Accuracy	Honing	Grades			Dimensions (mm)			
			Coated		Carbide	A	B	T	r $\epsilon$
			AH725	AH140	KS15F				
AOMT180508PDPR-MJ	M	with	●	●		19.5	10.7	5.6	0.8
AOMT180516PDPR-MJ	M	with	●	●		19.5	10.7	5.6	1.6
AOMT180524PDPR-MJ	M	with	●	●		19.5	10.7	5.6	2.4
AOMT180532PDPR-MJ	M	with	●	●		19.5	10.7	5.6	3.2
AOGT180504PDFR-AJ	G	without			●	19.8	10.8	6.1	0.4
AOGT180508PDFR-AJ	G	without			●	19.8	10.8	6.1	0.8

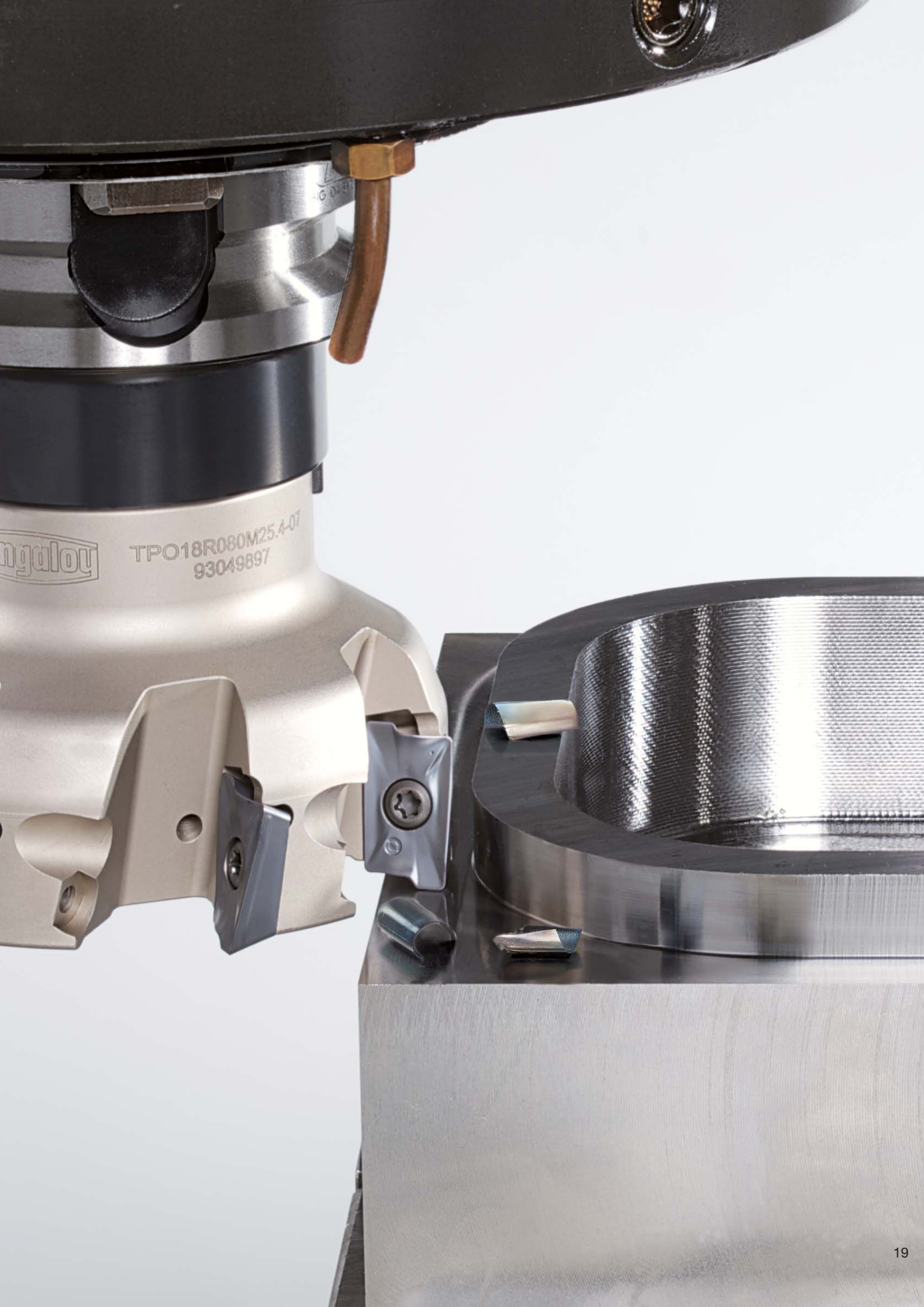
● : Stocked items

## ● Standard cutting conditions

ISO	Workpiece materials	Brinell hardness HB	Grade	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)	
					MJ	AJ
P	Low carbon steels (S15C / C15E4 etc.)	~ 200	AH725	100 - 250	0.08 - 0.25	-
	High carbon steels and Alloyed steels (S55C / C55, SCM440 / 42CrMo4 etc.)	200 ~ 300	AH725	100 - 230	0.08 - 0.2	-
	Tool Steel (SKD11 / X153CrMoV12 etc.)	150 ~ 300	AH725	100 - 180	0.08 - 0.2	-
M	Stainless steel (SUS304 / X5CrNi18-9 etc.)	-	AH140	90 - 200	0.08 - 0.2	-
K	Grey cast iron (FC250 / 250 etc.)	150 ~ 250	AH725	140 - 250	0.08 - 0.25	-
	Ductile cast iron (FCD450 / 450-10S etc.)	150 ~ 250	AH725	110 - 200	0.08 - 0.25	-
N	Aluminium alloys (Si < 13%)	-	KS15F	300 - 1000	-	0.05 - 0.25
	Aluminium alloys (Si ≥ 13%)	-	KS15F	100 - 200	-	0.05 - 0.25
S	Titanium alloys (Ti-6Al-4V etc.)	-	AH725	20 - 60	0.08 - 0.18	-
	Heat resistant alloys (Inconel718 etc.)	-	AH725	20 - 40	0.08 - 0.15	-

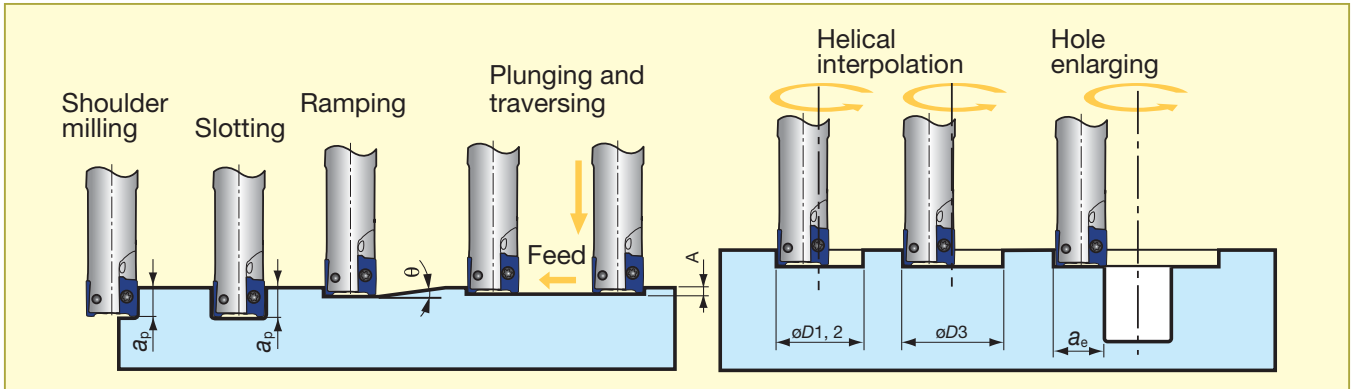
- To remove excessive chip accumulation use an air blast.
- To avoid build up edge on the cutting edges (aluminium machining), use a water soluble coolant.
- When cutting an interrupted surface or a casted skin, the feed per tooth (fz) should be reduced to the lower recommended value shown in the above table.

- Cutting conditions are limited by machine power, work piece rigidity, and spindle output. When the cutting width, depth, or overhang length is large, set Vc and fz to the lower recommended values and check the machine power and vibration.



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● **Machining applications**



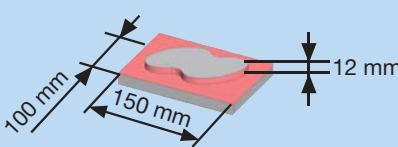
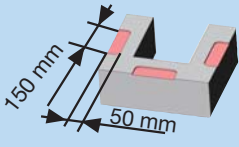
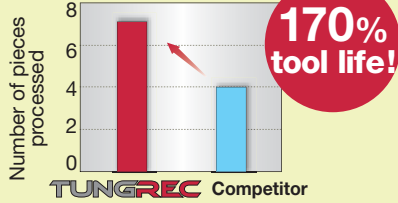
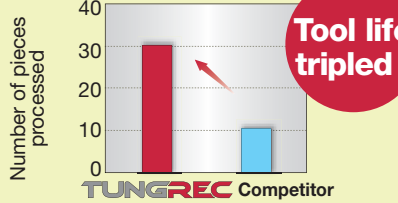
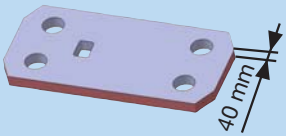
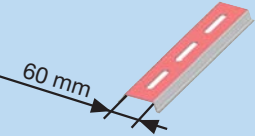
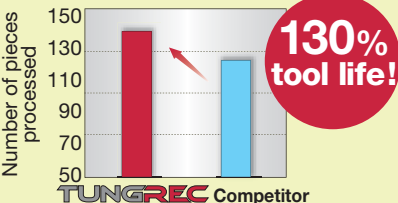
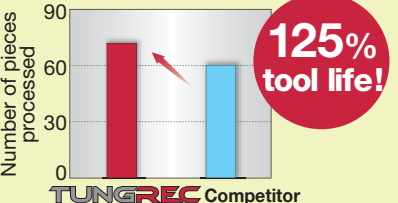
Cat. No.	Tool- $\phi$ $\phi D_c$ (mm)	Chip-breaker	Max. depth of cut $a_p$ (mm)	Max. ramping angle $\theta$	Max. plunging A (mm)	Min. machining $\phi D_1$ (mm)	Max. machining $\phi D_2$ (mm)	*Max. machining $\phi D_3$ (mm)	Max. cutting width in enlarging $a_e$ (mm)
E/HPO07R012...	$\phi 12$	MJ	7	8	0.5	16	23	20.5	11.5
E/HPO07R016...	$\phi 16$	MJ	7	5	0.5	24	3	28.5	15.5
EPO07R018...	$\phi 18$	MJ	7	4	0.5	28	35	32.5	17.5
E/HPO07R020...	$\phi 20$	MJ	7	3.5	0.5	32	39	36.5	19.5
EPO07R022...	$\phi 22$	MJ	7	3	0.5	36	43	40.5	21.5
E/HPO07R025...	$\phi 25$	MJ	7	2.5	0.5	42	49	46.5	24.5
EPO07R028...	$\phi 28$	MJ	7	2	0.5	48	55	52.5	27.5
TPO07R032...	$\phi 32$	MJ	7	1.8	0.5	56	63	60.5	31.5
TPO07R040	$\phi 40$	MJ	7	1.2	0.5	72	79	76.5	39.5
TPO07R050...	$\phi 50$	MJ	7	0.9	0.5	92	99	96.5	49.5
E/HPO07R012...	$\phi 12$	AJ	6.4	8	0.5	16	23	20.5	11.5
E/HPO07R016...	$\phi 16$	AJ	6.4	5	0.5	24	3	28.5	15.5
EPO07R018...	$\phi 18$	AJ	6.4	4	0.5	28	35	32.5	17.5
E/HPO07R020...	$\phi 20$	AJ	6.4	3.5	0.5	32	39	36.5	19.5
EPO07R022...	$\phi 22$	AJ	6.4	3	0.5	36	43	40.5	21.5
E/HPO07R025...	$\phi 25$	AJ	6.4	2.5	0.5	42	49	46.5	24.5
EPO07R028...	$\phi 28$	AJ	6.4	2	0.5	48	55	52.5	27.5
TPO07R032...	$\phi 32$	AJ	6.4	1.8	0.5	56	63	60.5	31.5
TPO07R040	$\phi 40$	AJ	6.4	1.2	0.5	72	79	76.5	39.5
TPO07R050...	$\phi 50$	AJ	6.4	0.9	0.5	92	99	96.5	49.5
E/HPO07R012...	$\phi 12.6$	HJ	0.8	5	0.5	17	24	-	9.6
E/HPO07R016...	$\phi 16.6$	HJ	0.8	3	0.5	25	32	-	13.6
EPO07R018...	$\phi 18.6$	HJ	0.8	2.5	0.5	29	36	-	15.6
E/HPO07R020...	$\phi 20.6$	HJ	0.8	2.1	0.5	33	40	-	17.6
EPO07R022...	$\phi 22.6$	HJ	0.8	1.9	0.5	37	44	-	19.6
E/HPO07R025...	$\phi 25.6$	HJ	0.8	1.6	0.5	43	50	-	22.6
EPO07R028...	$\phi 28.6$	HJ	0.8	1.3	0.5	49	56	-	25.6
TPO07R032...	$\phi 32.6$	HJ	0.8	1.1	0.5	57	64	-	29.6
TPO07R040	$\phi 40.6$	HJ	0.8	0.8	0.5	73	80	-	37.6
TPO07R050...	$\phi 50.6$	HJ	0.8	0.6	0.5	93	100	-	47.6
EPO11R012..., EPS11012R...	$\phi 12$	MJ, AJ	10.6	6	0.5	15	23	21	11.5
EPO11R016..., EPS11016R...	$\phi 16$	MJ, AJ	10.6	5	0.5	20	31	29	15.5
EPO11R018..., EPS11018R...	$\phi 18$	MJ, AJ	10.6	4	0.5	26	35	33	17.5
E/HPO11R020..., EPS11020R...	$\phi 20$	MJ, AJ	10.6	3	0.5	28	39	37	19.5
EPS11021R...	$\phi 21$	MJ, AJ	10.6	3	0.5	30	41	39	20.5
EPO11R022...	$\phi 22$	MJ, AJ	10.6	2.5	0.5	31	43	41	21.5

Cat. No.	Tool- $\varnothing$ $\varnothing Dc$ (mm)	Chip- breaker	Max. depth of cut ap (mm)	Max. ramping angle $\theta$	Max. plunging A (mm)	Min. machining $\varnothing D1$ (mm)	Max. machining $\varnothing D2$ (mm)	*Max. machining $\varnothing D3$ (mm)	Max. cutting width in enlarging ae (mm)
E/PO11R025..., EPS11025R...	$\varnothing 25$	MJ, AJ	10.6	2	0.5	38	49	47	24.5
EPS11026R...	$\varnothing 26$	MJ, AJ	10.6	2	0.5	40	51	49	25.5
EPO11R028...	$\varnothing 28$	MJ, AJ	10.6	1.5	0.5	42	53	51	27.5
EPO11R030..., EPS11030R...	$\varnothing 30$	MJ, AJ	10.6	1.5	0.5	48	55	53	29.5
E/PO11R032..., EPS11032R...	$\varnothing 32$	MJ, AJ	10.6	1.5	0.5	52	59	57	31.5
EPS11033R...	$\varnothing 33$	MJ, AJ	10.6	1.5	0.5	54	65	63	32.5
EPO11R035...	$\varnothing 35$	MJ, AJ	10.6	1	0.5	56	67	65	34.5
E/TPO11R040..., E/TPS11040R...	$\varnothing 40$	MJ, AJ	10.6	1	0.5	68	79	77	39.5
TPO11R050..., E/TPS11050R...	$\varnothing 50$	MJ, AJ	10.6	0.7	0.5	68	99	97	49.5
TPO11R063..., TPS11063RB	$\varnothing 63$	MJ, AJ	10.6	0.5	0.5	114	125	123	62.5
TPO11R080..., TPS11080RB	$\varnothing 80$	MJ, AJ	10.6	0.4	0.5	148	159	157	79.5
TPO11R100..., TPS1100RB	$\varnothing 100$	MJ, AJ	10.6	0.3	0.5	188	199	197	99.5
EPO11R012..., EPS11012R...	$\varnothing 12.6$	HJ	1.2	5	1	15	24	-	8.6
EPO11R016..., EPS11016R...	$\varnothing 16.6$	HJ	1.2	4.5	1	23	32	-	12.6
EPO11R018..., EPS11018R...	$\varnothing 18.6$	HJ	1.2	3.5	1	27	36	-	14.6
E/HPO11R020..., EPS11020R...	$\varnothing 20.6$	HJ	1.2	3	1	31	40	-	16.6
EPS11021R...	$\varnothing 21.6$	HJ	1.2	2.5	1	33	42	-	17.6
EPO11R022...	$\varnothing 22.6$	HJ	1.2	2.7	1	35	44	-	18.6
E/HPO11R025..., EPS11025R...	$\varnothing 25.6$	HJ	1.2	2.5	1	41	50	-	21.6
EPS11026R...	$\varnothing 26.6$	HJ	1.2	2.5	1	43	52	-	22.6
EPO11R028...	$\varnothing 28.6$	HJ	1.2	2	1	47	56	-	24.6
EPO11R030..., EPS11030R...	$\varnothing 30.6$	HJ	1.2	2	1	51	60	-	26.6
E/HPO11R032..., EPS11032R...	$\varnothing 32.6$	HJ	1.2	2	1	55	64	-	28.6
EPS11033R...	$\varnothing 33.6$	HJ	1.2	2	1	57	66	-	29.6
EPO11R035...	$\varnothing 35.6$	HJ	1.2	1.5	1	61	70	-	31.6
E/TPO11R040..., E/TPS11040R...	$\varnothing 40.6$	HJ	1.2	1	1	71	80	-	36.6
TPO11R050..., E/TPS11050R...	$\varnothing 50.6$	HJ	1.2	0.7	1	91	100	-	46.6
TPO11R063..., TPS11063RB	$\varnothing 63.6$	HJ	1.2	0.5	1	117	126	-	59.6
TPO11R080..., TPS11080RB	$\varnothing 80.6$	HJ	1.2	0.4	1	151	160	-	76.6
TPO11R100..., TPS1100RB	$\varnothing 100.6$	HJ	1.2	0.3	1	191	200	-	96.6
EPO18R025...	$\varnothing 25$	MJ, AJ	16.7	6	1	32	48	44	24
EPO18R028...	$\varnothing 28$	MJ, AJ	16.7	4.5	1	38	54	50	27
EPO18R030...	$\varnothing 30$	MJ, AJ	16.7	4	1	42	58	54	29
EPO18R032...	$\varnothing 32$	MJ, AJ	16.7	3.5	1	46	62	58	31
EPO18R035...	$\varnothing 35$	MJ, AJ	16.7	3	1	52	68	64	34
E/TPO18R040...	$\varnothing 40$	MJ, AJ	16.7	2.5	1	62	78	74	39
E/TPO18R050...	$\varnothing 50$	MJ, AJ	16.7	1.9	1	82	98	94	49
E/TPO18R063	$\varnothing 63$	MJ, AJ	16.7	1.4	1	108	124	120	62
TPO18R080...	$\varnothing 80$	MJ, AJ	16.7	1	1	142	158	154	79
TPO18R100...	$\varnothing 100$	MJ, AJ	16.7	0.8	1	182	198	194	99
TPO18R125...	$\varnothing 125$	MJ, AJ	16.7	0.6	1	232	248	244	124
TPO18R160...	$\varnothing 160$	MJ, AJ	16.7	0.4	1	302	318	314	159

\*Flat bottom hole

Notes: Corner  $r_\epsilon$  for dimensions of  $\varnothing D1$ ,  $\varnothing D2$ , and  $\varnothing D3$ :  $r_\epsilon = 0.4$  for EPO07 / EPS11 and  $r_\epsilon = 0.8$  for EPO18.

## Practical examples

Workpiece type		Machine parts	Compressor parts
Cutter		TPO07R040M16.0E10 (ø40, z = 10)	EPS11033RSB (ø33, z = 5)
Insert		AOMT070208PDPR-MJ	ASMT11T304PDPR-MJ
Grade		AH725	NS740
Workpiece material		SCM440 / 42CrMo4	SS400 / E275A
			
Cutting conditions	Cutting speed: $V_c$ (m/min)	130	150
	Feed per tooth: $f_z$ (mm/t)	0.1	0.13
	Feed speed: $V_f$ (mm/min)	1000	940
	Depth of cut: $a_p$ (mm)	3.0	5
	Width of cut: $a_e$ (mm)	~ 30	15
	Method of machining	Shoulder milling	Shoulder milling
	Coolant	Dry	Dry
	Machine	Vertical MC, BT40	Vertical MC, BT50
Results		 <p><b>170% tool life!</b></p> <p><math>V_f = 600 \rightarrow 1000</math> mm/min Improves productivity and makes tool life very stable.</p>	 <p><b>Tool life tripled!</b></p> <p>Improves tool life and surface finish.</p>
Workpiece type		Machine parts	Transportation rail
Cutter		TLS11R050M22.0E04	TPO18R050M22.0-05 (ø50, z = 5)
Insert		ASMT11T308PDPR-MJ	AOMT180516PDPR-MJ
Grade		AH725	AH725
Workpiece material		SS400 / E275A	S20C / C22
			
Cutting conditions	Cutting speed: $V_c$ (m/min)	150	220
	Feed per tooth: $f_z$ (mm/t)	0.17	0.16
	Feed speed: $V_f$ (mm/min)	649	1200
	Depth of cut: $a_p$ (mm)	40	6
	Width of cut: $a_e$ (mm)	5	20
	Method of machining	Shoulder milling	Face milling
	Coolant	Dry	Dry
	Machine	Vertical MC, BT50	Vertical MC, BT50
Results		 <p><b>130% tool life!</b></p> <p>Even in the machining of low rigid work piece, TungRec enables the productivity to improve 30% higher due to the low cutting force.</p>	 <p><b>125% tool life!</b></p> <p>Reduces machining noise with low cutting force.</p>



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