

# TUNG<sup>PEED</sup>MILL

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Tungaloy Report No. 524-G

## High speed face milling cutter for finishing aluminum



**INDUSTRY 4.0**  
*FEED the SPEED!*



TPYD06J100B31.7R22 Tungaloy 893355  
Nmax=15000min-1

ACCELERATED MACHINING

MillLine

**TUNG**<sup>PEED</sup>**MILL**  
TUNGALOY

**TUNG**<sup>FORCE</sup>**MILL**  
ACCELERATED MACHINING



## Super high density PCD cutter

with innovative insert clamp design for quick and easy insert setting

# Super high density cutter for efficient finishing of aluminum

## Extremely high number of PCD cutting edges

### Ensures machining efficiency

22 inserts per  $\varnothing 100$  mm cutter diameter.

Allows a cutting speed of 3,000 m/min or higher.



### Unique axial adjusting mechanism - Cam Adjust

A single key wrench is all it takes from mounting the inserts to fine-adjusting for precision, saving a great amount of presetting work. Setting range: 1 mm



### Internal coolant in each pocket

Coolant is directed to the cutting edge, facilitating smooth chip evacuation

### Steel body

the cutter body is made of durable steel

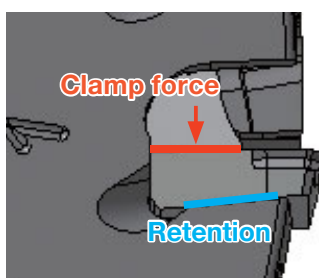
### Extremely high balancing quality for high speed milling

G6.3 under ISO1940/1

## Safety measures for high speed milling

### Safety insert lock against centrifugal force

Inserts are securely retained in place, preventing them from being dislocated by centrifugal force during high speed milling



Wedge shape design prevents the insert from breaking off the seat induced by centrifugal inertia force.

Note: Do not exceed the maximum rotation (n max) inscribed on the cutter body.

Cutter diameter (mm)	Max num. of teeth	Max. rotation number (min <sup>-1</sup> )	Cutter weight (kg)
50	8	20,000	0.86
63	10	19,000	0.53
80	16	17,000	1.18
100	22	15,000	1.66
125	26	14,000	3.44
160	34	12,000	5.15



## CamAdjust system - innovative insert axial adjusting mechanism

- The same key is used for mounting and adjusting the inserts
- The key wrench is operated in a single direction making insert adjustment easy on the pre-setter
- Significantly reduced insert setting time

**TORX bit**  
for clamping insert



**Eccentric cam**  
for adjusting axial runout

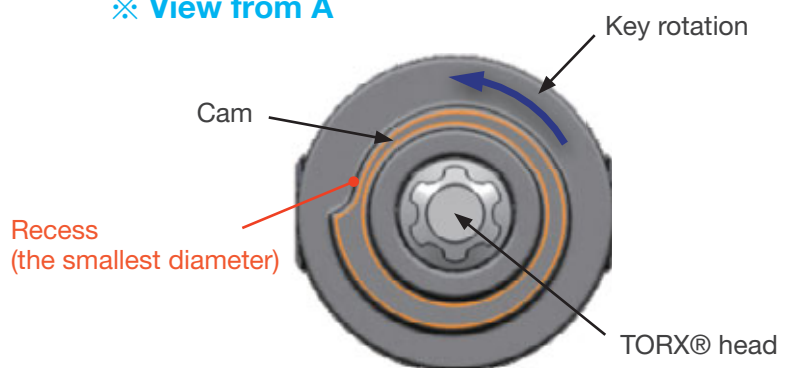


## Special key wrench with adjusting cam



Insert's axial runout is adjusted with the eccentric cam profile. Insert the key with the smallest cam diameter in contact with the insert bottom and rotate for larger cam diameter to obtain the required height.

### ※ View from A

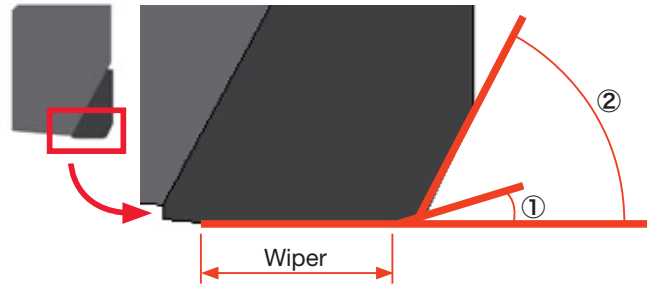


## Insert variations

### Standard insert with built-in deburrer

(YDEN0603PDFR-D, YDEN0603PDSR-D)

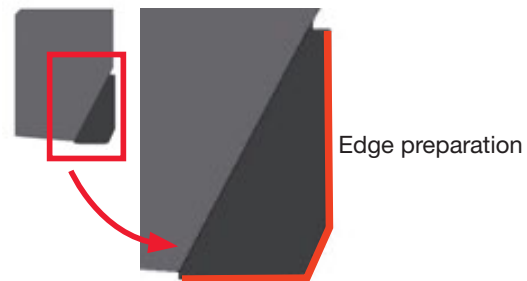
- Double-angled cutting edge for effective chip splitting
- Burr formation is significantly minimized by the cutting edge's chip thinning effect at the exit
- Built-in wiper geometry for better surface finishing



### Standard insert with edge preparation

(YDEN0603PDSR-D)

For cutting gates or greater depths of cut



### Deburring insert - Tungaloy's exclusive insert design

(YDEN0603PDFR-BD)

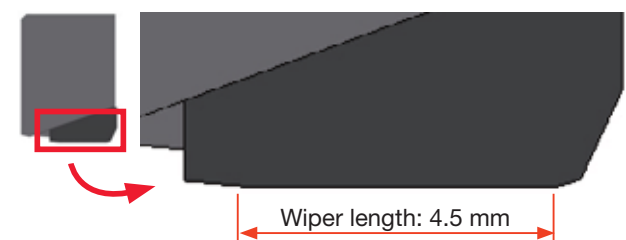
Use with standard inserts for enhanced burr-free machining



### Wiper insert - for superior surface finishing

(YDEN0603PDFR-WD)

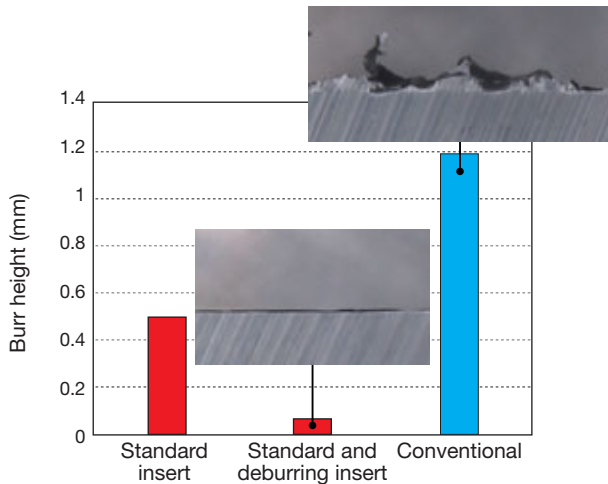
Use with standard inserts to improve the surface finishing quality. Number of wiper inserts on the cutter may depend on the feed rate.



## CUTTING PERFORMANCE

### Reduced burr formation

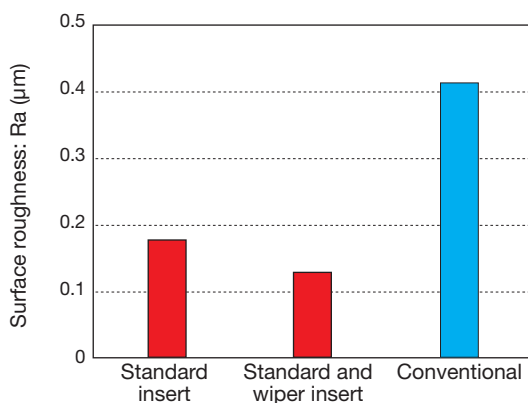
2 types of deburring inserts for burr-free milling



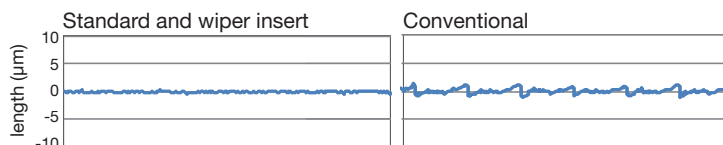
Cutter : TPYD06J080B25.4R16 ( $\phi = 80$  mm,  $z = 16$ )  
 Insert : YDEN0603PDFR-D DX110 (Standard insert)  
           : YDEN0603PDFR-BD DX110 (Deburring insert)  
 Workpiece : A1100 (30x100 mm)  
 Cutting speed :  $V_c = 2,513$  m/min  
 Number of revolutions:  $n = 10,000$  min<sup>-1</sup>  
 Feed per tooth :  $f_z = 0.1$  mm/t  
 Feed speed :  $V_f = 16,000$  m/min (Standard insert)  
               :  $V_f = 8,000$  m/min (Standard and deburring insert)  
 Insert runout :  $< 1$   $\mu$ m  
 Depth of cut :  $a_p = 0.5$  mm  
 Depth of width :  $a_e = 30$  mm  
 Coolant : Wet  
 Machining : Face milling (on center)  
 Machine : Vertical M/C, BT40

### Better surface roughness

Wiper inserts improve surface roughness



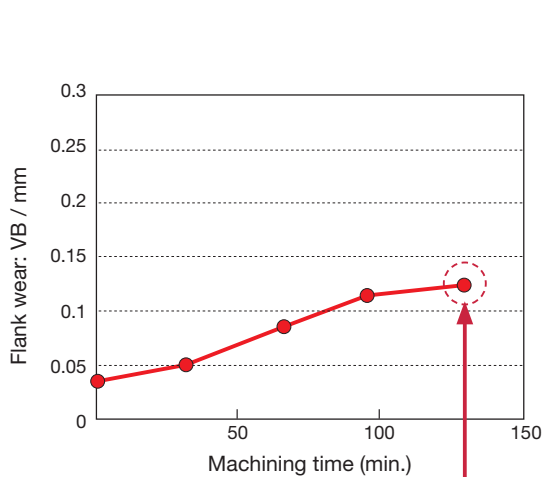
Cutter : TPYD06J080B25.4R16 ( $\phi = 80$  mm,  $z = 16$ )  
 Insert : YDEN0603PDFR-D DX110 (Standard insert)  
           : YDEN0603PDFR-WD DX110 (Wiper insert)  
 Workpiece : A1100 (30x100 mm)  
 Cutting speed :  $V_c = 2,513$  m/min  
 Number of revolutions:  $n = 10,000$  min<sup>-1</sup>  
 Feed per tooth :  $f_z = 0.1$  mm/t  
 Feed speed :  $V_f = 16,000$  m/min  
 Insert runout :  $< 1$   $\mu$ m  
 Depth of cut :  $a_p = 0.5$  mm  
 Depth of width :  $a_e = 30$  mm  
 Coolant : Wet  
 Machining : Face milling (on center)  
 Machine : Vertical M/C, BT40



## CUTTING PERFORMANCE

### Strong cutting edge

Optimized edge preparation ensures machining security during heavy interrupted cutting



Cutter : TPYD06J100B31.7R22 ( $\phi = 100$  mm,  $z = 1$ )  
 Insert : YDEN0603PDSR-D DX110 (with edge preparation)  
 Workpiece : AC4C-T6 (150 x 200 mm with 70 holes)  
 Cutting speed :  $V_c = 3,141$  m/min  
 Number of revolutions :  $n = 10,000$  min<sup>-1</sup>  
 Feed per tooth :  $f_z = 0.09$  mm/t  
 Insert runout :  $< 1$   $\mu$ m  
 Depth of cut :  $a_p = 0.2$  mm  
 Depth of width :  $a_e = 75$  mm  
 Coolant : Wet  
 Machining : Face milling (down cut)  
 Machine : Vertical M/C, BT40

After 130 min.





## Mounting of deburring inserts

To make the best of the cutter's deburring ability, make sure to place a deburring insert immediately behind every standard insert on the cutter.

Please note that, since a deburring insert has no cutting edge on the periphery, the effective cutting edges of the cutter will be divided by 2.

Example:

For  $\varnothing 100$  mm cutter with  $Z = 22$ , number of effective cutting edges would be  $Z = 11$ . (standard inserts x 11 and deburring inserts x 11)

The order of insert installation is as follows:

Standard  $\rightarrow$  Deburring  $\rightarrow$  Standard  $\rightarrow$  Deburring...

### Location of deburring inserts on the cutter

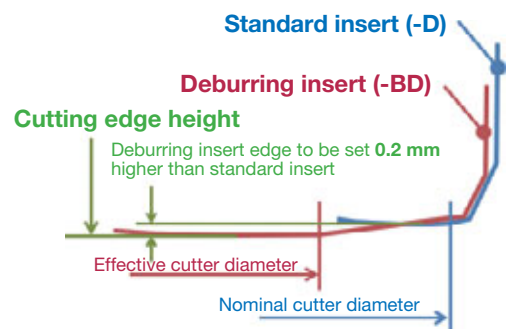
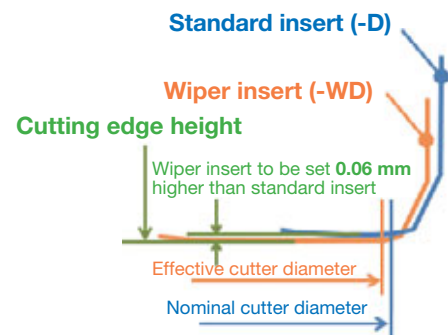


- **Standard insert**  
(YDEN0603PDF/SR-D)
- **Deburring insert**  
(YDEN0603PDFR-BD)

## Proper cutting edge setting

- For the best surface finishing results, wiper insert's (-WD) cutting edge should be set 0.06 mm higher than that of the standard insert's (-D). For deburring inserts (-BD), set 0.2 mm higher than that of the standard insert (-D).
- Effective cutter diameter will vary in accordance with wiper insert (-WD) or deburring insert (-BD) dimensions. Refer to the table below for an effective cutter diameter in each specific case.

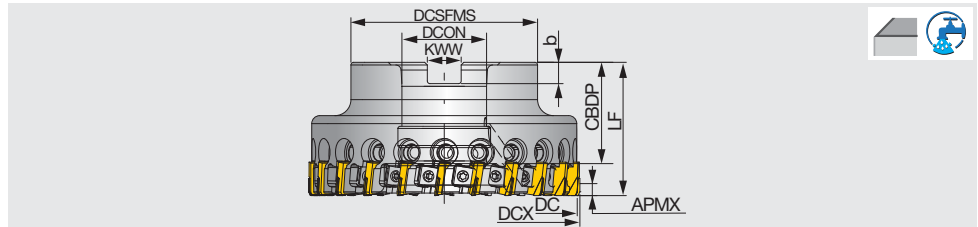
Cutter diameter (mm)	Effective cutter diameter (mm)		
	Standard (-D) only	Standard (-D) and wipers (-WD)	Standard (-D) and deburrers (-BD)
50	50	49.4	43.4
63	63	62.4	56.4
80	80	79.4	73.4
100	100	99.4	93.4
125	125	124.4	118.4
160	160	159.4	153.4



## TPYD06

Face milling cutter for non-ferrous applications, bore type, with PCD inserts

GAMP = +9°, GAMF = +4°



Designation	APMX	DC	DCX	CICT	DCSFMS	LF	DCON	CBDP	KWW	b	WT(kg)	Air hole	RPMX(min <sup>-1</sup> )	Insert
TPYD06M063B22.0R10	4.5	63	65	10	45	40	22	20	10.4	6.3	0.57	with	19,000	YDEN0603...
TPYD06M080B27.0R16	4.5	80	82	16	60	50	27	22	12.4	7	1.24	with	17,000	YDEN0603...
TPYD06J080B25.4R16	4.5	80	82	16	60	50	25.4	26	9.5	6	1.26	with	17,000	YDEN0603...
TPYD06M100B32.0R22	4.5	100	102	22	70	50	32	25	14.4	8	1.78	with	15,000	YDEN0603...
TPYD06J100B31.7R22	4.5	100	102	22	70	50	31.7	32	12.7	8	1.76	with	15,000	YDEN0603...
TPYD06M125B40.0R26	4.5	125	127	26	90	60	40	32	16.4	9	3.48	with	14,000	YDEN0603...
TPYD06J125B38.1R26	4.5	125	127	26	90	60	38.1	38	15.9	10	3.56	with	14,000	YDEN0603...
TPYD06M160B40.0R34	4.5	160	162	34	90	60	40	32	16.4	9	5.20	with	12,000	YDEN0603...
TPYD06J160B38.1R34	4.5	160	162	34	90	60	38.1	38	15.9	10	5.29	with	12,000	YDEN0603...

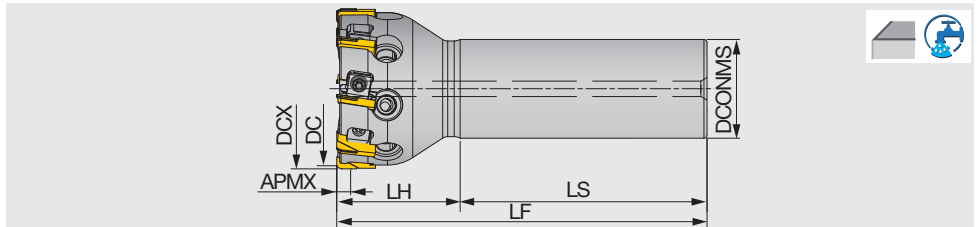
### SPARE PARTS

Designation	Insert locking wedge	Wedge fixing screw	Adjusting cam	Torx bit	Cam tightening screw	Wrench	Grip	Shell locking bolt
TPYD06M063B22.0R10	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W	CM10X30H
TPYD06*080B2*.R16	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W	CM12X30H
TPYD06*100B32.0R22	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W	CM16X40H
TPYD06*100B31.7R22	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W	TMBA-M16H
TPYD06*125B**.R26	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W	TMBA-M20H
TPYD06*160B**.R34	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W	TMBA-M20H

## EPYD06

Face milling cutter for non-ferrous applications, shank type, with PCD inserts

GAMP = +9°, GAMF = +4°



Designation	APMX	DC	DCX	CICT	DCONMS	LF	LH	LS	WT(kg)	Air hole	RPMX(min <sup>-1</sup> )	Insert
EPYD06M050C32.0R08	4.5	50	52	8	32	120	40	80	0.57	with	20,000	YDEN0603...

### SPARE PARTS

Designation	Insert locking wedge	Wedge fixing screw	Adjusting cam	Torx bit	Cam tightening screw	Wrench	Grip
EPYD06M050C32.0R08	WF875N	DS-5T	AJC08	BLDT10/S7-A	SSHM4-4	P-2	H-TB2W

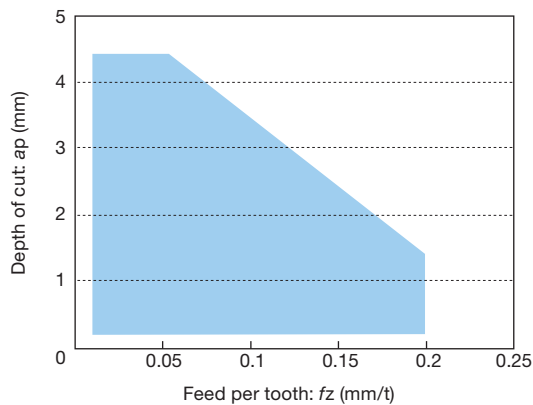


## STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Grades	Designation	Cutting speed Vc (m/min)	Feed per tooth fz (mm/t)
<b>N</b>	Cast aluminum alloy / Die-cast (Si < 13%)	DX110	YDEN0603PDFR-D	500 - 4,000	0.05 - 0.20
	Cast aluminum alloy / Die-cast (Si > 13%)	DX110	YDEN0603PDFR-D	200 - 800	0.05 - 0.20
	Aluminum alloy	DX110	YDEN0603PDFR-D	500 - 4,000	0.05 - 0.20
	Copper alloy	DX110	YDEN0603PDFR-D	200 - 500	0.05 - 0.20

- The values in the above list are of standard recommendations and may require adjustments in consideration with cutting depths and/or workpiece/machine rigidity.
- Use wiper inserts (-WD) for better surface requirements and deburring inserts (-BD) to remove burrs.
- Always use wet cutting (emulsion coolant) for machining aluminum or copper alloys.

## APPLICATION RANGE



Cutter : TPYD06J080B25.4R16 ( $\phi = 80$  mm, z = 16)  
 Insert : YDEN0603PDFR-D DX110  
 Workpiece material : ADC12  
 Cutting speed : Vc = 2,513 m/min  
 Coolant : Wet  
 Machine : Vertical M/C, BT40, 18.5 kW



## INSERT SETTING PROCEDURE

### 1 Mounting the inserts

Place the insert in the pocket and LIGHTLY tighten the screw at 1 N·m(0.74 ft-lb).

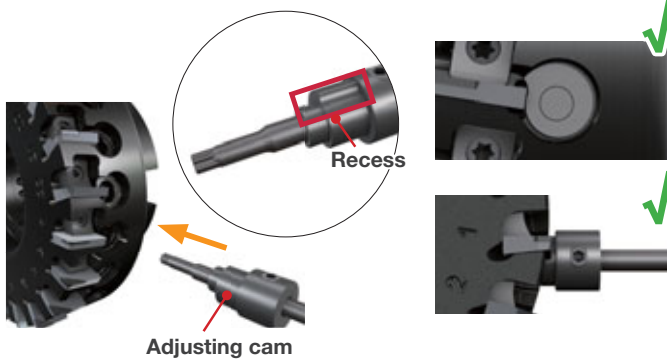
Do not fully tighten the screw at this point.

Note: Press the insert firmly to the pocket while clamping to eliminate the gap



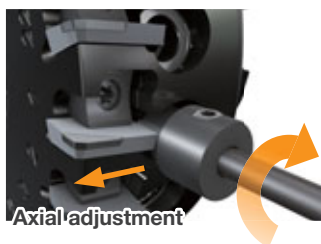
### 2 House to utilize the key

The recessed part of the cam should be placed on the insert bottom. Make sure to place the cam all the way in.



### 3 Adjusting the axial height

Place the adjusting cam in the hole located at the bottom of the pocket. Make sure that the cam is in contact with the insert bottom. Adjust the insert axial height by rotating the cam in the CW direction to gradually increase the axial measure. Stop when it reaches 30-40 μm just below the desired position. Then, slightly rotate the cam in the CCW direction before removing the cam from the cutter body.



### 4 Tighten the insert clamping screws

Firmly tighten the insert clamping screws at 3.5 N·m (2.58 ft-lb). In order to prevent the body deformation by tightening, it is recommended that the final tightening is done by alternately. (e.g. For  $\phi 100$ -z22, 1,3,5,7...21, then 2,4,6,8,...22). For the best balanced insert installation, repeat this tightening procedure for every other insert until all inserts are securely fixed.



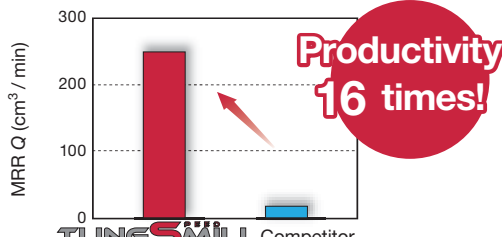
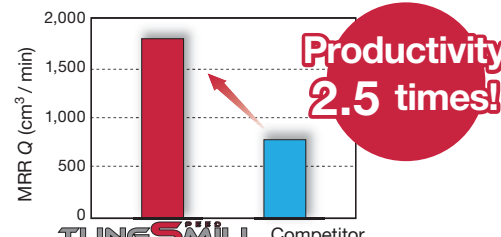


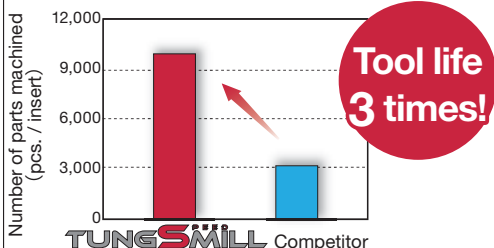
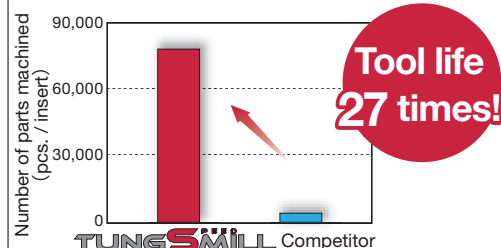


### 5 Final adjustments

For the final axial adjustment, instead of setting the insert height close to the target position, set so that it reaches approximately 8 μm above the target. Slightly rotate the cam CCW to remove the key off the body. The insert will go down by 8 μm to the target height when the cam is removed.

The inserts are recommended to set to < 5 μm axially in relation to one another.

## PRACTICAL EXAMPLES

Workpiece type		Hoist body part	Crank casing	
Cutter		TPYD06J080B25.4R16 (ø80 mm, z = 16)	TPYD06J100B31.7R22 (ø100 mm, z = 22)	
Insert		YDEN0603PDFR-D	YDEN0603PDFR-D	
Grade		DX110	DX110	
Workpiece material		High pressure aluminum die cast (ADC12)  <b>N</b>	High pressure aluminum die cast (ADC12)  <b>N</b>	
Cutting conditions	Cutting speed: $V_c$ (m/min)	2,011	3,142	
	Feed per tooth: $f_z$ (mm/t)	0.1	0.09	
	Feed speed: $V_f$ (mm/min)	12,800	20,000	
	Depth of cut: $a_p$ (mm)	4/1	4.5/1.5	
	Width of cut: $a_e$ (mm)	5 - 20	10 - 70	
	Machining	Face milling	Face milling	
Coolant	Wet (External)	Wet (Internal)		
Machine	Vertical M/C, BT50	Vertical M/C, BT40		
Results	 <p><b>Productivity 16 times!</b></p> <p>MRR was improved by 16x, with increased table feed and reduced number of passes. Deburring inserts eliminated burr formation.</p>		 <p><b>Productivity 2.5 times!</b></p> <p>MRR was improved by 2.5x thanks to super high density cutter design.</p>	
Workpiece type		Cam housing	Cylinder head	
Cutter		Special TPYD06 body (ø61 mm, z = 10)	Special TPYD06 body (ø75 mm, z = 15)	
Insert		YDEN0603PDSR-D	YDEN0603PDSR-D	
Grade		DX110	DX110	
Workpiece material		High pressure aluminum die cast (ADC12)  <b>N</b>	Cast aluminum alloy (AC2B)  <b>N</b>	
Cutting conditions	Cutting speed: $V_c$ (m/min)	1,916	990	
	Feed per tooth: $f_z$ (mm/t)	0.11	0.04	
	Feed speed: $V_f$ (mm/min)	11,400	2,849	
	Depth of cut: $a_p$ (mm)	0.5	0.5	
	Width of cut: $a_e$ (mm)	- 5	- 70	
	Machining	Face milling	Face milling	
Coolant	Wet (Internal)	Wet (Internal)		
Machine	Vertical M/C, BT30	Specialized machine		
Results	 <p><b>Tool life 3 times!</b></p> <p>Thanks to high tooth density, more number of teeth are engaged in cut, reducing the load per insert, and as the result, the insert life tripled.</p>		 <p><b>Tool life 27 times!</b></p> <p>Wear resistant DX110 PCD grade dramatically improved the tool life by 27x.</p>	

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