

Ultimate Solutions for High Efficiency Aluminum Machining







INDEX

06 TOOL SELECTION GUIDE

for Face milling / Shoulder milling / Pocket and Profile milling

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ALUMINUM MILLING

Tungaloy's aluminu



m milling solutions

As electric vehicles continue to grow in popularity, machining of the complex and intricate aluminum components also increases. As useful and advantageous as being light-weight, strong, more rust-resistant and easier to fabricate than steel, aluminum alloys also raise concerns with challenging chip control and burr formation during milling processes. Tungaloy offers a comprehensive range of sophisticated aluminum machining tools that contribute to manufacturers seeking to improve productivity.



TOOL SELECTION GUIDE

Based on cutting speed and cutter diameter







TOOL FEATURES AND COMPARISONS

| | | TUNG <mark>S</mark> ÄILL | TUNG <mark>S</mark> ÄILL | TUNG-ALUMILL | TUNGFREC | |
|--------------|------------------------------------|-------------------------------|-------------------------------|--|--|--|
| | | TPYD / EPYD | TPYP / EPYP | EPV / TPV | EPAV / HPAV / TPAV | |
| | | | | | | |
| A | pproach angle | 90° | 90° | 90° | 90° | |
| m | Suited for ultiple applications | | | \checkmark | ✓ | |
| Max. | depth of cut (APMX, mm) | 4.5 | 4 or 11 | 16 | 6 | |
| ade | PCD | \checkmark | \checkmark | | | |
| G | Carbide | | | \checkmark | \checkmark | |
| No. | of edges per insert | 1 | 1 or 2 | 2 | 2 | |
| r Z | Standard pitch | | | \checkmark | | |
| Cutte | Close pitch | \checkmark | | \checkmark | ✓ | |
| 00 | Extra-close pitch | \checkmark | \checkmark | | \checkmark | |
| Inse | rt height adjustment | \checkmark | \checkmark | | | |
| Thro | ough-coolant supply | Direct | Direct | \checkmark | \checkmark | |
| Applications | | Face milling Shoulder milling | Face milling Shoulder milling | Face milling Shoulder milling Profiling Slotting | Face milling Shoulder milling Profiling Slotting | |
| Tool profile | | | | | | |

| | | TFE / EFE | DOPENT | |
|------|------------------------------------|--------------|--------------|--|
| | | TFE / EFE | TEN / EEN | |
| | | | | |
| A | pproach angle | 86° | 70° | |
| m | Suited for ultiple applications | | | |
| Max. | depth of cut (APMX, mm) | 3.5 or 8 | 6.4 | |
| Ide | PCD | \checkmark | | |
| Gra | Carbide | \checkmark | \checkmark | |
| No. | of edges per insert | 1 or 4 | 10 | |
| | Standard pitch | \checkmark | \checkmark | |
| utte | Close pitch | \checkmark | \checkmark | |
| 0 8 | Extra-close pitch | | \checkmark | |
| Inse | rt height adjustment | \checkmark | | |
| Thro | ugh-coolant supply | \checkmark | \checkmark | |
| | Applications | Face milling | Face milling | |
| | Tool profile | | | |

TOOL SELECTION GUIDE

Based on cutting speed and cutter diameter







| | | SOLIDN | NEISTER | TUNGMEISTER | TUNGFREC | TUNG | REC |
|--------------|------------------------------------|-----------------------|-----------------|-------------------------------------|--|-------------------------------|--------------------|
| | | TECR-B3-R | TECA-H3-R | VEE-A | EPAV / HPAV / TPAV | EPO / HPO / TPO | ELS / TLS |
| | | ø6 - | ø1- | ø8 - | - 6 | 17 0 | Roughing |
| A | pproach angle | 90° | 90° | 90° | 90° | 90° | 90° |
| m | Suited for ultiple applications | \checkmark | \checkmark | | \checkmark | \checkmark | |
| Max. | depth of cut (APMX, mm) | > 1.1D | > 1.5D | > 0.6D | 6 | 7, 10.8, or 16.7 | ≈ 1D |
| ade | PCD | | | | | | |
| Ģ | Carbide | \checkmark | \checkmark | \checkmark | \checkmark | \checkmark | \checkmark |
| No. | of edges per insert | - | - | - | 2 | 2 | 2 |
| it c | Standard pitch | \checkmark | \checkmark | \checkmark | | \checkmark | \checkmark |
| Cutt | Close pitch | | | \checkmark | \checkmark | \checkmark | |
| 00 | Extra-close pitch | | | | \checkmark | \checkmark | |
| Inse | rt height adjustment | | | | | | |
| Thro | ough-coolant supply | | | | \checkmark | \checkmark | \checkmark |
| | Applications | Shoulder milling Prof | filing Slotting | Shoulder milling Profiling Slotting | Face milling Stouldermiling Profiling Slotting | Face milling Shoulder milling | Profiling Slotting |
| Tool profile | | | | | | | |
| | | | | | | | |
| | | | | | | 1 4 | |

TOOL FEATURES AND COMPARISONS

| | TUNG | 5-TRI | TUNG-ALUMILL | TUNG <mark>S</mark> ÄILL | TUNG <mark>S</mark> Äill |
|-------------------------------------|-------------------------------|--------------------|--|-------------------------------|-------------------------------|
| | EPA / HPA / TPA | TLA | EPV / TPV | TPYD / EPYD | TPYP / EPYP |
| | Roughing | | | | |
| Approach angle | 90° | 90° | 90° | 90° | 90° |
| Suited for multiple applications | \checkmark | | \checkmark | | |
| Max. depth of cut (APMX, mm) | 6, 10, or 15 | ≈ 1D | 16 | 4.5 | 4 or 11 |
| 용 PCD | PCD | | | \checkmark | \checkmark |
| G Carbide | \checkmark | \checkmark | \checkmark | | |
| No. of edges per insert | 3 | 3 | 2 | 1 | 1 or 2 |
| Standard pitch | \checkmark | \checkmark | \checkmark | | |
| Close pitch | \checkmark | | \checkmark | \checkmark | |
| Extra-close pitch | | | | \checkmark | \checkmark |
| Insert height adjustment | | | | \checkmark | \checkmark |
| Through-coolant supply | \checkmark | \checkmark | \checkmark | Direct | Direct |
| Applications | Face milling Shoulder milling | Profiling Slotting | Face milling Shoulder milling Profiling Slotting | Face milling Shoulder milling | Face milling Shoulder milling |
| Tool profile | | | | | |

TOOL SELECTION GUIDE

Based on cutting speed and cutter diameter

Pocket and profile milling



| | SOLIDMEISTER | | TUNGM | EISTER | TUNGFREC | TUNGREC | | |
|------------------------------|------------------|----------------------|-----------------|-----------------------------|--------------|--|--|--|
| TEC | | TECR-B3-R | TECA-H3-R | VEE-A | VBE-BGA | EPAV / HPAV / TPAV | EPO / HPO / TPO | |
| | | AN INCOMENT | 55 | | | | | |
| Appr | oach angle | 90°- | 90° | 90° | Ball | 90° | 90° | |
| S S | Suited for | | | | Jaii | | | |
| Max. depth of cut (APMX. mm) | | > 1.1D | > 1.5D | > 0.6D | >0.5D | 6 | 7. 10.8. or 16.7 | |
| qe | PCD | | | | | | | |
| Gra | Carbide | \checkmark | \checkmark | \checkmark | \checkmark | \checkmark | \checkmark | |
| No. of e | dges per insert | - | - | - | - | 2 | 2 | |
| _{क ट} St | tandard pitch | \checkmark | \checkmark | \checkmark | \checkmark | | \checkmark | |
| Cutto | Close pitch | | | ✓ | | √ | ✓ | |
| Ext | tra-close pitch | | | | | \checkmark | \checkmark | |
| Insert he | eight adjustment | | | | | | | |
| Through | -coolant supply | | | | | \checkmark | \checkmark | |
| Ар | plications | Shoulder milling Pro | filing Slotting | Shoulder Profiling Slotting | Profiling | Face milling Shoulder milling Profiling Slotting | Face milling Shoulder milling Profiling Slotting | |
| Tool profile | | | | | | | | |

TOOL FEATURES AND COMPARISONS

| | TUNG-TRI | TUNG-ALUMILL | ROUNDSPLIT | |
|-------------------------------------|--|--|-------------------------------------|--|
| | EPA / HPA / TPA | EPV / TPV | TRC / ERC | |
| | | | | |
| Approach angle | 90° | 90° | Round insert | |
| Suited for multiple applications | \checkmark | \checkmark | \checkmark | |
| Max. depth of cut (APMX, mm) | 6, 10 , or 15 | 16 | 6 or 8 | |
| PCD | | | | |
| Carbide | \checkmark | \checkmark | \checkmark | |
| No. of edges per insert | 3 | 2 | 4 | |
| Standard pitch | \checkmark | \checkmark | \checkmark | |
| Close pitch | \checkmark | \checkmark | | |
| Extra-close pitch | | | | |
| Insert height adjustment | | | | |
| Through-coolant supply | \checkmark | \checkmark | \checkmark | |
| Applications | Face milling Shoulder milling Profiling Slotting | Face milling Shoulder milling Profiling Slotting | Shoulder milling Profiling Slotting | |
| Tool profile | | | | |

Tungaloy's aluminum milling tools for high efficiency milling

SUCCESS CASES





| Workpiece | : Hoist body part |
|--------------------|------------------------------|
| Workpiece material | : ADC12 |
| Cutter | : TPYD06J080B25.4R1 |
| | (ø80 mm, z = 16) |
| Insert | : YDEN0603PDFR-D |
| Grade | : DX110 |
| Cutting speed | : <i>V</i> c = 2,011 m/min |
| Feed per tooth | : <i>f</i> z = 0.1 mm/z |
| Feed speed | : <i>V</i> f = 12,800 mm/min |
| Depth of cut | : ap = 4 mm / 1 mm |
| Width of cut | : ae = 5 - 20 mm |
| Machining | : Face milling, Wet |
| Machine | : Vertical M/C, BT50 |
| | |





| Workpiece | : Motorcycle parts | | | 2 | |
|--------------------|-------------------------------------|-------|----|------|------------|
| Workpiece material | : A7075S / AlZn5.5MgCu (200HB) | | | | |
| Cutter | : TEN09R125M38.1-10 | 6 | // | | |
| | (ø125 mm, z = 10) | | | | |
| Insert | : PNCU0905GNFR-AJ | | | (| Cuolo timo |
| Grade | : TH10 | | | , | |
| Cutting speed | : <i>V</i> c = 1,000 m/min | - | 40 | | 25 %! |
| Feed per tooth | : $fz = Roughing: 0.3 mm/z,$ | (bc) | | _ | |
| | Finishing: 0.1 mm/z | sec | 30 | | |
| Feed speed | : Vf = Roughing: 7,640 mm/min, | ue u | 20 | | |
| | Finishing: 2,550 mm/min | e tir | 20 | | |
| Depth of cut | : ap = Roughing: 2 mm, Finishing: 0 | .5 mm | 10 | | |
| Width of cut | : ae = 20 - 80 mm | 0 | | | |
| Machining | : Face milling, Wet | | 0 | | |
| Machine | : Vertical M/C, BT40 | | | Comp | . 4 |
| | | | | | |

ALUMINUM MILLING

| TUN | G-ALU | MILL | | | |
|---------------------------------|--|------|------------|-------------|-------------------|
| Workpiece Workpiece material | : Chamber : A6061 (Forged) | | | | N |
| Cutter | : TPV16R200U0075A04 (ø50.8 mm, z = 4) | | | 2 | |
| Insert | : XVCT160508R-AJ | | D.L. | | |
| Grade | : TH10 | | | | Productivity |
| Cutting speed | : <i>V</i> c = 1,006 m/min | | 1,6 | 00 | 1.3 times! |
| Feed per tooth | : fz = 0.2 mm/t | | <u> </u> | 00 | 1.5 tilles |
| Feed speed | : <i>V</i> f = 5,119 mm/min | | .j 1,2 | 00 | |
| Depth of cut | : <i>a</i> p = 6.35 mm | all | ຶີ 1,0 | 00 | |
| Width of cut | : ae = 44.5 mm | GI | 0 8 0 8 | 00 | |
| Machining | : Ramping, Wet | 13 | e By 6 | 00 | |
| Machine | : Vertical M/C | | ₹ 4 2 | 00 | |
| | | | TUN | IG-A | LUMILL Competitor |



| Workpiece | : Parts for industrial robot | |
|--------------------|--------------------------------|--|
| Workpiece material | : A2017 | |
| Cutter | : TPV16R050M22.0E04 | |
| | (ø50 mm, z = 4) | |
| Insert | : XVCT160504R-AJ | |
| Grade | : TH10 | |
| Cutting speed | : Vc = 864 m/min | |
| Feed per tooth | : <i>f</i> z = 0.18 mm/t | |
| Feed speed | : <i>V</i> f = 3,960 mm/min | |
| Depth of cut | : <i>a</i> p = 10 mm | |
| Width of cut | : <i>a</i> e = 35 mm | |
| Machining | : Square shoulder milling, Wet | |
| Machine | : Vertical M/C | |
| | | |

Productivity 1,600 1.3 times! 1,400 1,200 1,000 800 600 400 200 0

gineering

TUNG-ALUMILL Competitor

MMR Q (cm³/min)





Tailored to your specific a



TungSpeed-Mill with extended cutting edges

- Extended cutting edge length for efficient rough milling with high walls
- Axial insert adjustment capability provide high floor surface finish

Face mills with PCD-brazed cartridges

- Wedge-locked cartridges for enhanced process security
- Coolant jets are directed to the cutting edge for excellent surface quality



luminum machining needs

Tungaloy is your partner for complex engineering projects for complete machining of aluminum components. Our customized tools provide the machining processes with flexible and reliable solutions that meet the demands of precision, quality, and performance.



End mills with brazed PCD tips

- Provides extremely smooth wall surface with no witness mark
- Provides high surface quality at extremely high cutting speeds

Combination reaming and fine boring tools with brazed PCD tips

- Contour boring tool combines multiple cuts into a single process
- Provides superior surface finishing quality

Please contact your Tungaloy distributor to have your tools customized

TUNGALOY'S SIX KEY TECHNOLOGIES

1. Minimizing burr formation

Burr control is a challenge when milling aluminum components. For over two decades, Tungaloy's polycrystalline diamond (PCD) insert development for unique deburring design has contributed to aluminum component manufactures in conquering burr formation during milling. Innovative deburring inserts and standard inserts are alternately indexed on the cutter so that the deburring insert remove the burr generated by the preceding standard insert, minimizing burr for excellent part quality. This method relieves the non-productive, costly finishing process, while reducing cycle time.



2. Superior part quality by "direct coolant delivery" technology

Built-up edge is a common issue during aluminum machining. With Tungaloy's Direct Coolant Delivery technology, TungSpeed-Mill directs streams of coolant jets precisely to the cutting point, ensuring effective chip evacuation and superior part quality.



3. Chip splitters

A key to successful deep cavity and pocket milling is to split the chips into small segments. Serrated cutting edges crush chips into small pieces, as well as make cutting vibrations asynchronous to minimize chatter generation.



4. High density cutter body for increased productivity

Automotive part manufacturers are under constant pressure to meet stringent cycle time requirements. In finish machining, high number of teeth increase productivity. Tungaloy offers a range of high density cutters with innovative insert and cutter body designs.



5. Reduced insert setup time

Precise axial runout adjustments of inserts are critical in achieving high precision surface finish requirements. TungSpeed-Mill features innovative CamAdjust technology. Use a single wrench to increase the insert axial positions and tighten the insert screws to reduce the time consuming adjusting process.

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



Grip (H-TB2W) 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. Adjusting cam (AJC08) TUNG Key rotation View from A Cam TORX[®] bit Recess (BLDT10/S7 (the smallest diameter) TORX[®] head

Special key wrench with adjusting cam

6. Tools for high speed cutting

For productive aluminum milling it is common to use PCD-tipped inserts at extremely high cutting speeds. In addition, a strong body design is required to withstand extreme stress without breaking. Tungaloy offers a range of unique products that contributes to your high speed machining.

V bottom insert and tangential insert

Increased rotational speed induces a greater centrifugal force on the inserts, and in extreme cases can cause them to burst out of the cutter. Tungaloy's innovative V bottom inserts and tangential inserts are designed to eliminate radial insert displacements under extreme conditions to provide ultimate process security for your aluminum machining.



Transform your existing machine into a high speed milling performer

Get 35,000 rpm out of a 3,000 rpm spindle with Tungaloy's SpinJet, without adding a transformer or changing the main spindle itself. Simply attach SpinJet coolant-driven auxiliary high speed spindle to any machining center spindle and turn it into a high speed spindle machine, no matter what it's maximum rpm is. SpinJet transforms your machine into a high speed spindle machine that's capable of running small diameter rotary tools up to 35,000 rpm and higher.



Contact your local Tungaloy dealer for more information on productive and high precision aluminum milling solutions

FIVE PCD GRADES

PCD grades

| Grade | Microstructure | Approx. grain size (µm) | Hardness (Hv) | T.R.S. (GPa) | Feature | Applications |
|-------|----------------|-------------------------------|------------------|-----------------|--|---|
| DX110 | | <1 | 8,500 | 1.8 | Submicron grain PCD grade. Provides sharp cutting edge. Suited when mirror-like surface finish is required. | Rough to finish machining of aluminum alloys General finish machining of non-ferrous metals |
| DX120 | | 4.5 | 9,000 | 1.8 | Easily wire-EDM-able into tools for machining complicated profiles. | - General finish machining of non-ferrous metals |
| DX140 | | 12.5 | 10,000 | 1.7 | Good balance of wear and fracture resistance. | General finish machining of non-ferrous metals Suited for machining FRPs, carbons, and hard rubbers |
| DX160 | | 28 | 11,000 | 1.6 | Coarse grain PCD grade with good wear resistance. | Ideal for machining high silicon content (Si ≥ 13 vol%) aluminum alloys Suited for metal matrix composites Suited for rough machining of tungsten carbide alloys and ceramics Suited for masonry |
| DX180 | | 45 | 12,000 | 1.5 | Extremely wear resistant PCD grade featuring super-large grain sizes. | Ideal for machining high silicon content (Si ≥ 13 vol%) aluminum alloys Suited for metal matrix composites Suited for rough machining of tungsten carbide alloys and ceramics Suited for masonry |

Cutting performance





Workpiece material:

- 20 % Si, aluminum alloy ●Insert: SPGN120308-DIA
- Insert: SPGN120308-L
- Holder: CSBPR2525
- Cutting speed: Vc = 400 m/min• Feed: f = 0.1 mm/rev
- Depth of cut: ap = 0.5 mm
- Coolant: Dry
- Coolant DryCutting time: 30 min.



Continuous external turning

- Workpiece material:
- High purity aluminum ceramics (2040 Hv) Insert: SNGN120408-DIA
- Honed edge 0.05 mm x -30°
- Holder: CSBNR2525
 Cutting speed: Vc = 20 m/min
- Feed: f = 0.025 mm/rev
- Depth of cut: ap = 0.2 mm/rev
- Coolant: Wet
- Outting time: 5 min.



PCD grades and their properties

Standard cutting conditions

| ISO | Workpiece material | | | Grade | | | Cutting speed | Depth of cut | Feed per tooth |
|-----|-------------------------------------|-------|-------|-------|-------|-------|---------------|-----------------|----------------|
| 150 | trempiece material | DX110 | DX120 | DX140 | DX160 | DX180 | Vc(m/min) | <i>a</i> p (mm) | fz(mm/t) |
| | Cast aluminum alloys (Si < 13%) | Ø | 0 | 0 | | | 500 - 4,000 | 0.1 - 4 | 0.05 - 0.2 |
| | Cast aluminum alloys (Si ≥ 13%) | Ø | 0 | 0 | | | 200 - 800 | 0.1 - 3 | 0.05 - 0.2 |
| | Wrought aluminum alloys | Ø | 0 | 0 | | | 500 - 4,000 | 0.1 - 4 | 0.05 - 0.2 |
| | Metal matrix composites | Ø | 0 | 0 | | | 200 - 800 | 0.1 - 3 | 0.05 - 0.2 |
| | Copper alloys | Ø | 0 | | | | 200 - 500 | 0.1 - 3 | 0.05 - 0.2 |
| | Magnesium alloy | Ø | 0 | | | | 200 - 700 | 0.1 - 3 | 0.05 - 0.2 |
| N | Carbon, graphite | | | 0 | 0 | Ø | 300 - 500 | 0.05 - 2 | 0.05 - 0.2 |
| | FRPs | | | 0 | 0 | Ø | 100 - 1,000 | 0.05 - 0.5 | 0.05 - 0.1 |
| | Bi-metals (Aluminum + cast iron) | | | 0 | 0 | Ø | 50 - 180 | 0.25 - 1 | 0.05 - 0.15 |
| | Titanium alloys | Ø | 0 | 0 | | | 50 - 250 | 0.1 - 0.3 | 0.05 - 0.2 |
| | Ceramics (green) | | | | 0 | Ø | 20 - 90 | 0.1 - 1 | 0.05 - 0.2 |
| | Ceramics (sintered) | | | | 0 | Ø | 10 - 50 | 0.1 - 0.5 | 0.05 - 0.1 |
| | Cemented carbide | | | | 0 | Ø | 10 - 20 | 0.02 - 0.2 | 0.01 - 0.05 |
| | Wood and fiber cement siding boards | Ø | 0 | 0 | | | 500 - 4,000 | - | 0.05 - 0.2 |

©:First choice ○:Second choice

Choose the most suited PCD grade for your applications







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Tungaloy APP & SNS

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