Member IMC Group

Tungaloy

INDUSTRY 4.0

FEED the SPEED!

HIGH-FEED MILLING SOLUTIONS

HIGH-FEED MILLING

the Go-to Solution for *Accelerated Machining*

Three decades of know-how developing the most efficient solutions for **High-Feed Milling (HFM)**

1990

Tungaloy quickly detects the emerging needs for higher efficiency in face milling in the late 1990s and introduces the **MillFeed** TXP series to the market.

2010

Tungaloy introduces its **DoFeed** line in 2010 as the market starts to prefer more compact but faster machines. **DoFeed** revolutionized the concept of high-feed milling, offering large diameter cutters with higher feed rates.

2020

TungForceFeed, **MillQuadFeed**, and **DoTwistBall** continue Tungaloy's legacy of offering highly efficient products to the market, reflecting the company's core concept of accelerated machining.

GET STARTED!

What is inside?

4

WHY HFM?

HFM is the go-to solution for accelerated machining!

In today's hypercompetitive machining market, ***cycle time plays a major role in determining the productivity*** and profitability of any given job

Simply increasing the speed or revolutions per minute (RPM) may appear to decrease the cycle time at a glance. A reduction in cycle time, however, is minimized by the time spent on changing inserts as the increase in speed or RPM shortens tool life. This additional job also increases the overall tool cost.

High-feed milling (HFM) is the solution for this problem. The tool works at elevated feed rates with modest speed or RPM, which reduces cycle time while extending tool life.

Thus, HFM has drastically transformed the world of milling. These flexible and versatile tools offer incomparable advantages over other milling products: dramatically reduced cycle time and cost, longer tool life, and higher quality of finished parts.

Machining faster and more efficiently - Long overhang and large components

HFM specializes in long-reach applications, such as deep-hole and pocket machining. Combined with its capability of ramping, Tungaloy's high-feed cutters perform well in helical interpolation, where the tool moves in a circular motion to X and Y axes while simultaneously moving downward on the Z axis.

HFM is also the most suitable operation for machining large components. However, an additional finishing pass is usually required to clean up the rough surface. Using wiper inserts on Tungaloy's HFM cutters helps customers achieve outstanding surface finish with no reduction in feed rate, thereby drastically making the overall machining process more efficient.

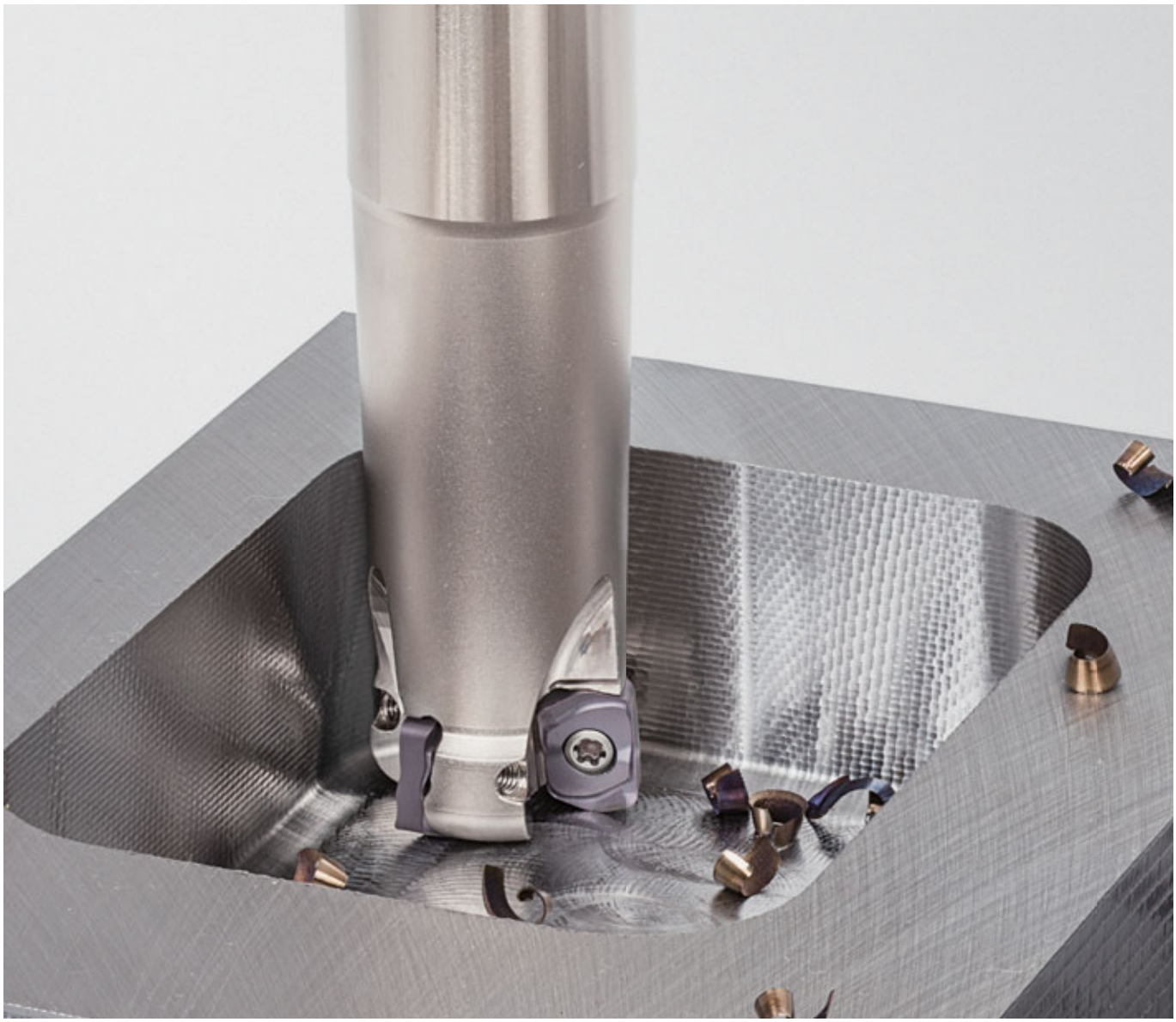
Simplifying the processes for near net shape

HFM provides high metal removal rate despite its small depth of cut. As this feature makes workpiece materials closer to the desired shape in one operation, semi-finishing operations can often be eliminated, and the finishing process can be simplified.

Versatility

Versatility is another advantage of HFM. Tungaloy offers HFM inserts with very positive cutting edges, which easily shear the material without work hardening.

For an example, **DoFeed** cutters can machine multiple hole diameters and produce counterbore and countersink in the same operation with no need to change or purchase multiple tools. This versatility helps customers save both cost and time.



HIGH-FEED MILLING MECHANISM

The HFM mechanism is based on the *"chip thinning"* principle

First utilized in the die and mold industry, high-feed milling is a machining method that pairs shallow depth of cut (DOC) with high feed rate up to 2.0 mm per tooth. This combination maximizes the amount of metal being removed from a part and increases the number of finished parts in a given time.

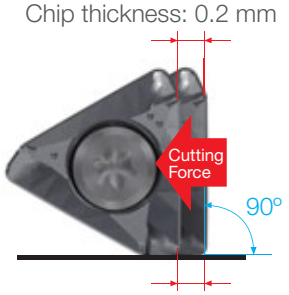
The HFM mechanism is based on the "chip thinning" effect. The thickness of a chip depends on the entry angle of a milling cutter. A cutter with a 90° entry angle has no benefit of chip thinning as the feed per tooth at 0.2 mm only creates chips 0.2 mm thick (Fig. 1). In the case of a cutter with a 45° entry angle, feed per tooth at 0.28 mm creates chips 0.2 mm thick (Fig. 2), which allows the feed to be increased, resulting in reduced cycle time. Fig. 3 shows the chip thinning effect of **DoFeed**, Tungaloy's best selling HFM line, where the feed per tooth at 0.77 mm also provides chips 0.2 mm thick. Such an increase in the feed per tooth helps customers cut the cycle time by half or even more.

Low cutting force is another advantage of HFM. The entry angle on a cutter decides the direction of the cutting force. A 90° cutter (Fig. 1) will produce cutting force that acts perpendicular to the spindle, putting incredible pressure on the tool. As for a 45° cutter (Fig. 2), cutting force acts against the spindle at a 45° angle. With **DoFeed**, cutting force is almost parallel to the spindle due to its acute entry angle (Fig. 3), which means there is less pressure on the spindle.

DoFeed series

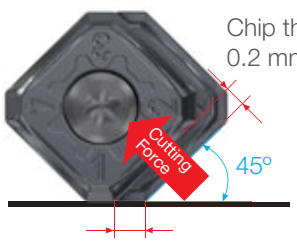
Fig.1

Chip thickness: 0.2 mm



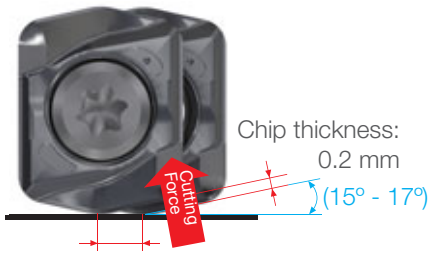
Feed per tooth: 0.2 mm/t

Fig.2



Feed per tooth: 0.28 mm/t

Fig.3

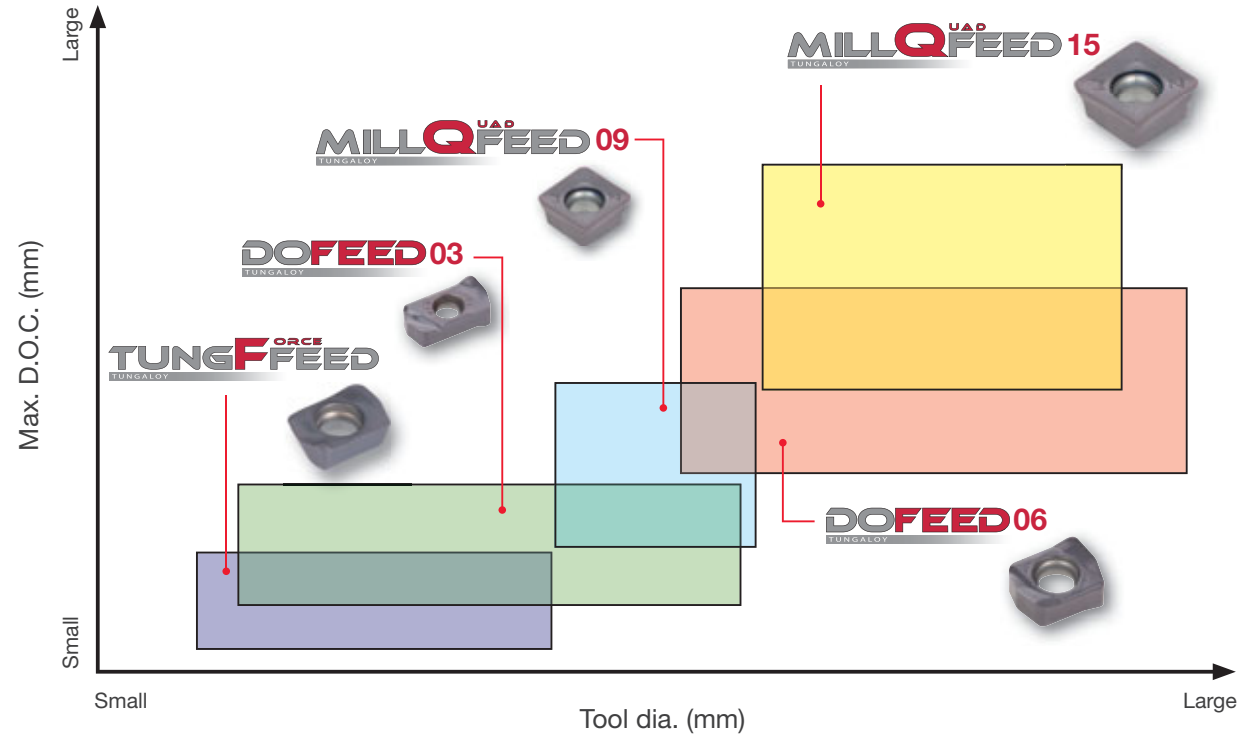


Feed per tooth: 0.77 mm/t

TOOL SELECTION GUIDE

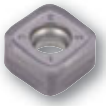
Selecting the right tool to maximize profitability

Tungaloy's High-Feed MillLines is shown on this chart in relation to tool diameter and depth of cut



TUNGMEISTER
Priority on accuracy

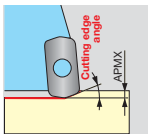
DOTWIST BALL
Priority on large D.O.C and ramping



DOFEEDQUAD
Priority on economics

In principle, if the spindle power increases, higher cutting parameters, including higher feed per tooth, larger cutting diameter, and denser tooth pitch, can be used on a machine. However, if the parameters are set too high, the cutting force may exceed the spindle capacity and suddenly stop the machine. To prevent such a problem from happening, it is recommended to calculate the theoretical cutting force prior to machining and ensure that the cutting parameters are set within the limits.

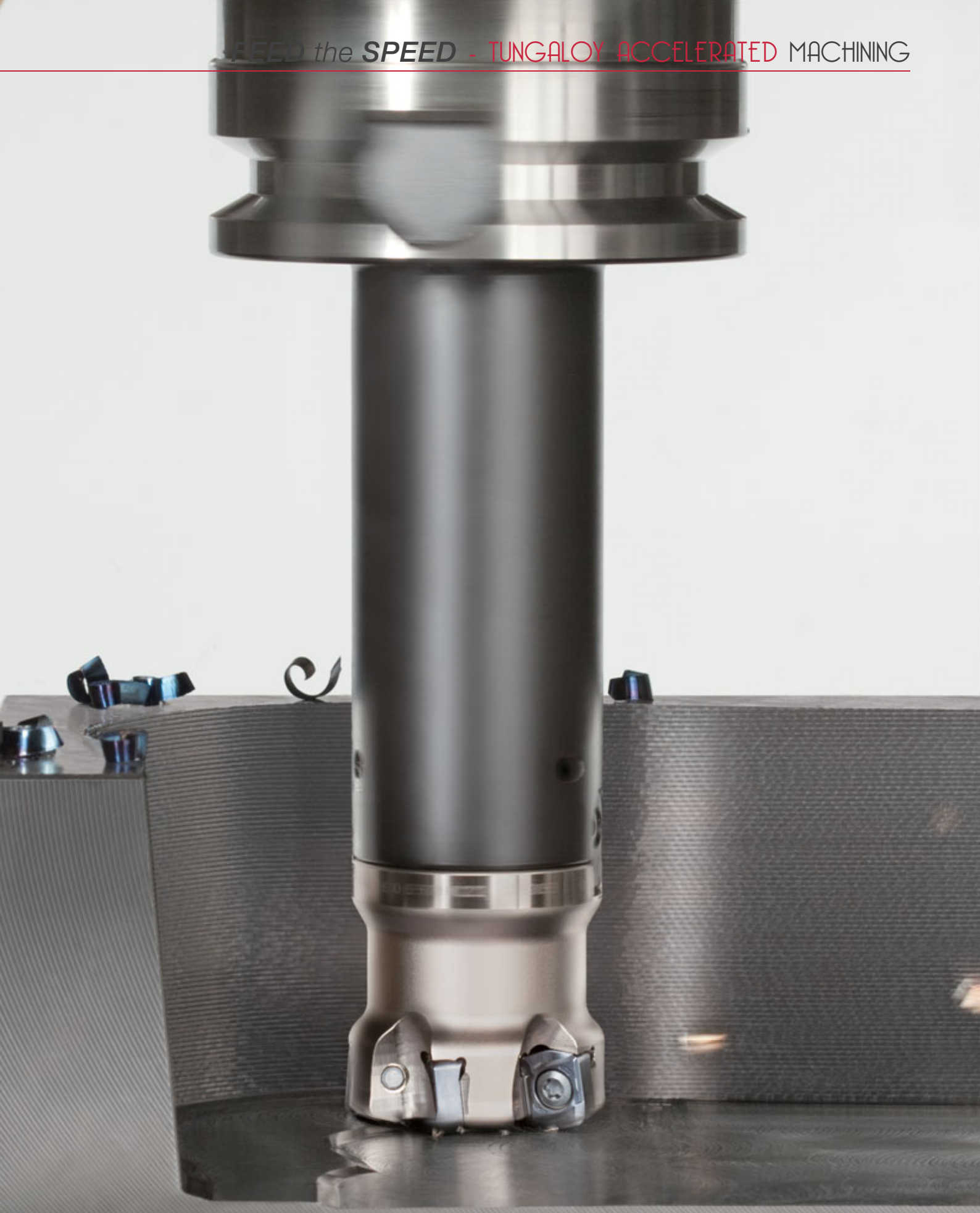
Tool and application choices

		TungForceFeed	DoFeed	MillQuadFeed	DoTwistBall	DoFeedQuad	TungMeister
							
Tool diameter		ø8 - ø25	ø16 - ø200	ø25 - ø160	ø20 - ø63	ø50 - ø125	ø10 - ø20
Depth of cut (APMX)		0.5	1 / 1.5	1 / 1.5 / 2 / 2.5	1.3 / 2	2	0.6 - 1.5
Entry angle		12º	17º / 15º	7º / 12º / 10º / 14º	20º / 25º	13º	R
No. of corners (insert)		2	4	4	4	8	1
Spindle size	BT30 / SK30 / CAT30	↕	↕				↕
	BT40 / SK40 / CAT40	↕	↕	↕	↕		↕
	BT50 / SK50 / CAT50	↕	↕	↕	↕	↕	↕
Applications	Facing	☆	★	★	☆	☆	★
	Shouldering	☆	★	☆	☆		☆
	Shouldering R	★			★		
	Slotting	☆	★	★	★		★
	Slotting R	★			★		
	Profiling	☆	☆	☆	☆		★
	Pocketing	☆	★	☆	★		☆
	Ramping	☆	★	☆	★		☆
	Plunging	★	☆	★	☆		★
	Long overhang	☆	☆	★	★	☆	☆
	Interrupted surface	☆	☆	★	☆	☆	★
	Thin workpiece	☆	★	★	★	★	☆

★: Most suitable
☆: Suitable
★: Usable

Insert grade choices for each workpiece material

ISO	Workpiece material	Hardness	1st choice	Wear resistance	Fracture resistance
P	Carbon steels	- 300HB	AH3225	AH8015	AH3135
	Alloy steels				
M	Austenitic stainless steels	- 200HB	AH130	AH3135	-
	Ferritic stainless steels				
	Martensitic stainless steels	- 200HB			
	Precipitation hardening stainless steels	- 40HRC			
K	Gray cast irons	- 250HB	AH120	AH8015	AH3225
	Ductile cast irons				
S	Titanium alloys	- 40HRC	AH130	AH3135	-
	Supper alloys	- 40HRC	AH8015	-	AH120
H	Plastic mold steels	- 45HRC	AH3225	AH8015	AH3135
	Hot mold steels	45 - 55HRC	AH8015	AH8005	-
	Cold mold steels	55 - 60HRC	AH8005	-	AH8015



MILESTONE PRODUCTS

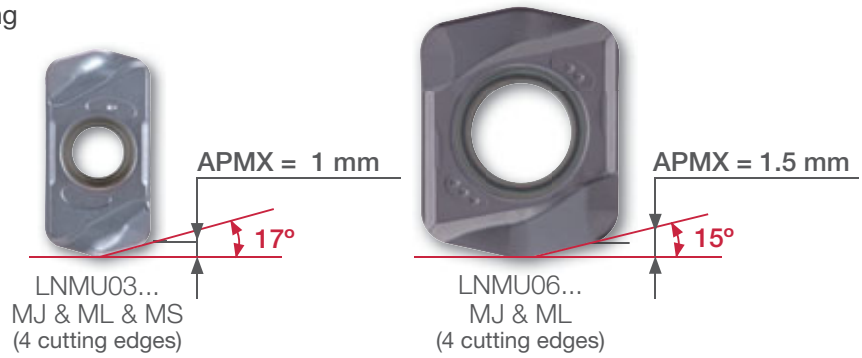
Offering a wide range of HFM tools and inserts, covering the vast application needs in the market

DOFEED TUNGALOY

Versatility at its finest

- Perfect for ramping, plunging, hole enlarging, slotting, drilling, and shoulder milling in a wide range of industries
- Smooth chip evacuation and minimal chattering
- High productivity due to close-pitch design
- Maximum feed rate: 1.5 mm/z

See Tungaloy Report "DoFeed"



LNMU03...
MJ & ML & MS
(4 cutting edges)

LNMU06...
MJ & ML
(4 cutting edges)

MILLQUAD FEED TUNGALOY

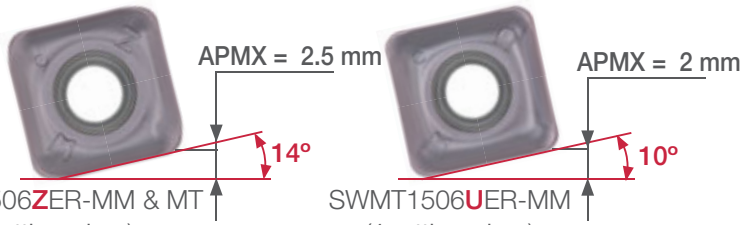
Highly versatile series with the unique insert design that allows *changing entry angles*

- Two types of inserts fit on one cutter body, providing two different entry angles
- ZER type: For general application with low cutting force
- UER type: Suitable for difficult-to-cut materials and long overhang machining
- Maximum feed rate: 2 mm/z

See Tungaloy Report "MillQuadFeed"

SWMT0904**Z**ER-MM
(4 cutting edges)

SWMT0904**U**ER-MM
(4 cutting edges)



SWMT1506**Z**ER-MM & MT
(4 cutting edges)

SWMT1506**U**ER-MM
(4 cutting edges)

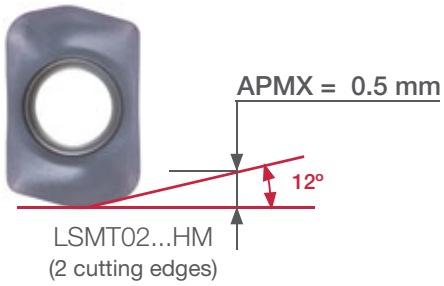
TUNGFORCEFEED

TUNGALOY

HFM cutter with *robust design* in small diameters

- Strong insert corner for high-feed operations
- Incredible productivity thanks to extra close-pitch tool
- R2 round insert is also mountable
- Maximum feed rate: 0.8 mm/z

See Tungaloy Report "TungForceFeed"



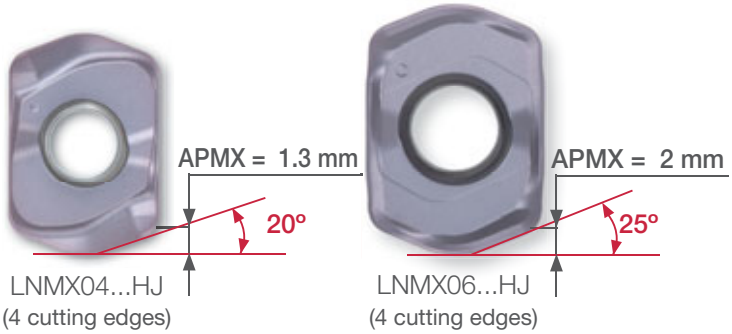
DOTWISTBALL

TUNGALOY

Unique twist on the insert ensures *stability and maximizes productivity*

- R4,5,6 round inserts are also mountable
- High machining efficiency with 30% greater D.O.C
- Maximum feed rate: 1.3 mm/z

See Tungaloy Report "DoTwistBall"



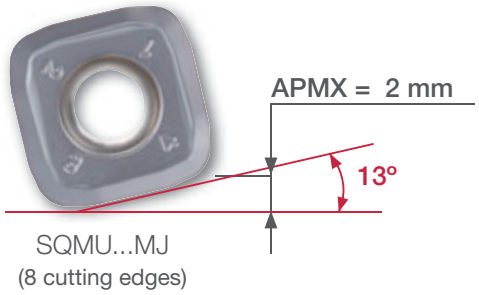
DOFEEDQUAD

TUNGALOY

Economical tool for rough operations

- Dovetail clamping prevents inserts from lifting up during heavy roughing operations
- Maximum feed rate: 2 mm/z

See Tungaloy Report "DoFeedQuad"



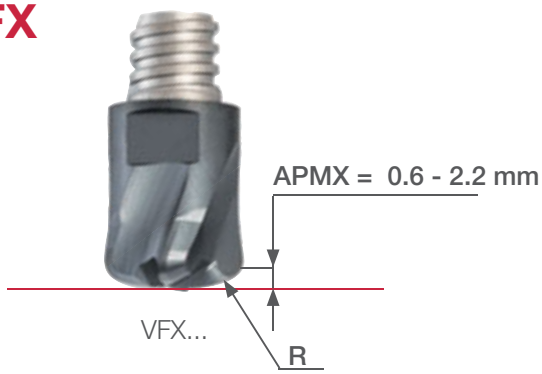
TUNGMEISTER VFX

TUNGALOY

Indexable solid carbide head

- Highly accurate repeatability
- Drastically reduces tool changeover time
- Maximum feed rate: 1 mm/z

See Tungaloy Report "TungMeister"



INDUSTRY SEGMENTS

The right tool for each application

Die & Mold INDUSTRY

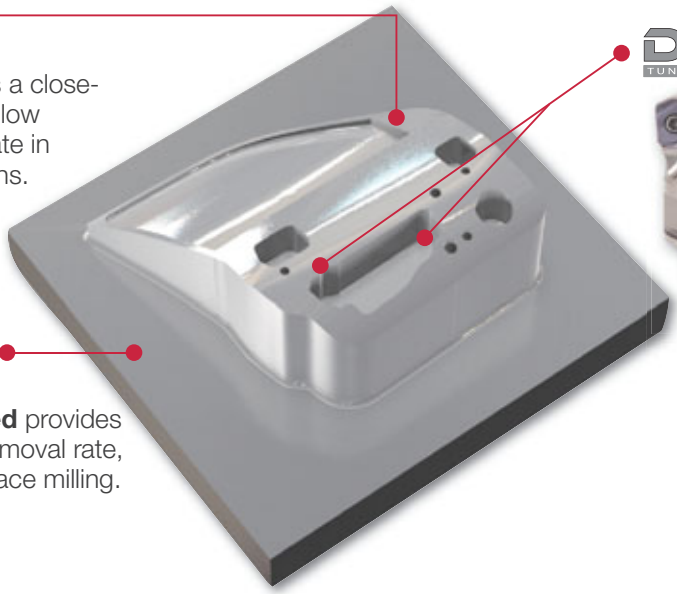
The die and mold industry requires machining complex 3D forms. Stamping, forming, forging dies, as well as injection and blow molds are all examples of processes in the industry that may require the final product to precisely meet the required dimensions for mass production. HFM is an important topic for die and mold machining because of the need to take light milling passes in order to obtain both the required geometry and the surface finish.

DOFEED TUNGALOY

DoFeed features a close-pitch design to allow increased feed rate in profiling operations.

DOTWISTBALL TUNGALOY

DoTwistBall offers stable chip evacuation in pocketing operations.



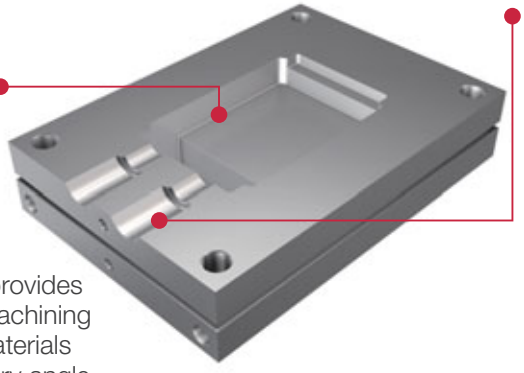
MILLQUADFEED TUNGALOY

MillQuadFeed provides high metal removal rate, especially in face milling.

TUNGFORCEFEED TUNGALOY

TungForceFeed specializes in machining narrow work areas with its small diameters.

MILLQUADFEED TUNGALOY



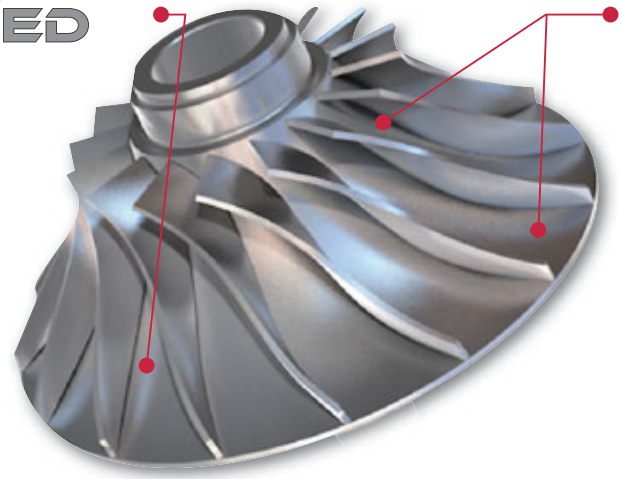
MillQuadFeed provides long tool life in machining difficult-to-cut materials due to its low entry angle.

Power Generation INDUSTRY

The power generation industry is known for using components made of complex structures in stainless steel or heat-resistant alloys. Maching such parts requires cutters that not only feature sharp cutting edges but also offer high metal removal rate at low depth of cut. With well-balanced toughness and cutting edge sharpness, Tungaloy's high-feed mills assure stable machining even in delicate operations.

TUNGFORCEFEED TUNGALOY

TungForceFeed specializes in machining narrow work areas with its small diameters.



DOFEED TUNGALOY

DoFeed's low cutting force prevents chattering even with long overhang.

Aerospace INDUSTRY

Many components in the aerospace industry are made of tough materials, such as precipitation hardened stainless steel and titanium alloy. Standard tools quickly wear out while machining such parts, making it difficult to balance tool life and machining performance. Tungaloy's close-pitched high-feed mills guarantee accelerated machining even in aerospace manufacturing.

DOFEED TUNGALOY

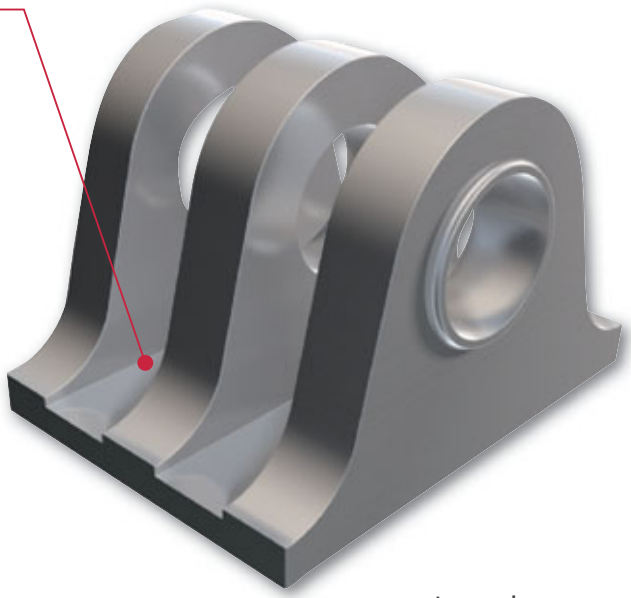
Priority on productivity

DoFeed can machine titanium alloys with high feed and speed because of its close-pitch design.

MILLQUADFEED TUNGALOY

Priority on tool life

MillQuadFeed provides long tool life in machining difficult-to-cut materials due to its low entry angle.

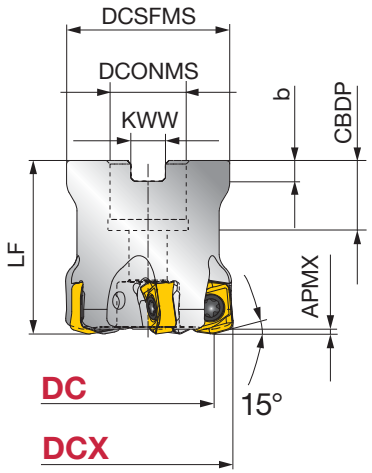


TECHNICAL GUIDES AND TIPS IN HFM

For maximum performance

DC and DCX

Effective diameter DC is usually smaller than tool diameter DCX.

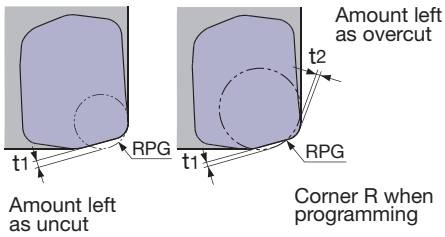


Designation	APMX	DCX	CICT	DC
TXN06R050M22.0E04	1.5	50	4	37.6

Theoretical radius and programming

CAD/CAM systems require a defined radius dimension to program wall/shoulder machining. The parameters shown below are used for programming DoFeed's EXN06/TXN06 inserts. The "R" noted below is defined as the theoretical radius used for programming.

When programming the machining process, the theoretical radius (R) and the actual profile left uncut on the machined surface (t1) should be noted. Here, R = 3 mm is recommended for a EXN06/TXN06 insert. If a larger radius (such as R = 4 mm) is programmed, an overcut (t2) of 0.26 mm may occur and the dimensional accuracy may deviate from the requirement.



Corner R when program-ming	Amount left as uncut t_1	Amount left as overcut t_2
2	1	-
3	0.77	-
4	0.54	0.26

Each value above is calculated theoretically at the maximum condition.

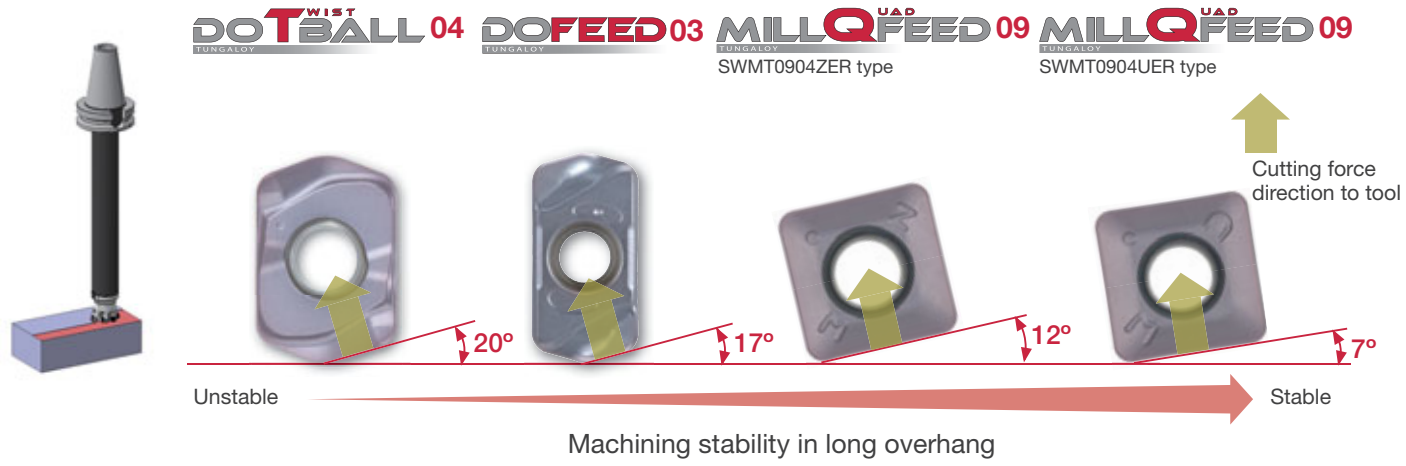
Long overhang and chattering

HFM offers chatter-free, stable machining with long overhang settings because the cutting force directs axially towards the spindle. However, vibration may still occur with long-reach tools of 5xD or greater. The following measures are recommended to eliminate chattering in such conditions.

Change the cutting tool

1. Use inserts with a small entry angle

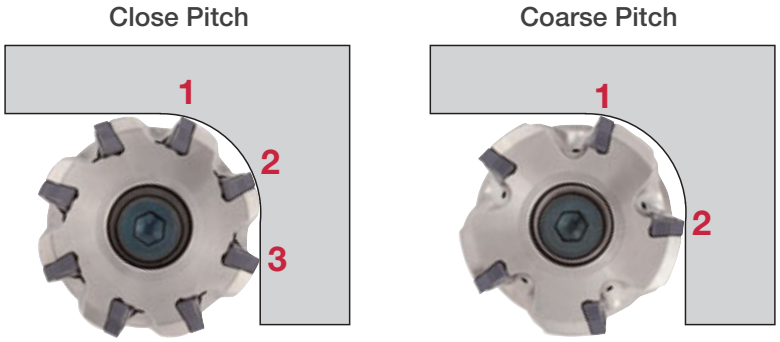
If the entry angle of the insert is small, the cutting force is directed axially towards the machine spindle during HFM operations, which minimizes tool vibration. Use inserts with an entry angle as small as possible to minimize chatter and maximize machining stability.



Machining stability in long overhang

2. Use a coarse-pitched tool

Using a coarse-pitched tool will decrease the number of cutting edges simultaneously in contact with the workpiece and reduce chattering. If an additional stability is needed, use a sharper chipbreaker after selecting a coarse-pitched tool.



Change the cutting parameters

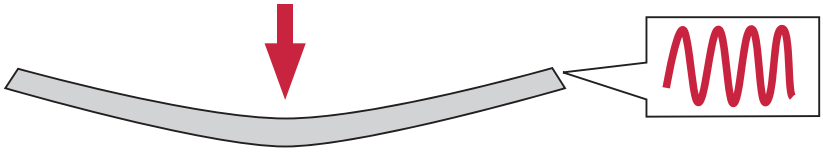
Optimizing the cutting parameters to 70% of the recommended values may minimize vibration. Adjust the parameters in the following order:

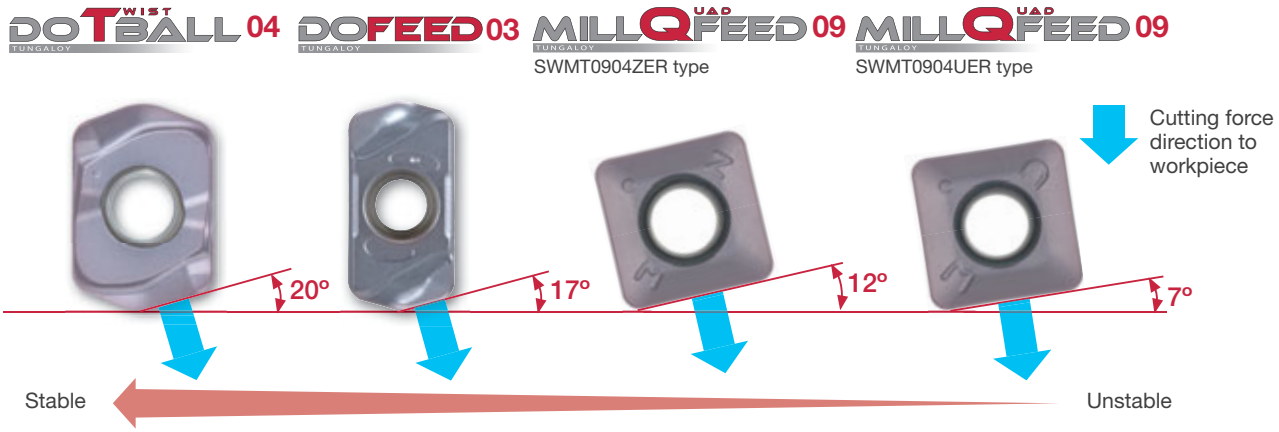
1: Reduce the cutting speed (*Vc*)
2: Reduce the DOC (*ap*)
3: Reduce the feed rate (*fz*)

(Note: Using a feed rate of 0.5 mm/z or lower may adversely increase vibration.)

Machining thin workpieces with weak fixture

Workpieces in a thin, flat structure with weak fixture setting are prone to chatter. To minimize vibration, reduce thrust force by decreasing D.O.C. or feed rate. Another option is to use a cutter with a bigger entry angle for reduced thrust force.





Machining stability in thin workpiece

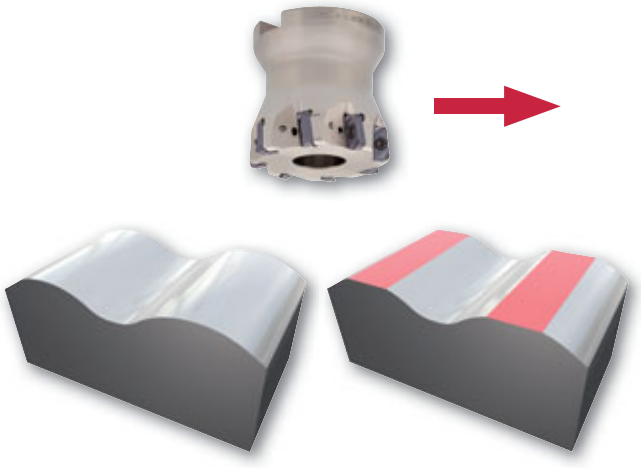
Milling unstable surfaces

Milling unstable surfaces, including scale removal, is a troublesome operation. Insert damage is common in these operations, hindering unmanned machine operations. Many customers choose a high-feed cutter as a safe and productive machining solution. However, due to surface unevenness, a high-feed cutter is forced to make unproductive "air cut" passes before the surfaces reach a quality high enough for the finishing operations to follow.

MillQuadFeed is an extremely efficient milling solution for unstable surfaces. With its high-feed capability of 2 mm per tooth at 2.5 mm depth of cut, **MillQuadFeed** ensures high stability and metal removal rates. Face milling cutter with round inserts, for example **DoTripleMill** with round inserts, is another solution. One single set of inserts can be used for both highly efficient scale removal and follow-up high-feed milling.

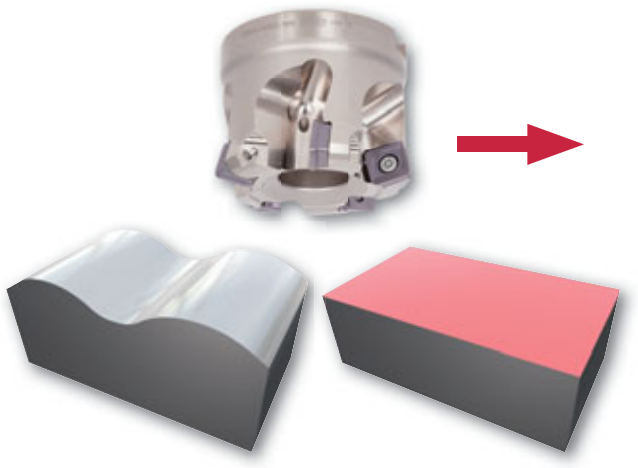
Small depth of cut

DOFEED 03



High depth of cut

MILLQUAD FEED 15



FIELD TEST REPORTS

Success stories with Tungaloy's HFM products

TUNGFORCE FEED TUNGALOY

Die & Mold INDUSTRY

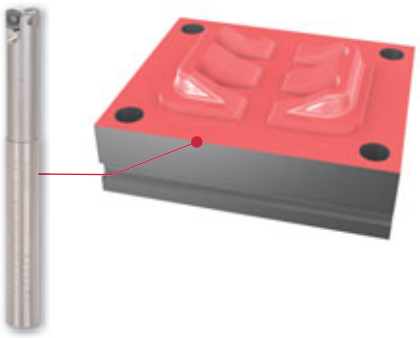
H

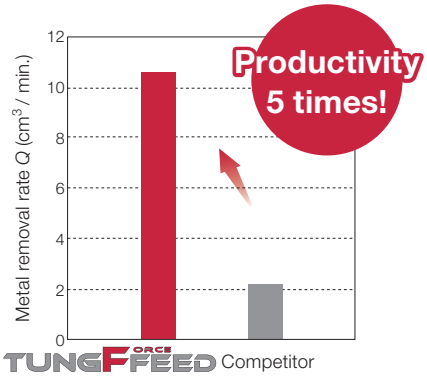
Part: Stamping die part
Material: SKD61 / x40CrMoV5-1 (45HRC)
Cutter: EXLS02M012C12.0LH50R02 (ø12, z = 2)
Insert: LSMT0202ZER-HM
Grade: AH3225

Cutting conditions:

Vc = 113 m/min
fz = 0.5 mm/z
Vf = 3000 mm/min
ap = 0.3 mm
ae = 12 mm

Process: Face milling
Machine: Vertical MC, BT50





Die & Mold INDUSTRY

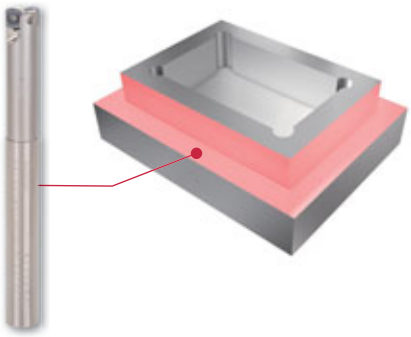
P

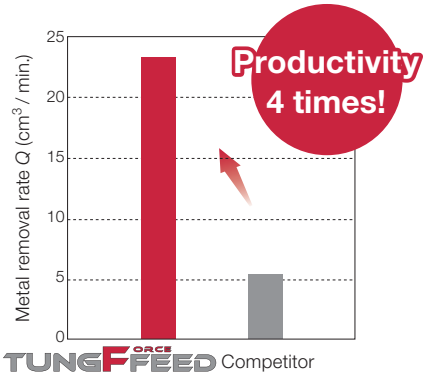
Part: Mold
Material: S50C
Cutter: EXLS02M012C12.0LH50R02 (ø12, z = 2)
Insert: LSMT0202ZER-HM
Grade: AH3225

Cutting conditions:

Vc = 200 m/min
fz = 0.6 mm/z
Vf = 6370 mm/min
ap = 0.3 mm
ae = 12 mm

Process: Shouldering, Air blow
Machine: Vertical M/C, BT30



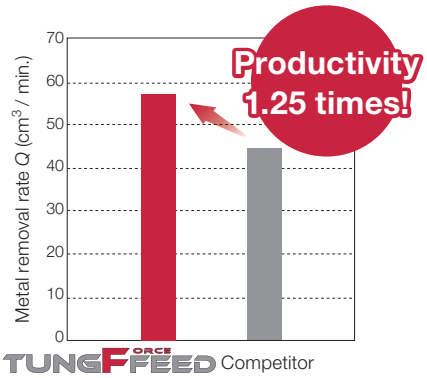


Part: Linear guide part
Material: S50C
Cutter: HXLS02M016M08R05 (ø16, z = 5)
Insert: LSMT0202ZER-HM
Grade: AH3225

Cutting conditions:

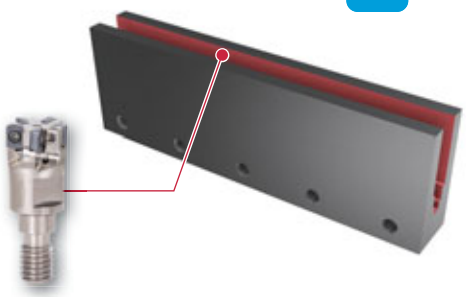
Vc = 181 m/min
fz = 0.5 mm/z
Vf = 9000 mm/min
ap = 0.4 mm
ae = 16 mm

Process: Slotting, Wet
Machine: Vertical M/C, BT30



Die & Mold INDUSTRY

P



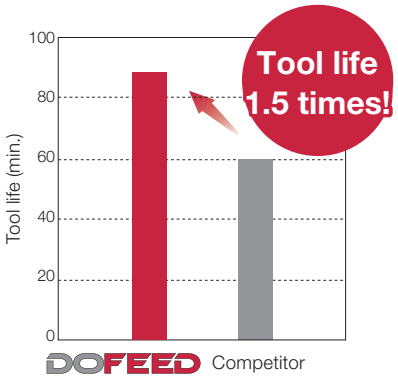
DOFEED TUNGALOY

Part: Back block
Material: Prehardened steel HPM7 (HRC30)
Cutter: TXN06R080M31.7-08 (ø80, z = 8)
Insert: LNMU06X5ZER-MJ
Grade: AH3035

Cutting conditions:

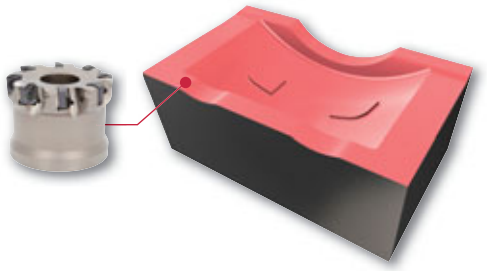
Vc = 115 m/min
fz = 0.7 mm/z
Vf = 2564 mm/min
ap = 1.1 mm
ae = 42 mm

Process: Contour milling, Air blow
Machine: Vertical M/C, BT50



Die & Mold INDUSTRY

P

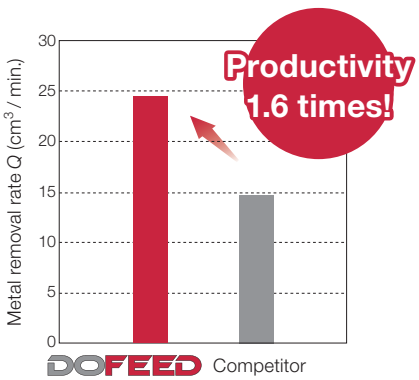


Part: Turbine blade
Material: Heat resistant cast steel
Cutter: EXN03R035M32.0-05 (ø35, z = 5)
Insert: LNMU0303ZER-ML
Grade: AH725

Cutting conditions:

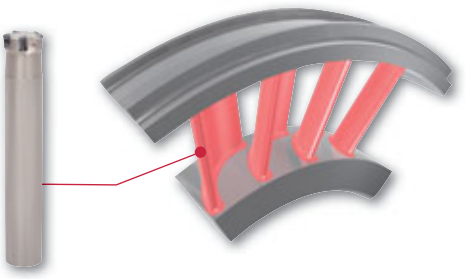
Vc = 70 m/min
fz = 0.5 mm/z
Vf = 1590 mm/min
ap = 0.5 mm
ae = 30 mm

Process: Shoulder milling, Wet
Machine: Vertical M/C, BT50



Power Generation INDUSTRY

S

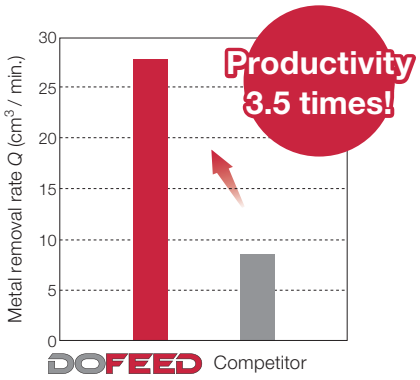


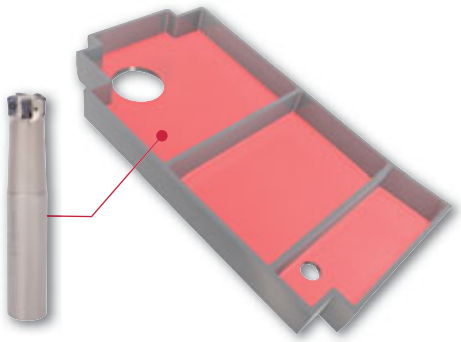
Part: Airplane component
Material: Ti-6Al-4V (36HRC)
Cutter: EXN03R025M25.0-05 (ø25, z = 5)
Insert: LNMU0303ZER-ML
Grade: AH725

Cutting conditions:

Vc = 50 m/min
fz = 0.7 mm/z
Vf = 2230 mm/min
ap = 0.5 mm
ae = 25 mm

Process: Pocket milling, Wet
Machine: Vertical M/C, BT40





Aerospace INDUSTRY

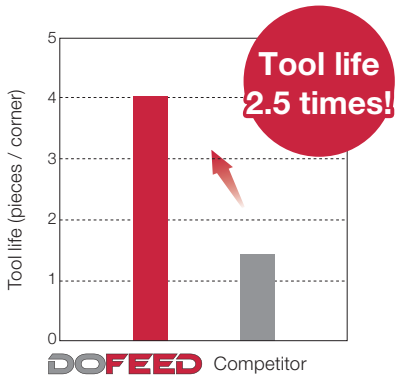
S

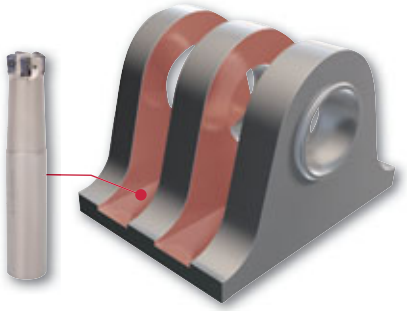
Part: End fitting
Material: Ti-6Al-4V
Cutter: EXN03R025M25.0-05 (ø25, z = 5)
Insert: LNMU0303ZER-ML
Grade: AH130

Cutting conditions:

Vc = 40 m/min
fz = 0.7 mm/z
Vf = 1800 mm/min
ap = 0.8 mm
ae = variable

Process: Rough pocket milling, Wet
Machine: Horizontal M/C





Aerospace INDUSTRY

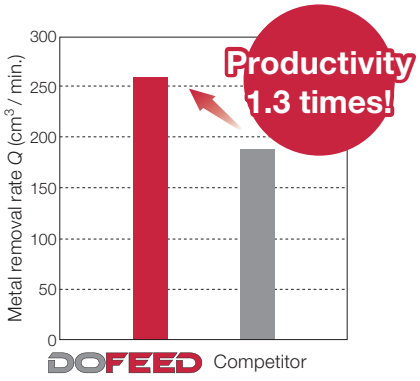
S

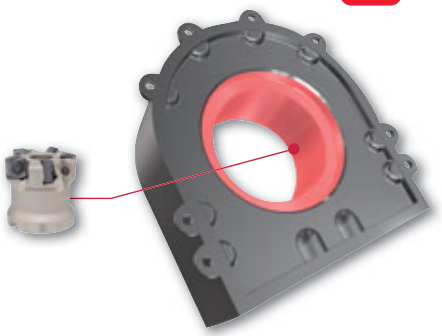
Part: Body
Material: FCMP45-06
Cutter: TXN06R050M22.0E05 (ø50, z = 5)
Insert: LNMU06X5ZER-MJ
Grade: AH130

Cutting conditions:

Vc = 170 m/min
fz = 1 mm/z
Vf = 5410 mm/min
ap = 1.3 mm
ae = 38 mm

Process: Plunging / Helical milling, Dry
Machine: Horizontal M/C, BT50





Heavy INDUSTRY

K

Part: Automotive parts
Material: DHA WORLD (X40CrMoV5-1) 44HRC
Cutter: TXN06R080M31.7-08 (ø80, z = 8)
Insert: LNMU06X5ZER-MJ x7
LNGU06X5ZER-W x1 (Wiper)
Grade: AH725

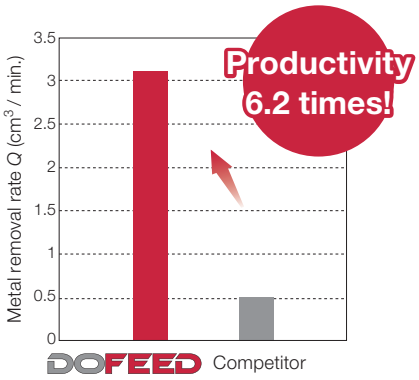
Die & Mold INDUSTRY

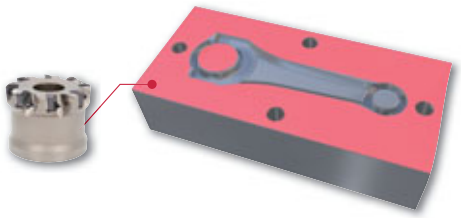
H

Cutting conditions:

Vc = 151 m/min
fz = 0.11 mm/z
Vf = 529 mm/min
ap = 0.1 mm
ae = 60 mm

Process: Face milling, Air blow
Machine: Vertical M/C, BT50





Part: Discharge casing
Material: Duplex stainless steel
Cutter: TXN06R200M47.6-12 (ø200, z = 12)
Insert: LNMU06X5ZER-MJ
Grade: AH3035

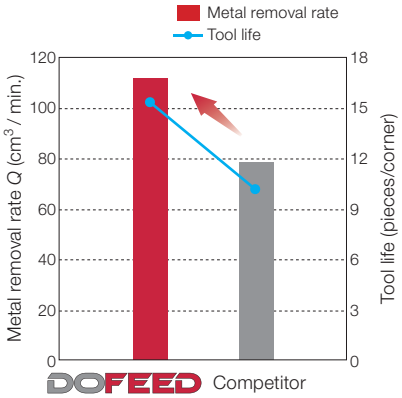
Power Generation INDUSTRY

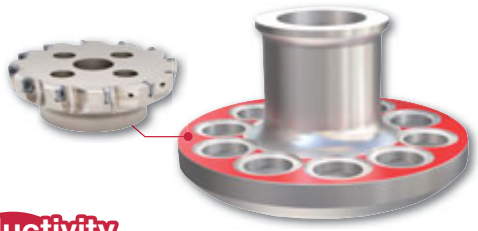
M

Cutting conditions:

Vc = 75 m/min
fz = 0.97 mm/z
Vf = 1.400 mm/min
ap = 0.5 mm
ae = 160 mm

Process: Face milling: Interrupted, Dry
Machine: Vertical M/C, BT50





Productivity 1.4 times!
Tool life 1.5 times!

Part: Impeller wing
Material: SRUD, SUS630
Cutter: TXN06R080M31.7E08 (ø80, z = 8)
Insert: LNMU06X5ZER-MJ
Grade: AH3035

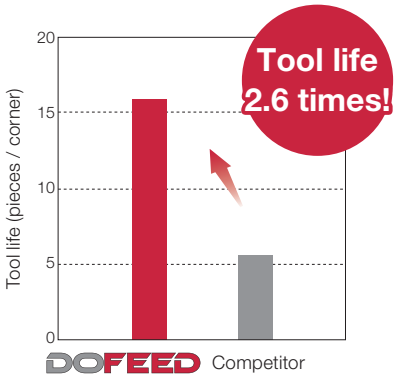
Power Generation INDUSTRY

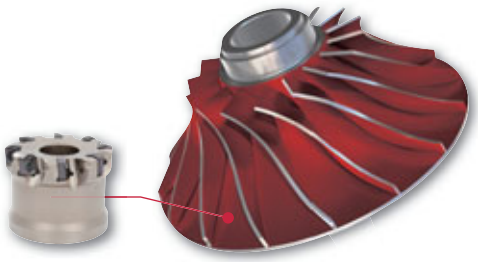
M

Cutting conditions:

Vc = 46.7 m/min
fz = 0.67 mm/z
Vf = 997 mm/min
ap = 0.7 mm
ae = variable

Process: Pocketing, Wet
Machine: Vertical M/C, BT50





MILLQFEED UAD TUNGALOY

Die & Mold INDUSTRY

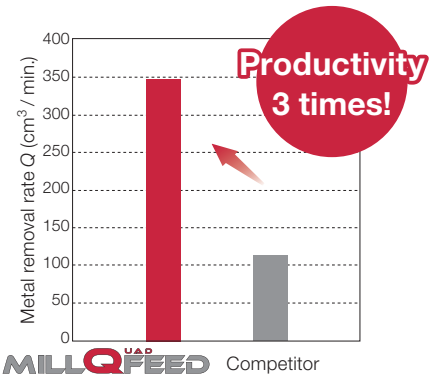
P

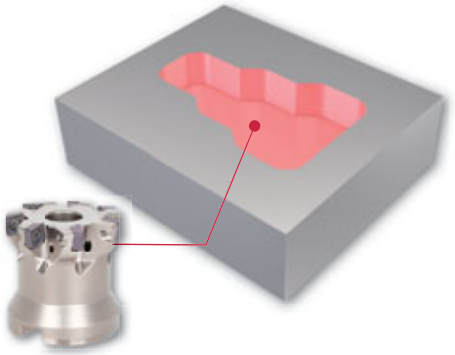
Part: Stamping die
Material: S45C /C45 (28HRC)
Cutter: TXSW09M050B22.0R07 (ø50, z = 7)
Insert: SWMT0904ZER-MM
Grade: AH3135

Cutting conditions:

Vc = 204 m/min
fz = 0.84 mm/z
Vf = 7600 mm/min
ap = 0.9 mm
ae = 50 mm

Process: Pocketing, Air blow
Machine: Vertical M/C, BT50





Power Generation INDUSTRY

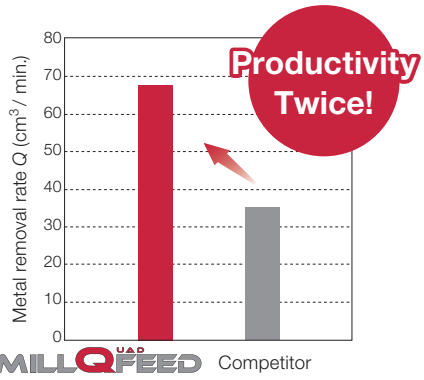
M

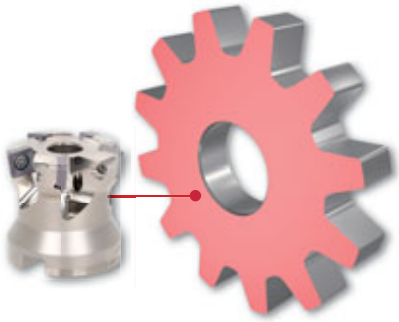
Part: Gearwheel
Material: SUS316Ti
Cutter: TXSW09M040B16.0R05 (ø40, z = 5)
Insert: SWMT0904UER-MM
Grade: AH3135

Cutting conditions:

Vc = 100 m/min
fz = 0.6 mm/z
Vf = 2400 mm/min
ap = 0.7 mm
ae = 40 mm

Process: Face milling, Air blow
Machine: Horizontal M/C, BT50





Oil & Gas INDUSTRY

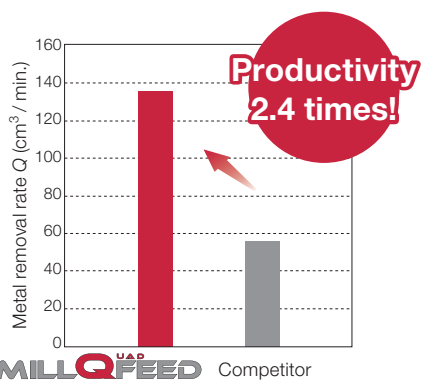
M

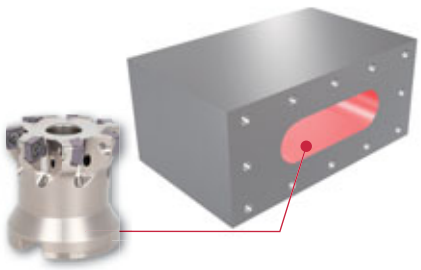
Part: Vacuum valve
Material: SUS316L
Cutter: TXSW09M050B22.0R07 (ø50, z = 7)
Insert: SWMT0904UER-MM
Grade: AH3135

Cutting conditions:

Vc = 100 m/min
fz = 1.2 mm/z
Vf = 5350 mm/min
ap = 0.5 mm
ae = - 50 mm

Process: Pocketing, Dry
Machine: Horizontal M/C, BT50





Part: Ship crankshaft
Material: SCM440
Cutter: TXSW15J100B31.7R06 (ø100, z = 6)
Insert: SWMT1506ZER-MJ
Grade: AH3135

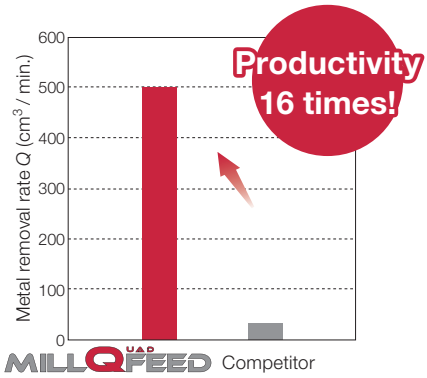
Heavy INDUSTRY

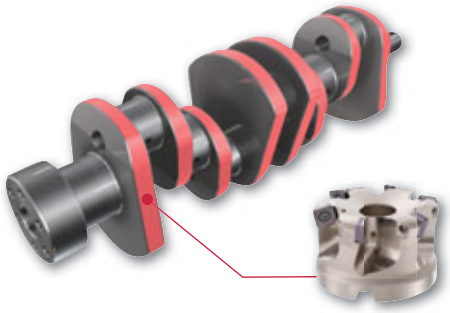
P

Cutting conditions:

Vc = 150 m/min
fz = 2 mm/z
Vf = 5730 mm/min
ap = 2.0 mm
ae = 44 mm

Process: Face milling, Air blow
Machine: Turning center, 51kw





Part: Windmill housing
Material: Ductile cast iron 450 (GGG40)
Cutter: TXSW15J125B40.0R07 (ø125, z = 7)
Insert: SWMT1506ZER-MJ
Grade: AH120

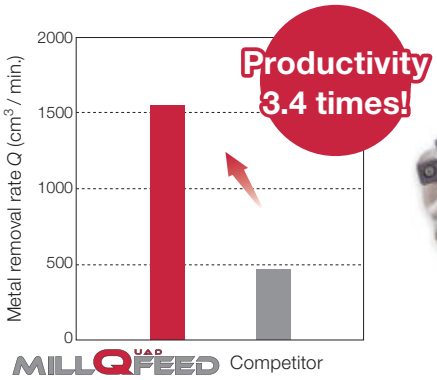
Power Generation INDUSTRY

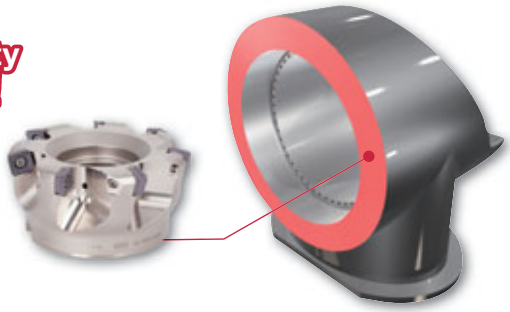
K

Cutting conditions:

Vc = 220 m/min
fz = 1.3 mm/z
Vf = 5020 mm/min
ap = 2.5 mm
ae = 125 mm

Process: Face milling, Air blow
Machine: Horizontal M/C, BT50





TWIST DOTBALL TUNGALOY

Power Generation INDUSTRY

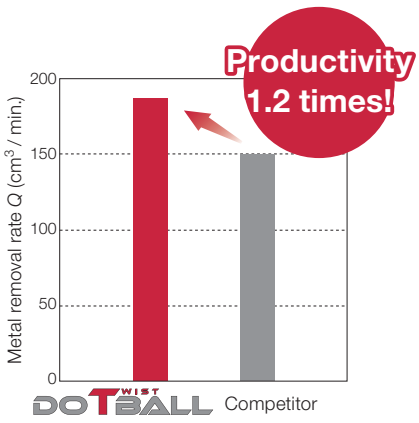
P

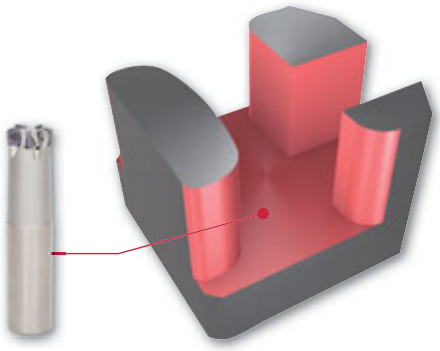
Part: Planetary carrier
Material: Stainless steel X5CrNiNb 18-10
Cutter: EXLN04M032C32.0R05 (ø32, z = 5)
Insert: LNMX0405ZER-HJ
Grade: AH3135

Cutting conditions:

Vc = 140 m/min
fz = 0.7 mm/z
Vf = 4874 mm/min
ap = 1.2 mm
ae = 32 mm

Process: Deep 3D profiling, Air blow
Machine: Vertical M/C, BT50

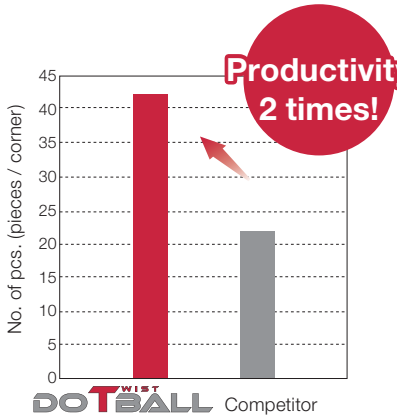


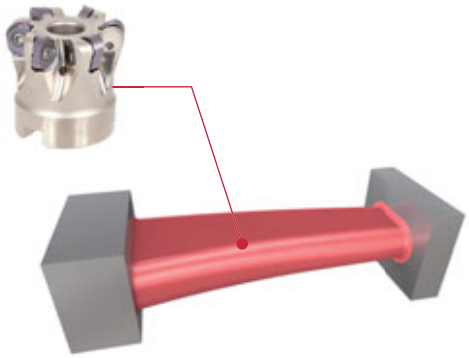


Part: Turbine blade
Material: 12CrMo
Cutter: TXLN04M050B22.0R07 (ø50, z = 7)
Insert: LNMX0405R4-MJ
Grade: AH3135
Cutting conditions:
Vc = 270 m/min
fz = 0.23 mm/z
Vf = 2767 mm/min
ap = 0.8 mm
ae = 25 mm
Process: Profiling, Wet
Machine: Vertical M/C, BT50

Power Generation INDUSTRY

M

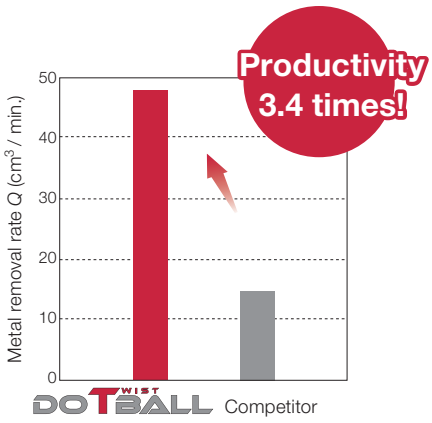


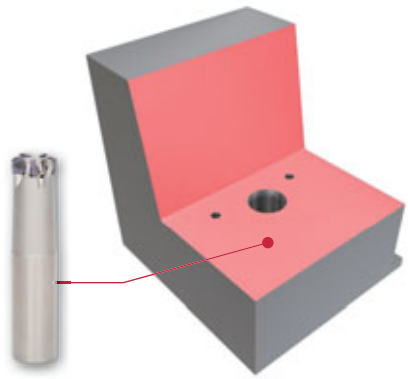


Part: Slide Core
Material: NAK80 (HRC40)
Cutter: EXLN04M025C25.0R03 (ø25, z = 3)
Insert: LNMX0405R4-MJ
Grade: AH3135
Cutting conditions:
Vc = 150 m/min
fz = 0.3 mm/z
Vf = 1719 mm/min
ap = 4 mm
ae = 7 mm
Process: Shoulder milling, Wet
Machine: Vertical M/C

Die & Molc INDUSTRY

P

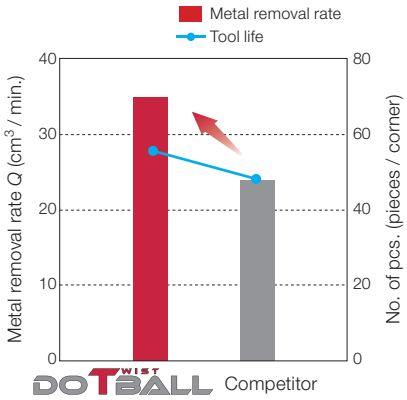




Part: Arm
Material: SC480
Cutter: EXLN04M032C32.0R04 (ø32, z = 4)
Insert: LNMX0405ZER-HJ
Grade: AH3135
Cutting conditions:
Vc = 200 m/min
fz = 0.36 mm/z
Vf = 2865 mm/min
ap = 1.2 mm
ae = 10 mm
Process: Hole enlarging
Machine: Horizontal M/C

Heavy INDUSTRY

P



Part: Die
Material: DAC10 (Tool steel, 48HRC)
Cutter: TXLN04M040B16.0R06 (ø40, z = 6)
Insert: LNMX0405ZER-HJ
Grade: AH120

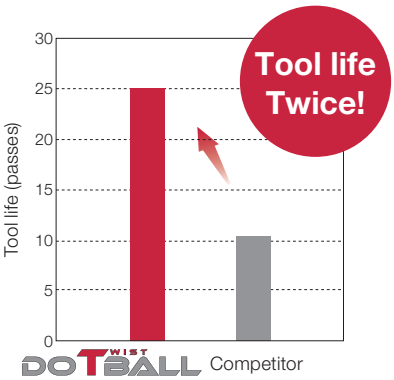
Die & Mold INDUSTRY

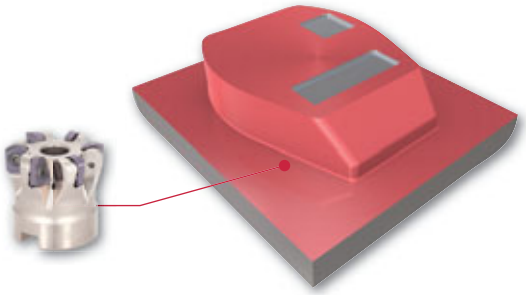
H

Cutting conditions:

Vc = 100 m/min
fz = 0.44 mm/z
Vf = 2100 mm/min
ap = 1.96 mm
ae = variable

Process: Contouring, Air blow
Machine: Vertical M/C, BT50





DOFEEDQUAD TUNGALOY

Heavy INDUSTRY

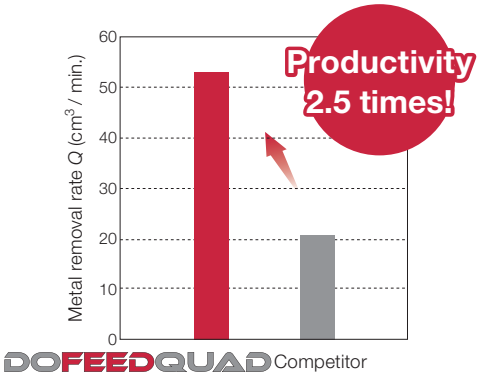
M

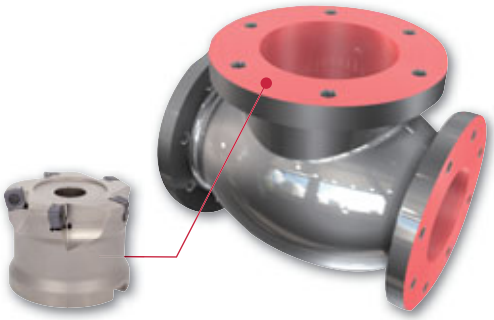
Part: Body and frame
Material: Super-duplex stainless steel
Cutter: TXQ12R080M27.0E05 (ø80, z = 5)
Insert: SQMU1206ZSR-MJ
Grade: AH130

Cutting conditions:

Vc = 80 m/min
fz = 0.6 mm/z
Vf = 960 mm/min
ap = 0.8 mm
ae = 70 mm

Process: Face milling, Dry
Machine: Multi-axis M/C





TUNGMEISTER TUNGALOY

Engineering INDUSTRY

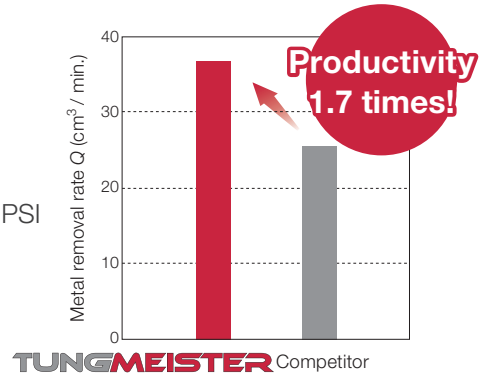
P

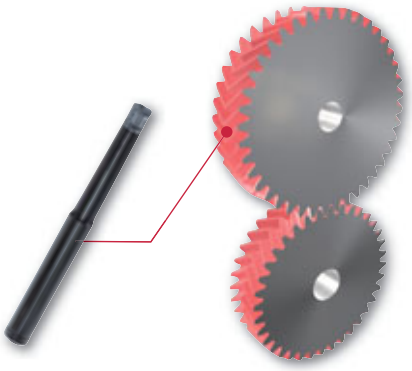
Part: Herringbone gear
Material: SCM440 / 42CrMo4 (34HRC)
Shank: VTSD12L110S06-W-A
Head: VFX120L01.0R25-02S08 (ø12, z = 2)
Grade: AH725

Cutting conditions:

Vc = 120 m/min
fz = 0.8 mm/z
Vf = 5093 mm/min
ap = 0.6 mm
ae = 12.7 mm

Process: Slot milling, 1000 PSI
Machine: Horizontal M/C





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