Member IMC Group
Tungaloy

FEED the SPEED!

HIGH-FEED MILLING SOLUTIONS

HIGH-FEED MILLING

the Go-to Solution for *Accelerated Machining*

Tungaloy´s renowned solutions for **High-Feed Milling (HFM)** *have been around for many years*

1990

Tungaloy´s insightfulness and devotion to HFM dates back to the late 1990s with the release of the MillFeed TXP series to meet the emerging needs for higher efficiency in face milling.

2010

Tungaloy introduces its DoFeed line in 2010 as the market starts to prefer more compact but faster machines. DoFeed revolutionized high-feed milling, offering large diameter cutters utilizing higher feed rates for incredible performance.

2016

MillQuad-Feed and DoTwist-Ball continue Tungaloy's history of offering high efficiency products reflecting the core concept of Accelerated Machining.

WHY HFM?

HFM is the go-to solution for Accelerated Machining!

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

Simply increasing the speed or revolutions per minute (RPM) may appear to decrease cycle time. A reduction in cycle time, however, is hampered by the time to change inserts as the increase in speed or RPM shortens tool life, which increases the tool cost in parallel.

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 transformed** many manufacturers' ways **of thinking about milling.** These flexible and versatile tools offer much more than any other milling tool: dramatically reduced cycle time and cost, long tool life, and high quality of finished parts.

Faster and more efficient machining—long overhang, large components.

HFM specializes in long-reach applications such as deep hole and pocket machining. Combined with its capability of ramping, this feature allows the High Feed cutter to perform helical interpolation: the tool moves in a circular motion to X and Y axes while simultaneously moving downward on the Z axis.

HFM is the strongest and fastest in milling operations when machining large parts. Customers usually have to make an additional finishing pass, however, to clean up the rough surface generated. With the incorporation of wiper inserts, Tungaloy's **HFM cutter** can deliver outstanding surface finish with no reduction in feed rate. As a result, the efficiency of the overall machining process is drastically improved.

Simplifying the processes for near net shape

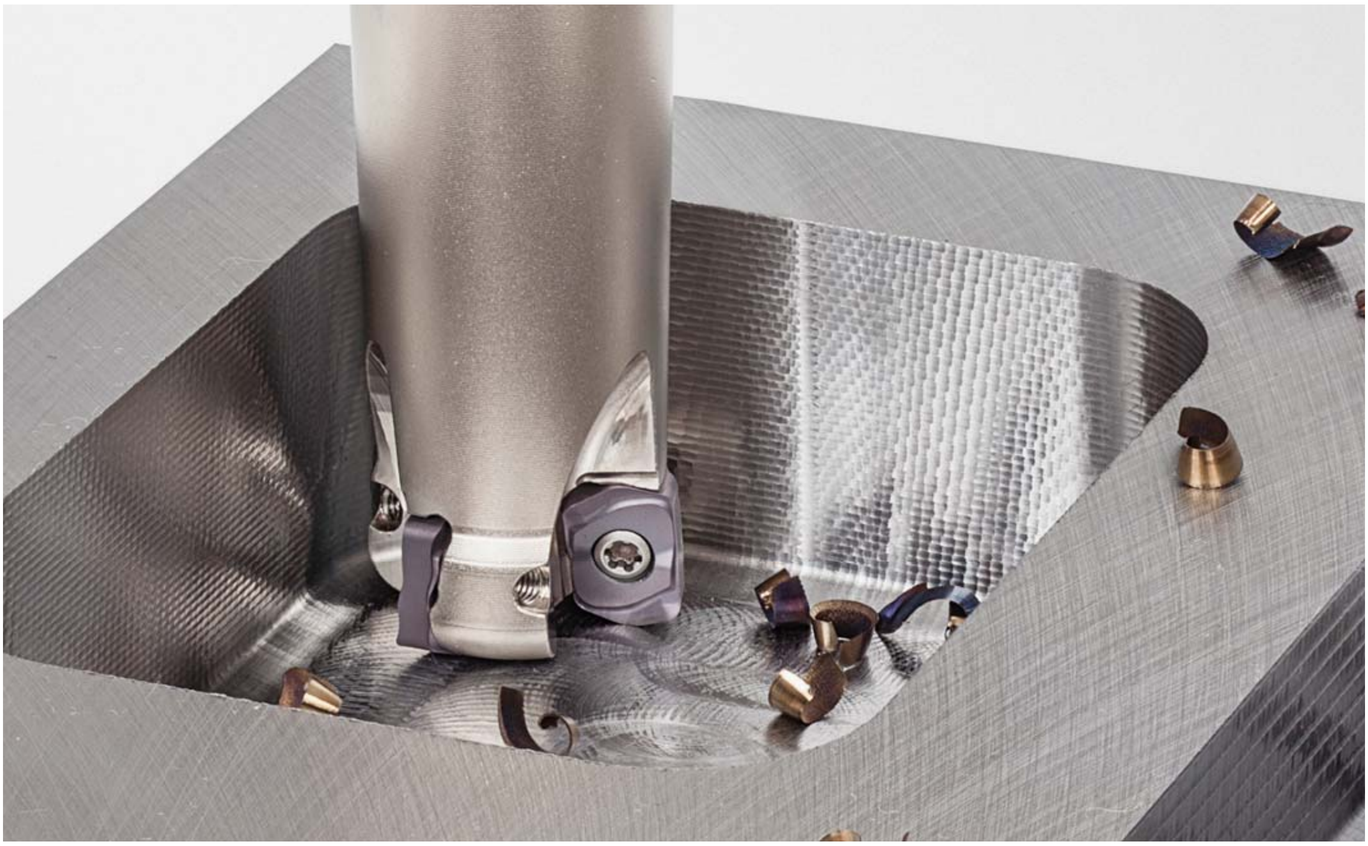
HFM provides a high metal removal rate, despite its small depth of cut. As this makes workpiece materials closer to the desired shape in one operation, semi-finishing operations can often be eliminated, and the finishing process can be simplified.

This characteristic is ideal for 3D machining. Most 3D machining begins with a solid block of material. The material is gradually removed until the desired configuration is obtained. This method is called subtractive manufacturing, and is the opposite of additive manufacturing. An example of additive manufacturing would be 3D printing. While a 3D printer places thin layers upon layers, 3D machining removes thin layers of material in each pass. In both cases, thin layers help produce a shape close to the final structure.

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 example, **DoFeed cutters** can machine multiple hole diameters and produce counter bore and countersink in the same operation, with no need to change or purchase multiple tools. This versatility saves on both cost, and time.



HOW IT WORKS?

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 milling method that pairs shallow depth of cut (DOC) with high feed rate up to 2.0 mm per tooth to maximize the amount of metal being removed from a part, resulting in more parts being machined more quickly.

The **HFM** mechanism is based on the “chip thinning” effect. Chip thinning depends on the lead angle of a milling cutter. A cutter with a 90° lead angle has no benefit of chip thinning as 0.2 mm of feed per tooth only delivers the same 0.2 mm of chip thickness (Fig. 1). In the case of a cutter with a 45° lead angle, a 0.25 mm of feed per tooth creates a 0.178 mm of chip thickness (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 a 1.27 mm of feed per tooth provides chip thickness of only 0.178 mm, and cycle time is typically decreased by 50% or more.

Low cutting force is also an advantage of **HFM**. The lead 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, and directed back to the spindle due to its acute lead angle (Fig. 3), which means less pressure on the spindle.

DoFeed Series

Fig.1

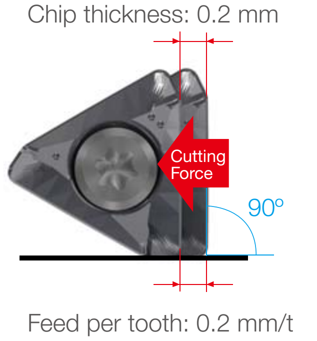


Fig.2

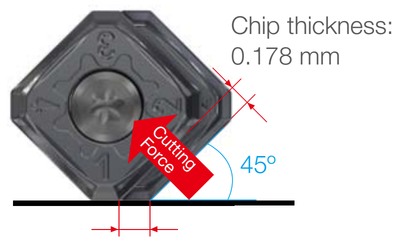
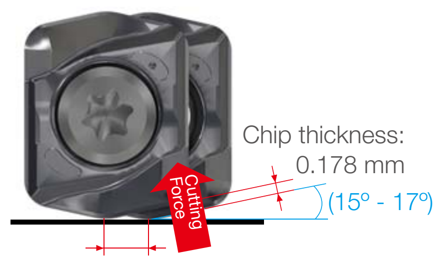


Fig.3



GET STARTED!

What is inside?

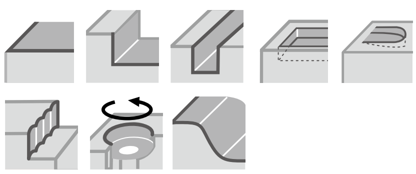
MILESTONE PRODUCTS

Tungaloy has developed the widest range of High-Feed Milling tools and inserts, covering a spectrum of applications

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.
- **Easy machining on long overhang applications** like large depth machining.
- **Maximum feed rate: 1.5 mm/z**
- **Tool diameters ø16 - ø200 mm**



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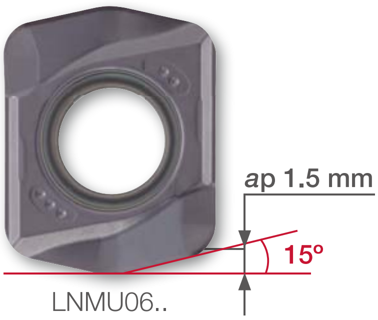
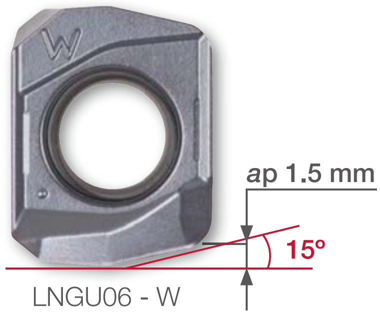
LNMU03..
MJ & ML
(4 cutting edges)



LNMU06..
MJ & ML
(4 cutting edges)

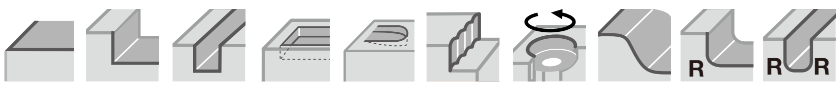


LNGU06 - W
(2 cutting edges - Wiper)

DOTWISTBALL TUNGALOY

Unique twist on the insert to ensure *stability for incredible productivity*

- **04 inserts to complement DoFeed´s 03 and 06 inserts ranges**
- **R4 round inserts are also mountable**
- **Maximum feed rate: 1.3 mm/z**
- **Tool diameters ø20 - ø50 mm**



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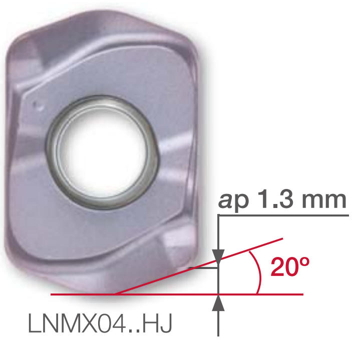
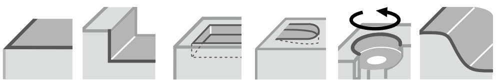


LNMX04..HJ
(4 cutting edges)

MILLQUADFEED
TUNGALOY

Simple but powerful for maximum performance and productivity

- Ideal for use with a **high power spindle** (40kW or more)
- **Maximum feed rate: 2.0 mm/z**
- **Tool diameters ø50 - ø160 mm**



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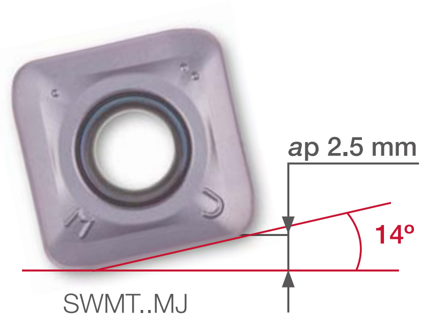

SWMT..MJ
(4 cutting edges)

DOFEEDQUAD
TUNGALOY

Economical tool for rough operations

- **Dovetail clamping** prevents inserts from lifting up during heavy roughing operation.
- **Maximum feed rate: 2.0 mm/z**
- **Tool diameters ø50 - ø125 mm**

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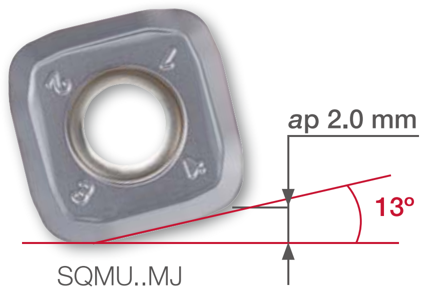
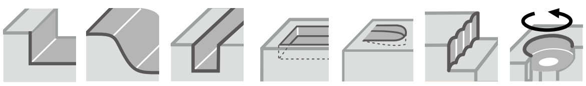


SQMU..MJ
(8 cutting edges)

TUNGMEISTER VFX
TUNGALOY

Indexable solid carbide head for high feed machining

- **Highly accurate repeatability**
- **Drastically reduces tool changeover time**
- **Maximum feed rate: 1.0 mm/z**
- **Tool diameters ø10 - ø16 mm**



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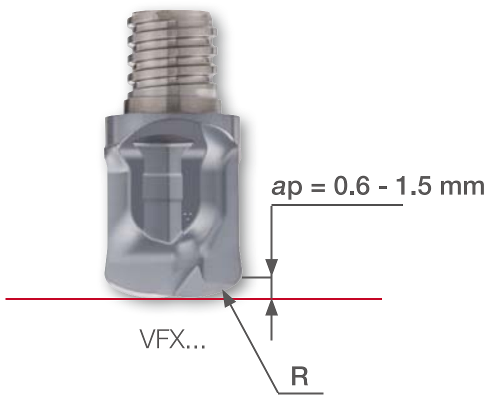
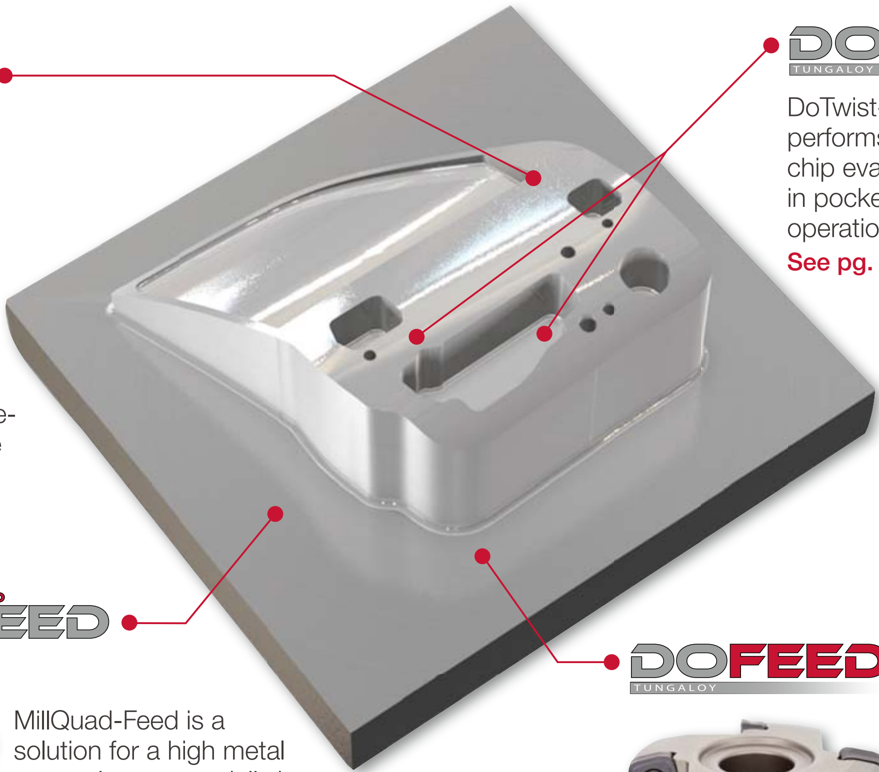


INDUSTRY SEGMENTS

The right tool for each application

Die & Mold INDUSTRY

Die and Mold machining primarily refers to the machining of complex 3D forms. Stamping, forming, forging dies, injection and blow molds are all examples of tooling that might have complex shapes precisely mirroring or matching the intended dimensions of a final, mass-produced part. 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 surface finish.



DOFEED TUNGALOY

DoFeed features a close-pitch design to increase the feed rate in profiling operations.

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DOTWISTBALL TUNGALOY

DoTwist-Ball performs stable chip evacuation in pocketing operations.

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MILLQUADFEED TUNGALOY

MillQuad-Feed is a solution for a high metal removal rate especially in face milling.

See pg. 36

DOFEEDQUAD TUNGALOY

DoFeedQuad's dovetail clamping system ensures stable machining.

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Power Generation
INDUSTRY

The Power Generation industry is known for using components of complex structures made of stainless steel or heat-resistant alloys. To improve the performance in machining a complex structure, a cutter should be capable of delivering an elevated metal removal rate at a low depth of cut, and feature sharp cutting edges. With well balanced toughness and cutting edge sharpness, Tungaloy's High-Feed mills assure stable machining in delicate operations.

TUNGMEISTER

The TungMeister series of indexable end mills are available in small diameters for machining narrow work areas.

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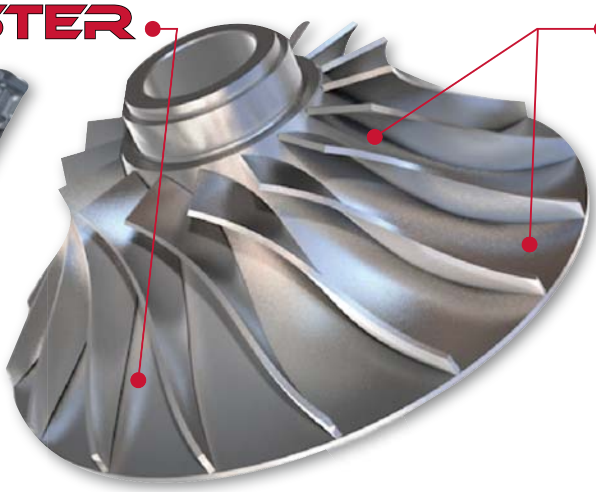

DOFEED

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

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Aerospace
INDUSTRY

Many components in the aerospace industry are made of tough materials such as precipitation hardened stainless steel or titanium alloy. This quickly uses up common tools, making it difficult to balance tool life and machining performance. Tungaloy's close-pitched High Feed mills will guarantee Accelerated Machining in aerospace manufacturing.

DOFEED

DoFeed can machine titanium alloy with high feed and speed because of the close pitch design.

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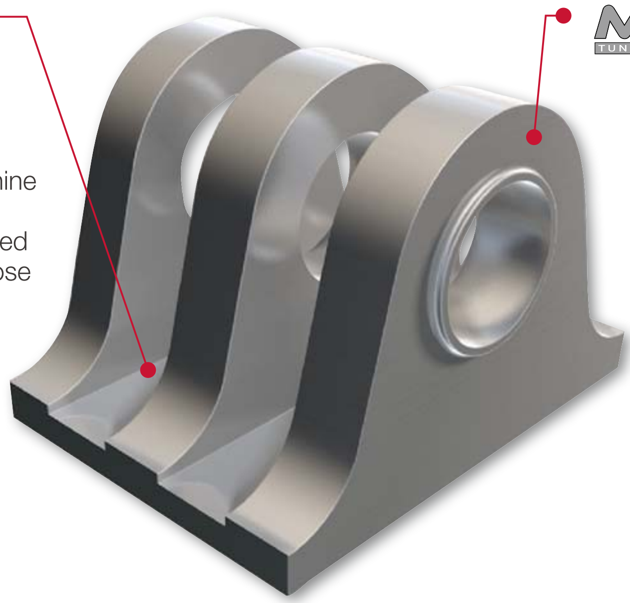

MILLQUAD-FEED

MillQuad-Feed ensures reliability in heavy high-feed milling on unstable surfaces.

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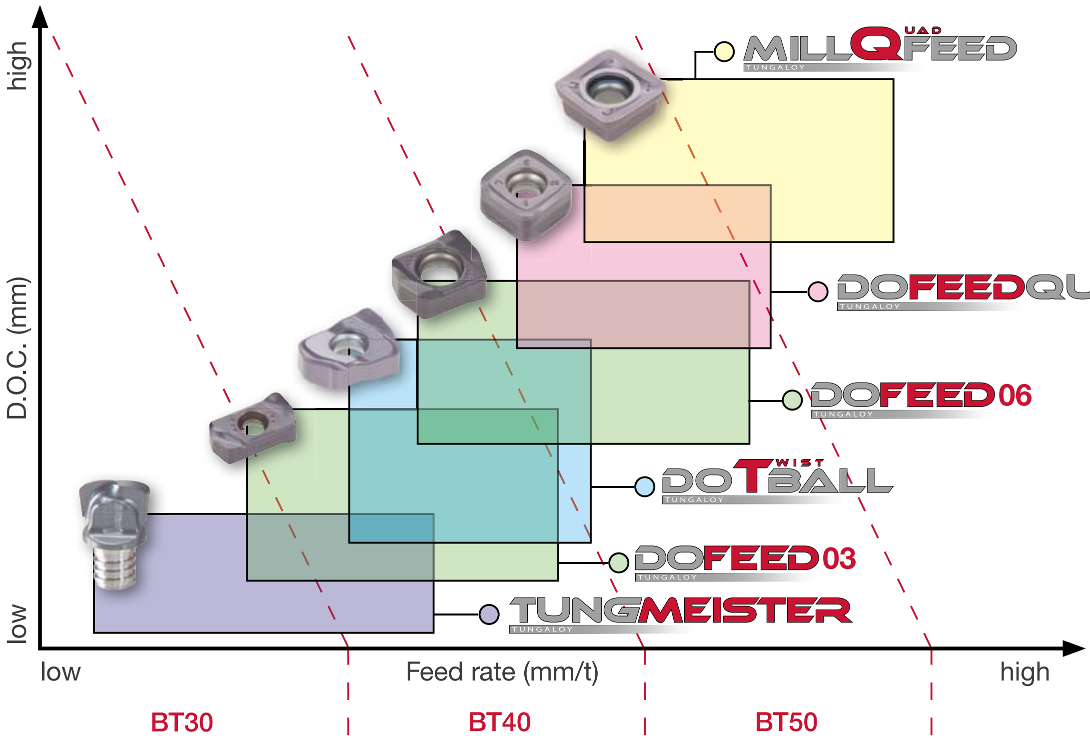
TOOL SELECTION GUIDE

Tungaloy’s High-Feed MillLines are shown on this chart in relation to feed rate and depth of cut. Metal removal rates increase with spindle capacity.



In principle, the stronger the spindle power the machine is capable of, the higher the cutting parameters that can be used, such as a higher feed per tooth, larger cutter diameter, and/or denser tooth pitch. If the parameter is set too high, however, the cutting force will exceed the machine’s spindle capacity, causing sudden machine stoppage. To prevent such machine failures, calculate the theoretical cutting force prior to machining to ensure that the parameters to be used are within the safe level.

For easy calculation of theoretical cutting power, download “Dr. Carbide“ here

Dr. Carbide Tungaloy

Available on the App Store

GET IT ON Google play

Recomended *Cutting Parameters*

Recommended cutting parameters for given materials in terms of cutting speed and feed per tooth.

		DoFeed 03	DoTwistBall 04	DoFeed 06	MillQuadFeed	DoFeedQuad	TungMeister
Density of cutter		Close					Coarse
P	Vc	100 - 300	150 - 250	100 - 300	100 - 300	100 - 300	80 - 200
	fz	0.5 -1.2	0.5 - 1.3	0.5 - 1.5	1.0 - 2.0	0.5 - 1.5	0.2 - 0.7
M	Vc	100 - 150	100 - 200	100 - 150	100 - 150	100 - 150	60 - 100
	fz	0.3 - 0.7	0.3 - 0.7	0.3 - 0.7	0.3 - 1.0	0.3 - 0.8	0.2 - 0.6
K	Vc	100 - 300	150 - 250	100 - 300	100 - 300	100 - 300	100 - 220
	fz	0.5 -1.2	0.5 - 1.3	0.5 - 1.5	1.0 - 2.0	0.5 - 1.5	0.2 - 0.7
S	Vc	30 - 60	30 - 60	30 - 60	30 - 60	30 - 60	40 - 80
	fz	0.3 - 0.7	0.3 - 0.7	0.3 - 0.7	0.3 - 0.7	0.3 - 0.7	0.2 - 0.5
H	Vc	80 - 130	50 - 150	80 - 130	80 - 130	80 - 130	40 - 80
	fz	0.1 - 0.3	0.1 - 0.5	0.1 - 0.3	0.1 - 0.3	0.1 - 0.3	0.2 - 0.4

Tool and application choices

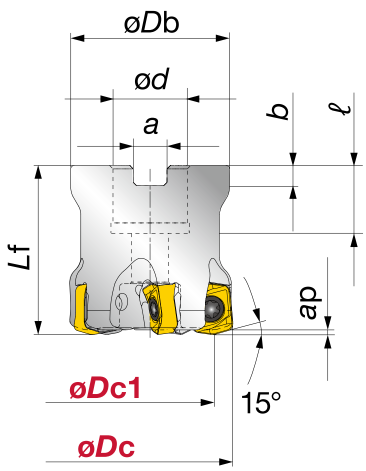
	Facing	Shouldering	Shouldering R	Slotting	Slotting R	Profiling	Pocketing	Ramping	Helical Interpolation	Plunging
TungMeister		●		●		●	●	●	●	●
DoFeed 03	●	●		●		●	●	●	●	●
DoTwistBall	●	●	●	●	●	●	●	●	●	●
DoFeed 06	●	●		●		●	●	●	●	●
DoFeedQuad	●									
MillQuadFeed	●					●	●	●	●	

TECHNICAL GUIDES AND TIPS IN HFM

For maximum performance

øDc1 and øDc

Effective tool diameter øDc1 is usually smaller than tool diameter øDc.

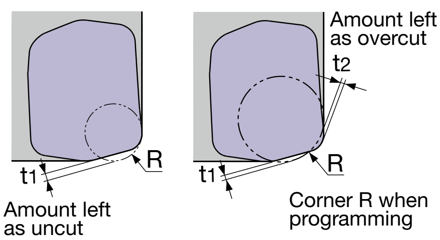


Designation	Max. ap	øDc	z	øDc1
TXN06R050M22.0E04	1.5	50	4	37.6

Theoretical radius and programming

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

When programming, a **theoretical radius** (R) and the actual profile left uncut on the machined surface (t1) should be noted. Here R=3.0 mm is recommended for a **EXN06/TXN06 insert**. If a larger radius (e.g. R=4.0 mm) is programmed, an overcut (t2) of 0.26 mm may occur and the dimensional accuracy may be deviated from what is required.

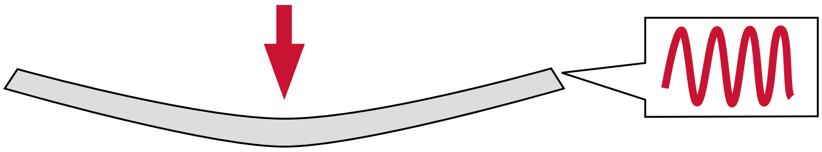


Max. depth of cut max. ap(mm)	Corner radius rε	W (mm)	Corner R when program-ming	Amount left as uncut t1	Amount left as overcut t2
1.5	2	6	2	1	-
			3	0.77	-
			4	0.54	0.26

Each value above is calculated theoretically at the maximum condition.

Machining thin workpieces with weak fixture

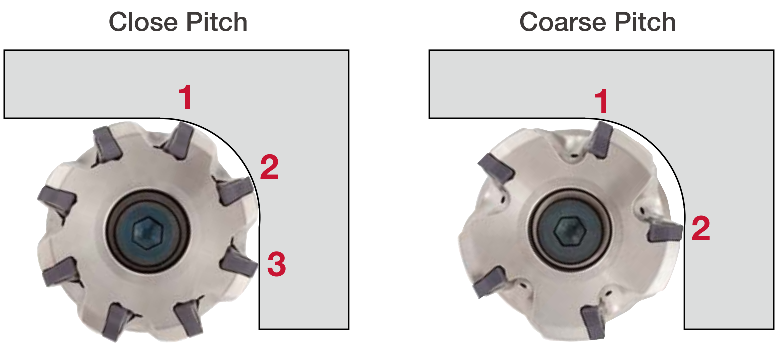
Workpieces in a thin, flat structure with weak fixture setting are prone to chatter. To minimize vibration, reduce thrust force by **decreasing D.O.C. or feed rate**. Another option is to use a cutter with a bigger approach angle for reduced thrust force.



Long overhang and chattering

Due to the cutting force acting vertically up to the spindle, **HFM** is an ideal method in long reach applications to improve efficiency. However, if a tool length of 5xD or longer is used, the following cautions are advised to be taken:

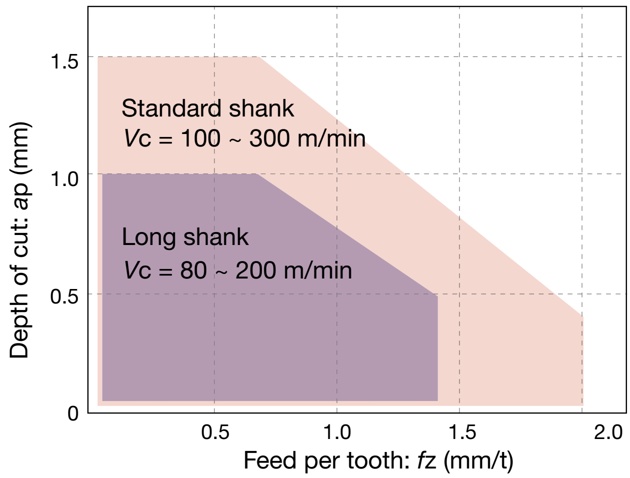
- Use a **coarse-pitched cutter**: This will decrease the number of cutting edges in contact simultaneously on the workpiece. If additional stability is needed, use an **ML chipbreaker** (Use only as a supplemental method).



- Vibration may be minimized by optimizing cutting parameters (to 70% of the recommended parameters). Adjust the parameters in the following orders:

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

(Note: when using a fz=0.5 mm/z or lower, a reduction in feed rate may adversely increase vibration.)



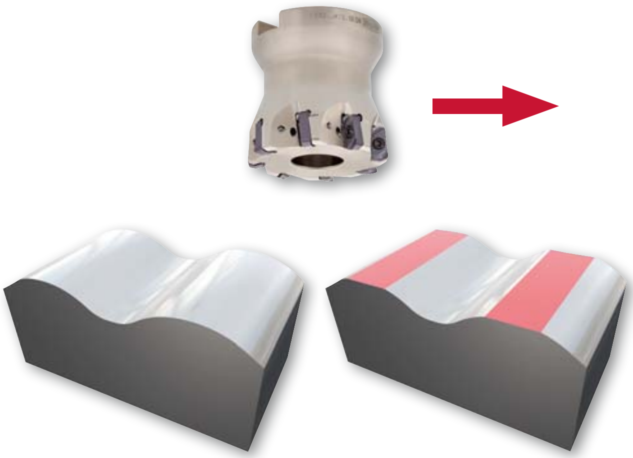
Note: If all the above measures are taken and chatter still exists, or production efficiency is not reaching an adequate level, use Tungaloy´s RoundSplit milling cutter.

Milling unstable surfaces

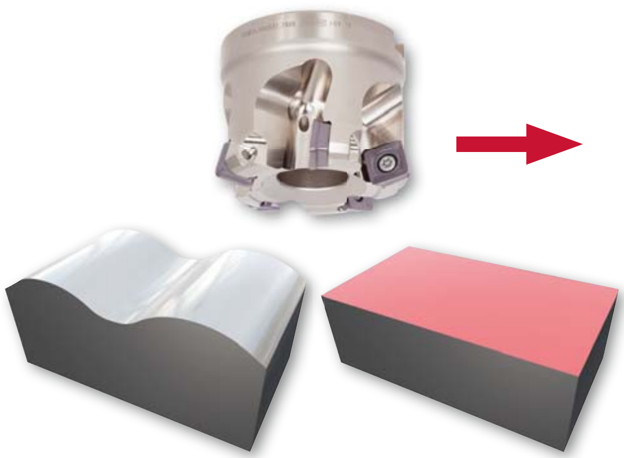
Milling unstable surfaces including scale removal is a troublesome operation. Insert damage is common in these operations, hindering unmanned machine operations. Many customers choose a **high-feed cutter** as a safe and productive machining solution. Due to surface unevenness, a **high-feed cutter**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

MillQuad-Feed is an extremely efficient milling solution for unstable surfaces, with its **high-feed capability** of 2.0 mm per tooth at 2.5 mm depth of cut **MillQuad-Feed** ensures high stability and metal removal rates. **DoTriple-Mill** round inserts are 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



High depth of cut



MillQuad-Feed Series

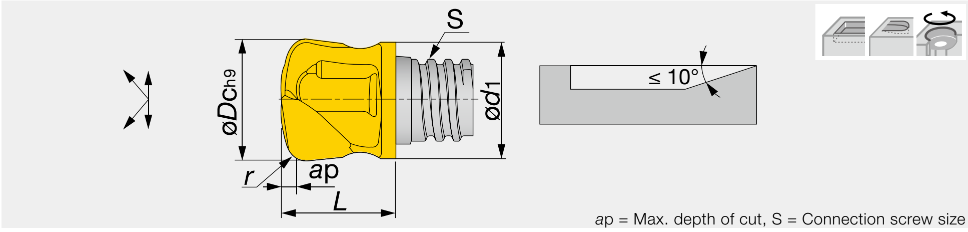
PRODUCT LINE-UP

A wide range of High-Feed Milling tools

TUNGMEISTER

VFX**-02...

TungMeister radius head for super high-feed milling



ap = Max. depth of cut, S = Connection screw size

Designation	AH725	z	Helx	øDc	ød1	Max. ap	r(1)	S	L	Wrench	Torque*
VFX100L00.6R20-02S06	●	2	0°	10	9.6	0.6	2	S06	12.5	KEYV-S06	10
VFX120L01.0R25-02S08	●	2	0°	12	11.5	1.0	2.5	S08	11.1	KEYV-S08	15
VFX160L01.1R30-02S10	●	2	0°	16	15.2	1.1	3	S10	20	KEYV-S10	28
VFX200L01.5R33-02S12	●	2	0°	20	18.3	1.5	3.3	S12	17.5	KEYV-S12	28

●: Standard item

(1) Corner radius for CAM programing
Note: For VFX head, taper neck shank or Tungsten shank should be recommended.
*Torque: Recommended torque (Nm) for clamping.
Packing quantity = 2 pcs.

STANDARD CUTTING CONDITIONS

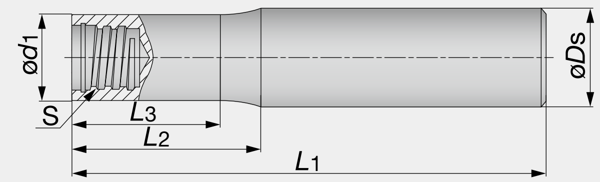
High feed milling (VFX)

ISO	Workpiece material	Hardness	Cutting speed Vc (m/min)	ø10		ø12		ø16		ø20		Width of cut ae (mm)
				Feed per tooth fz (mm/z)	Depth of cut ap (mm)	Feed per tooth fz (mm/z)	Depth of cut ap (mm)	Feed per tooth fz (mm/z)	Depth of cut ap (mm)	Feed per tooth fz (mm/z)	Depth of cut ap (mm)	
P	Low carbon steels S45C, S55C, etc. C45, C55, etc.	- 300 HB	100 - 200	0.3 - 0.7	0.5	0.4 - 0.8	0.5	0.5 - 0.9	0.75	0.6 - 1	1	0.6 x øDc
P	High carbon steels SCM440, SCr415, etc. 42CrMo4, 15Cr3, etc.	- 300 HB	80 - 180	0.2 - 0.6	0.5	0.3 - 0.7	0.5	0.4 - 0.8	0.75	0.5 - 0.9	1	0.6 x øDc
P	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	80 - 160	0.2 - 0.5	0.4	0.2 - 0.5	0.4	0.3 - 0.6	0.5	0.3 - 0.6	0.75	0.6 x øDc
M	Stainless steels SUS304, SUS316, etc. X5CrNi18-9, X5CrNiMo17-12-2, etc.	- 200 HB	60 - 100	0.2 - 0.6	0.4	0.2 - 0.6	0.4	0.3 - 0.7	0.5	0.3 - 0.7	0.75	0.6 x øDc
K	Grey cast irons FC250, FC300, etc. 250, 300, etc.	150 - 250 HB	100 - 220	0.3 - 0.7	0.5	0.4 - 0.8	0.75	0.5 - 0.9	0.75	0.6 - 1	1	0.6 x øDc
K	Ductile cast irons FCD400, etc. 400-15S, etc.	150 - 250 HB	100 - 220	0.2 - 0.6	0.5	0.3 - 0.7	0.75	0.4 - 0.8	0.75	0.5 - 0.9	1	0.6 x øDc
S	Titanium alloys Ti-6Al-4V, etc.	-	40 - 80	0.2 - 0.5	0.4	0.2 - 0.5	0.4	0.2 - 0.6	0.5	0.2 - 0.6	0.5	0.25 x øDc
S	Heat-resistant alloys Inconel 718, etc.	-	20 - 40	0.1 - 0.3	0.3	0.1 - 0.3	0.3	0.1 - 0.3	0.4	0.1 - 0.3	0.4	0.25 x øDc
H	Hardened steel SKD61, SKT4, etc. X40CrMoV5 1, 55NiCrMoV6, etc.	40 - 50 HRC	40 - 80	0.2 - 0.4	0.3	0.2 - 0.4	0.3	0.3 - 0.5	0.4	0.3 - 0.5	0.4	0.45 x øDc
H	Hardened steel SKD11, SKH, etc. X153CrMoV12, HS18-0-1, etc.	50 - 60 HRC	20 - 60	0.1 - 0.2	0.2	0.1 - 0.2	0.2	0.1 - 0.3	0.3	0.1 - 0.3	0.3	0.25 x øDc

TUNGMEISTER

VSSD...

TungMeister, straight neck and cylindrical shank



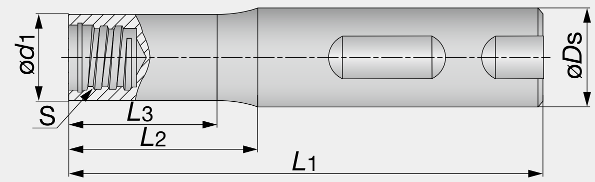
S = Connection screw size

Designation	øDs	ød1	L1	L2	L3	S	Type	Material
VSSD08L060S05-S	8	7.6	60	15	12.80	S05	CYLINDRICAL	STEEL
VSSD08L070S05-C	8	7.6	70	20	19	S05	CYLINDRICAL	CARBIDE
VSSD08L090S05-C	8	7.6	90	40	39	S05	CYLINDRICAL	CARBIDE
VSSD08L110S05-C	8	7.6	110	60	59	S05	CYLINDRICAL	CARBIDE
VSSD10L070S06-C	10	9.6	70	20	18.5	S06	CYLINDRICAL	CARBIDE
VSSD10L075S06-S	10	9.6	75	20	17.7	S06	CYLINDRICAL	STEEL
VSSD10L090S06-C	10	9.6	90	40	38.5	S06	CYLINDRICAL	CARBIDE
VSSD10L110S06-C	10	9.6	110	60	58.5	S06	CYLINDRICAL	CARBIDE
VSSD10L150S06-C	10	9.6	150	100	98.5	S06	CYLINDRICAL	CARBIDE
VSSD12L070S08-C	12	11.5	70	20	17	S08	CYLINDRICAL	CARBIDE
VSSD12L090S08-C	12	11.5	90	40	37	S08	CYLINDRICAL	CARBIDE
VSSD12L090S08-S	12	11.5	90	16	13.6	S08	CYLINDRICAL	STEEL
VSSD12L110S08-C	12	11.5	110	60	57	S08	CYLINDRICAL	CARBIDE
VSSD12L130S08-C	12	11.5	130	80	77	S08	CYLINDRICAL	CARBIDE
VSSD16L090S10-C	16	15.2	90	40	38	S10	CYLINDRICAL	CARBIDE
VSSD16L100S10-S	16	15.2	100	20	18	S10	CYLINDRICAL	STEEL
VSSD16L110S10-C	16	15.2	110	60	58	S10	CYLINDRICAL	CARBIDE
VSSD16L130S10-C	16	15.2	130	80	78	S10	CYLINDRICAL	CARBIDE
VSSD16L150S10-C	16	15.2	150	100	98	S10	CYLINDRICAL	CARBIDE
VSSD20L090S12-C	20	18.3	90	40	37	S12	CYLINDRICAL	CARBIDE
VSSD20L120S12-S	20	18.3	120	25	20.5	S12	CYLINDRICAL	STEEL
VSSD20L130S12-C	20	18.3	130	80	77	S12	CYLINDRICAL	CARBIDE
VSSD20L200S12-C	20	18.3	200	120	117	S12	CYLINDRICAL	CARBIDE
VSSD25L120S15-C	25	23.9	120	60	58	S15	CYLINDRICAL	CARBIDE
VSSD25L135S15-S	25	23.9	135	35	33	S15	CYLINDRICAL	STEEL
VSSD25L170S15-C	25	23.9	170	100	98	S15	CYLINDRICAL	CARBIDE
VSSD25L250S15-C	25	23.9	250	150	148	S15	CYLINDRICAL	CARBIDE

TUNGMEISTER

VSSD**W...

TungMeister, straight neck and weldon shank



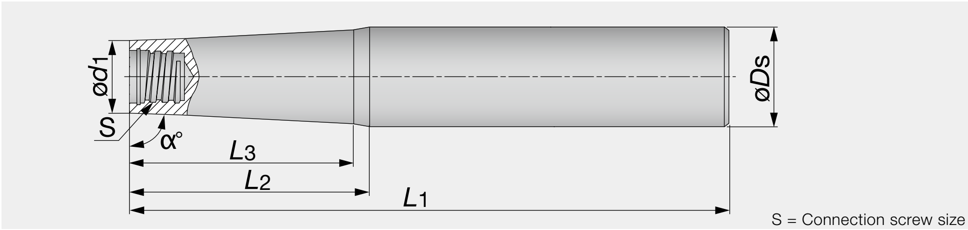
S = Connection screw size

Designation	øDs	ød1	L1	L2	L3	S	Shank	Material
VSSD12L055W05-S	12	7.6	55	3.8	-	S05	WELDON	STEEL
VSSD16L065W06-S	16	9.6	65	6	-	S06	WELDON	STEEL
VSSD16L065W08-S	16	11.5	65	4	-	S08	WELDON	STEEL
VSSD20L070W10-S	20	15.2	70	4	-	S10	WELDON	STEEL
VSSD25L075W12-S	25	18.3	75	6	-	S12	WELDON	STEEL

TUNGMEISTER

VTSD...

TungMeister, straight shank and taper neck

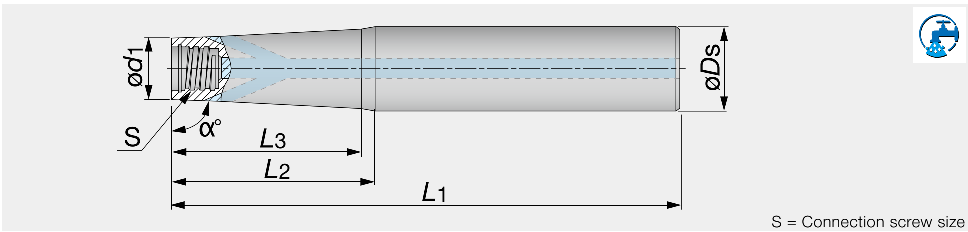


Designation	α°	øDs	ød1	L1	L2	L3	S	Material
VTSD12L080S05-S	85	12	7.6	80	25	-	S05	STEEL
VTSD12L100S05-S	89	12	7.6	100	35	31	S05	STEEL
VTSD12L110S05-C	89	12	7.6	110	60	58	S05	CARBIDE
VTSD12L130S05-C	89	12	7.6	130	80	79	S05	CARBIDE
VTSD16L125S06-S	85	16	9.6	125	34	31.6	S06	STEEL
VTSD16L130S08-C	89	16	11.5	130	80	78.8	S08	CARBIDE
VTSD16L140S08-S	85	16	11.5	140	22	19.3	S08	STEEL
VTSD16L150S05-C	89	16	7.6	150	100	96	S05	CARBIDE
VTSD16L150S06-C	89	16	9.6	150	100	98	S06	CARBIDE
VTSD16L150S08-C	89	16	11.5	150	100	-	S08	CARBIDE
VTSD16L160S06-S	89	16	9.6	160	55	45.9	S06	STEEL
VTSD16L170S06-C	89	16	9.6	170	120	119	S06	CARBIDE
VTSD20L140S10-S	85	20	15.2	140	27.5	-	S10	STEEL
VTSD20L170S08-C	89	20	11.5	170	120	117	S08	CARBIDE
VTSD20L170S08-S	89	20	11.5	170	80	68.6	S08	STEEL
VTSD20L170S10-C	89	20	15.2	170	120	-	S10	CARBIDE
VTSD20L190S10-C	89	20	15.2	190	140	-	S10	CARBIDE
VTSD20L190S10-S	89	20	15.2	190	80	73	S10	STEEL
VTSD20L210S10-C	89	20	15.2	210	160	-	S10	CARBIDE
VTSD25L160S12-S	85	25	18.3	160	40	-	S12	STEEL
VTSD25L170S10-S	85	25	15.2	170	56	-	S10	STEEL
VTSD25L180S12-C	89	25	18.3	180	120	-	S12	CARBIDE
VTSD25L210S12-S	89	25	18.3	210	100	91	S12	STEEL
VTSD25L250S12-C	89	25	18.3	250	140	-	S12	CARBIDE
VTSD32L155S15-S	85	32	23.9	155	45	40	S15	STEEL
VTSD32L190S12-S	85	32	18.3	190	80	-	S12	STEEL
VTSD32L220S15-S	85	32	23.9	220	100	-	S15	STEEL
VTSD32L250S15-C	89	32	23.9	250	150	-	S15	CARBIDE
VTSD32L300S15-C	89	32	23.9	300	200	-	S15	CARBIDE

TUNGMEISTER

VTSD**-W-A

TungMeister, straight shank and taper neck with coolant hole

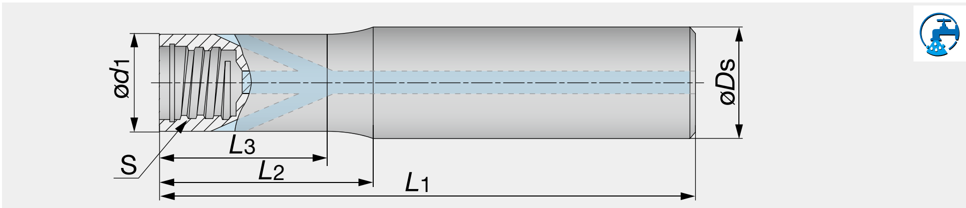


Designation	α°	øDs	ød1	L1	L2	L3	S	Material
VTSD12L110S06-W-A	89	12	9.6	110	60	59	S06	TUNGSTEN
VTSD16L170S06-W-A	89	16	9.6	170	120	116	S06	TUNGSTEN

TUNGMEISTER

VSSD**-W-A

TungMeister, straight shank and neck with coolant hole



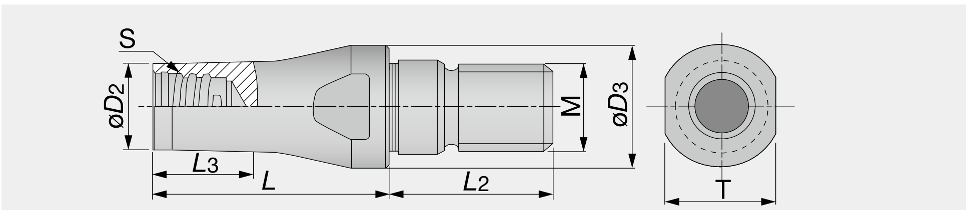
S = Connection screw size

Designation	øDs	ød1	L1	L2	L3	S	Material
VSSD10L070S06-W-A	10	9.6	70	20	19	S06	TUNGSTEN
VSSD10L090S06-W-A	10	9.6	90	40	39	S06	TUNGSTEN
VSSD10L110S06-W-A	10	9.6	110	60	59	S06	TUNGSTEN
VSSD12L070S08-W-A	12	11.5	70	20	19	S08	TUNGSTEN
VSSD12L090S08-W-A	12	11.5	90	40	39	S08	TUNGSTEN
VSSD12L110S08-W-A	12	11.5	110	60	59	S08	TUNGSTEN
VSSD12L130S08-W-A	12	11.5	130	80	79	S08	TUNGSTEN
VSSD16L070S10-W-A	16	15.2	70	20	18.5	S10	TUNGSTEN
VSSD16L090S10-W-A	16	15.2	90	40	36.5	S10	TUNGSTEN
VSSD16L110S10-W-A	16	15.2	110	60	58.5	S10	TUNGSTEN
VSSD16L130S10-W-A	16	15.2	130	80	78.5	S10	TUNGSTEN
VSSD20L090S12-W-A	20	18.3	90	40	37	S12	TUNGSTEN
VSSD20L130S12-W-A	20	18.3	130	80	77	S12	TUNGSTEN

TUNGMEISTER TUNGFLEX

VAD**-M...

TungFlex conversion adaptor with TungMeister



S = Connection screw size

Designation	øD2	øD3	L	L2	L3	S	M	T
VAD130L016S08-S-M8	11.7	13	16	17.5	6	S08	M8	11
VAD130L025S08-S-M8	11.7	13	25	17.5	20	S08	M8	11
VAD180L020S08-S-M10	11.7	18	20	20	12	S08	M10	13
VAD180L025S08-S-M10	11.7	18	25	20	15	S08	M10	11
VAD210L020S08-S-M12	11.7	21	20	20	10	S08	M12	12.75
VAD210L025S08-S-M12	11.7	21	25	20	13	S08	M12	12.75

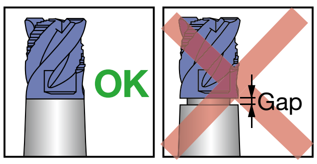
WRENCH

Appearance	Designation	Connection screw size	Torque (N·m)	Applicable head
	KEYV-S05	S05	7	Square Ball Radius Drilling Chamfering Counter boring
	KEYV-S06	S06	10	
	KEYV-S08	S08	15	
	KEYV-S10	S10	28	
	KEYV-S12	S12	28	
	KEYV-W20	S15	40	

Note: Optional parts

CAUTIONARY POINTS IN USE

· The cutting heads specified by Tungaloy must be used. Avoid using alternate heads that are not Tungaloy products as this will damage the shank and can cause severe accident or injury.
· Before setting the head, clean the connection screw with an air blast or a wiping cloth to remove chips and other foreign matter that may remain.
· Do not apply the lubricant to the connection screw.
· Please use the supplied wrench. Tighten the head slowly until the face of the head contacts the shank. (Please refer to the picture shown on the right.) Do not re-tighten or over-tighten. Excessive tightening may cause the cutting head to break.
· Do not apply excessive force or hammer when tightening or exchanging the cutting heads.

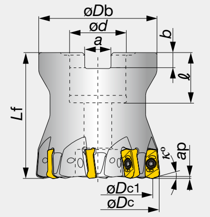


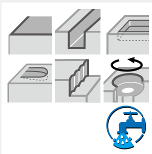
DOFEED

TXN03

Super high-feed milling cutters with double sided inserts with 4 edges

A.R. = +6°, R.R. = +12° ~ 13°





Designation	Max. ap	øDc	z	øDc1	øDb	ød	ℓ	Lf	b	a	κ°	Kg	Air hole	Insert
TXN03R040M16.0E05	1	40	5	33.6	35	16	18	40	5.6	8.4	17	0.2	✓	LNMU03...
TXN03R040M16.0E06	1	40	6	33.6	35	16	18	40	5.6	8.4	17	0.2	✓	LNMU03...
TXN03R050M22.0E05	1	50	5	43.6	47	22	20	50	6.3	10.4	17	0.5	✓	LNMU03...
TXN03R050M22.0E08	1	50	8	43.6	47	22	20	50	6.3	10.4	17	0.5	✓	LNMU03...
TXN03R050M22.2-08	1	50	8	43.6	47	22.225	20	50	5	8	17	0.5	✓	LNMU03...

SPARE PARTS

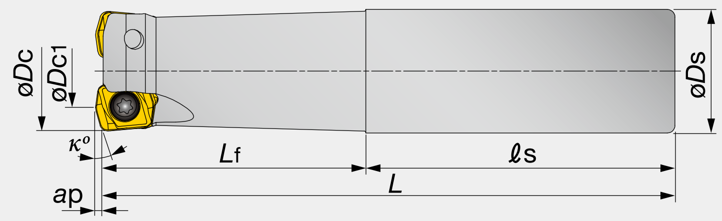
Designation	Clamping screw	Lubricant	Shell locking bolt	Wrench
TXN03R04...	CSPB-2.5	M-1000	CM8X30H	IP-8D
TXN03R05...	CSPB-2.5	M-1000	CM10X30H	IP-8D

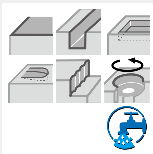
DOFEED

EXN03

Super high-feed milling endmills with double sided inserts with 4 edges

A.R. = +6°, R.R. = +5° ~ +11°





Designation	Max. ap	øDc	z	øDc1	øDs	L	Lf	ℓs	κ°	Kg	Air hole	Insert
EXN03R016M16.0-02	1	16	2	9.5	16	100	30	70	15	0.2	✓	LNMU03...
EXN03R016M16.0-02L	1	16	2	9.5	16	150	50	100	15	0.2	✓	LNMU03...
EXN03R018M16.0-02	1	18	2	11.5	16	100	30	70	17	0.2	✓	LNMU03...
EXN03R018M16.0-02L	1	18	2	11.5	16	150	25	125	17	0.2	✓	LNMU03...
EXN03R020M20.0-03	1	20	3	13.5	20	130	50	80	17	0.3	✓	LNMU03...
EXN03R020M20.0-03L	1	20	3	13.5	20	160	80	80	17	0.3	✓	LNMU03...
EXN03R020M20.0-04	1	20	4	13.5	20	130	50	80	17	0.3	✓	LNMU03...
EXN03R022M20.0-03	1	22	3	15.5	20	130	50	80	17	0.3	✓	LNMU03...
EXN03R022M20.0-03L	1	22	3	15.5	20	160	30	130	17	0.4	✓	LNMU03...
EXN03R022M20.0-04	1	22	4	15.5	20	130	50	80	17	0.3	✓	LNMU03...
EXN03R025M25.0-04	1	25	4	18.5	25	140	60	80	17	0.5	✓	LNMU03...
EXN03R025M25.0-04L	1	25	4	18.5	25	180	100	80	17	0.6	✓	LNMU03...
EXN03R025M25.0-05	1	25	5	18.5	25	140	60	80	17	0.5	✓	LNMU03...
EXN03R028M25.0-04	1	28	4	21.5	25	140	60	80	17	0.5	✓	LNMU03...
EXN03R028M25.0-04L	1	28	4	21.5	25	180	35	145	17	0.7	✓	LNMU03...
EXN03R028M25.0-05	1	28	5	21.5	25	140	60	80	17	0.5	✓	LNMU03...
EXN03R030M32.0-04	1	30	4	23.5	32	150	70	80	17	0.8	✓	LNMU03...
EXN03R030M32.0-04L	1	30	4	23.5	32	200	120	80	17	0.9	✓	LNMU03...
EXN03R030M32.0-05	1	30	5	23.5	32	150	70	80	17	0.8	✓	LNMU03...
EXN03R032M32.0-05	1	32	5	25.5	32	150	70	80	17	0.8	✓	LNMU03...
EXN03R032M32.0-05L	1	32	5	25.5	32	200	120	80	17	1.1	✓	LNMU03...
EXN03R032M32.0-06	1	32	6	25.5	32	150	70	80	17	0.9	✓	LNMU03...
EXN03R035M32.0-05	1	35	5	28.6	32	150	35	115	17	0.9	✓	LNMU03...
EXN03R035M32.0-05L	1	35	5	28.5	32	200	35	165	17	1.2	✓	LNMU03...
EXN03R035M32.0-06	1	35	6	28.5	32	150	35	115	17	0.9	✓	LNMU03...

SPARE PARTS

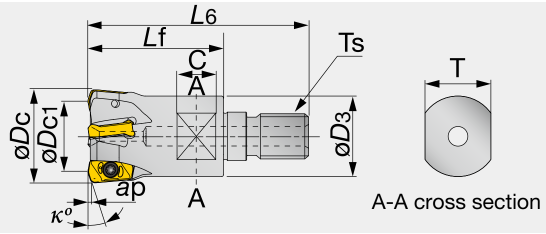
Designation	Clamping screw	Lubricant	Wrench
EXN03...	CSPB-2.5	M-1000	IP-8D

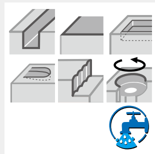
DOFEED

HXN03-M

Super high-feed milling endmills (Dofeed) with TungFlex

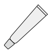
A.R. = +6°, R.R. = +5° ~ +11°





Designation	Max. ap	øDc	z	øDc1	L6	Lf	C	T	øD3	κ°	Ts	Kg	Air hole	Insert
HXN03R016MM08-02	1	16	2	9.5	42	25	8	10	12.8	15	M8	0.03	✓	LNMU03...
HXN03R018MM08-02	1	18	2	11.5	42	25	8	10	14.5	17	M8	0.04	✓	LNMU03...
HXN03R020MM10-03	1	20	3	13.6	49	30	10	15	17.8	17	M10	0.06	✓	LNMU03...
HXN03R020MM10-04	1	20	4	13.5	49	30	10	15	17.8	17	M10	0.06	✓	LNMU03...
HXN03R022MM10-03	1	22	3	15.6	49	30	10	15	17.8	17	M10	0.06	✓	LNMU03...
HXN03R022MM10-04	1	22	4	15.5	49	30	10	15	17.8	17	M10	0.07	✓	LNMU03...
HXN03R025MM12-04	1	25	4	18.5	57	35	10	17	20.8	17	M12	0.1	✓	LNMU03...
HXN03R025MM12-05	1	25	5	18.5	57	35	10	17	20.8	17	M12	0.11	✓	LNMU03...
HXN03R028MM12-04	1	28	4	21.6	57	35	10	17	23	17	M12	0.12	✓	LNMU03...
HXN03R028MM12-05	1	28	5	21.5	57	35	10	17	23	17	M12	0.12	✓	LNMU03...
HXN03R030MM16-04	1	30	4	23.6	63	40	12	22	28.8	17	M16	0.19	✓	LNMU03...
HXN03R030MM16-05	1	30	5	23.5	63	40	12	22	28.8	17	M16	0.2	✓	LNMU03...
HXN03R032MM16-05	1	32	5	25.5	63	40	12	22	28.8	17	M16	0.2	✓	LNMU03...
HXN03R032MM16-06	1	32	6	25.5	63	40	12	22	28.8	17	M16	0.21	✓	LNMU03...

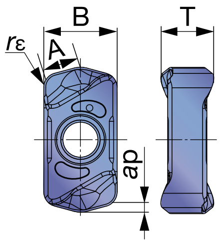
SPARE PARTS



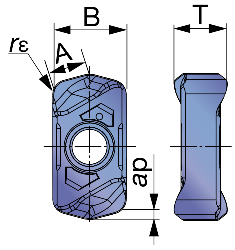
Designation	Clamping screw	Lubricant	Wrench
HXN03...	CSPB-2.5	M-1000	IP-8D

INSERTS

LNMU03-MJ (for general use)



LNMU03-ML (for low cutting force)



		AH130	AH725	AH3035
P	Steel		★	★
M	Stainless	★	☆	☆
K	Cast iron		☆	
N	Non-ferrous			
S	Superalloys	☆	★	
H	Hard materials		★	★

★ : First choice
☆ : Second choice

Designation	rε	Max. ap	Coated AH130	Coated AH725	Coated AH3035	A	B	T
LNMU0303ZER-MJ	1.2	1	●	●	●	3.2	6	4.3
LNMU0303ZER-ML	1.2	1	●	●	●	3.2	6	4.3

●: Standard item

STANDARD CUTTING CONDITIONS TXN03/EXN03/HXN03

ISO	Work materials	Hardness	Priority	Grades	Chip-breaker	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/z) Tool dia: øDc (mm) ø16~ ø22	ø25 ~ ø50	Plunging
P	Carbon steels S45C, S55C, etc. C45, C55, etc.	~ 300HB	First choice	AH725	MJ	100 - 300	0.5 -1.2	0.5 - 1.5	0.1
		~ 300HB	For low cutting force	AH725	ML	100 - 300	0.5 - 0.7	0.5 - 1	0.1
		~ 300HB	For impact resistance	AH3035	MJ	100 - 300	0.5 -1.2	0.5 - 1.5	0.1
	Alloy steels SCM440, SCr415, etc. 42CrMo4, 17Cr3, etc.	~ 300HB	First choice	AH725	MJ	100 - 200	0.5 -1.2	0.5 - 1.5	0.1
		~ 300HB	For low cutting force	AH725	ML	100 - 200	0.5 - 0.7	0.5 - 1	0.1
		~ 300HB	For impact resistance	AH3035	MJ	100 - 200	0.5 -1.2	0.5 - 1.5	0.1
	Prehardened steels NAK80, PX5, etc.	30 ~ 40HRC	-	AH3035	ML	100 - 200	0.5 - 0.7	0.5 - 1	0.1
M	Stainless steels SUS304, SUS316, etc. X5CrNi18-10, X5CrNiMo17-12-2, etc.	~ 200HB	First choice	AH130	ML	100 - 150	0.3 - 0.5	0.3 - 0.7	0.08
		~ 200HB	For impact resistance	AH130	MJ	100 - 150	0.3 - 0.8	0.3 - 0.8	0.08
K	Grey cast irons FC250, FC300 / GG25, GGG30, etc.	150 ~ 250HB	-	AH725	MJ	100 - 300	0.5 - 1.2	0.5 - 1.5	0.1
	Ductile cast irons FCD400 / GGG40, etc.	150 ~ 250HB	-	AH725	MJ	80 - 200	0.5 - 1.2	0.5 - 1.5	0.1
S	Titanium alloy Ti-6Al-4V, etc.	~ 40HRC	-	AH725	ML	30 - 60	0.3 - 0.5	0.3 - 0.7	0.08
H	Hardened steels SKD61 X40CrMoV5-1, etc.	40 ~ 50HRC	-	AH3035	MJ	80 - 130	0.1 - 0.2	0.1 - 0.3	0.05
	Hardened steels SKD11 X153CrMoV12, etc.	50 ~ 60HRC	-	AH725	MJ	50 - 70	0.03 - 0.05	0.03 - 0.07	0.03

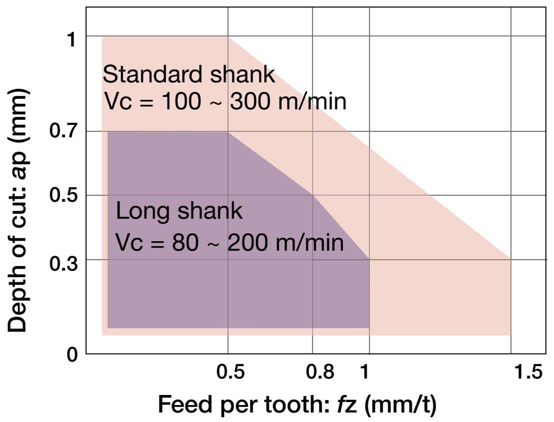
Always use an airgun to clear cavities and slots completely of chips and debris.

Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.

CAUTIONARY POINTS IN USE

The usage of standard and long shanks

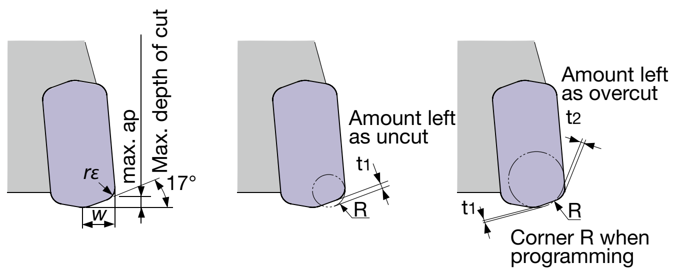
When using a long shank, always lower the cutting conditions (Vc, fz, ap) to 70% of the maximum conditions for the standard shank.



Tool dia.: øDc = ø16 ~ 35 mm
Work material: S55C / C55 (200HB)
Standard shank: L/D ≤ 3
Long shank: L/D = 4
L/D ratio of overhang

CAM programming

When programming for CAM, the tool should be considered as a round insert cutter. Usually, the corner radius should be set as R = 1.5 mm. If a larger radius is used, overcutting will occur. The following table shows the amount left as uncut (t_1) and overcut (t_2).



Max. depth of cut max. ap	Corner radius rε	W (mm)	Corner R when program-ming	Amount left as uncut t1	Amount left as overcut t2
1	1.2	3	1	0.6	-
			1.5	0.5	-
			2	0.25	0.08
			2.5	0.14	0.26

Each value in the table is calculated theoretically at the maximum condition.

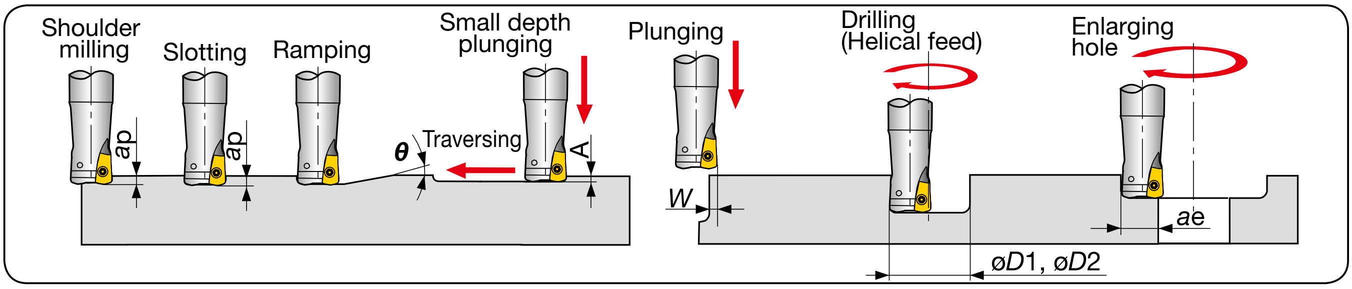
Tool diameter: øDc (mm), Number of revolutions: n (min^{-1}), Feed speed: Vf (mm/min), Max. depth of cut: ap = 1.0 mm

ø16, z = 2		ø18, z = 2		ø20, z = 4		ø22, z = 4		ø25, z = 5		ø28, z = 5		ø30, z = 5		ø32, z = 6		ø35, z = 6		ø40, z = 6		ø50, z = 8	
n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf
3,980	6,370	3,540	5,660	3,180	10,180	2,890	9,250	2,550	12,750	2,270	11,350	2,120	10,600	1,990	11,940	1,820	10,920	1,590	9,540	1,270	10,160
Vc = 200 m/min, fz = 0.8 mm/z								Vc = 200 m/min, fz = 1.0 mm/z													
3,980	4,780	3,540	4,250	3,180	7,630	2,890	6,940	2,550	10,200	2,270	9,080	2,120	8,480	1,990	9,550	1,820	8,740	1,590	7,630	1,270	8,130
Vc = 200 m/min, fz = 0.6 mm/z								Vc = 200 m/min, fz = 0.8 mm/z													
3,980	6,370	3,540	5,660	3,180	10,180	2,890	9,250	2,550	12,750	2,270	11,350	2,120	10,600	1,990	11,940	1,820	10,920	1,590	9,540	1,270	10,160
Vc = 200 m/min, fz = 0.8 mm/z								Vc = 200 m/min, fz = 1.0 mm/z													
2,980	4,770	2,650	4,240	2,390	7,650	2,170	6,940	1,910	9,550	1,710	8,550	1,590	7,950	1,490	8,940	1,360	8,160	1,190	7,140	950	5,700
Vc = 150 m/min, fz = 0.8 mm/z								Vc = 150 m/min, fz = 1.0 mm/z													
2,980	3,580	2,650	3,180	2,390	5,740	2,170	5,210	1,910	7,640	1,710	6,840	1,590	6,360	1,490	7,150	1,360	6,530	1,190	5,710	950	4,560
Vc = 150 m/min, fz = 0.6 mm/z								Vc = 150 m/min, fz = 0.8 mm/z													
2,980	4,770	2,650	4,240	2,390	7,650	2,170	6,940	1,910	9,550	1,710	8,550	1,590	7,950	1,490	8,940	1,360	8,160	1,190	7,140	950	5,700
Vc = 150 m/min, fz = 0.8 mm/z								Vc = 150 m/min, fz = 1.0 mm/z													
2,980	3,580	2,650	3,180	2,390	5,740	2,170	5,210	1,910	7,640	1,710	6,840	1,590	6,360	1,490	7,150	1,360	6,530	1,190	5,710	950	4,560
Vc = 150 m/min, fz = 0.6 mm/z								Vc = 150 m/min, fz = 0.8 mm/z													
2,390	1,910	2,120	1,700	1,910	3,060	1,740	2,780	1,530	3,830	1,360	3,400	1,270	3,180	1,190	3,570	1,090	3,270	950	2,850	760	3,040
Vc = 120 m/min, fz = 0.4 mm/z								Vc = 120 m/min, fz = 0.5 mm/z													
2,390	2,390	2,120	2,120	1,910	3,820	1,740	3,480	1,530	4,590	1,360	4,080	1,270	3,810	1,190	4,280	1,090	3,920	950	3,420	760	3,650
Vc = 120 m/min, fz = 0.5 mm/z								Vc = 120 m/min, fz = 0.6 mm/z													
3,980	6,370	3,540	5,660	3,180	10,180	2,890	9,250	2,550	12,750	2,270	11,350	2,120	10,600	1,990	11,940	1,820	10,920	1,590	9,540	1,270	10,160
Vc = 200 m/min, fz = 0.8 mm/z								Vc = 200 m/min, fz = 1.0 mm/z													
2,980	4,770	2,650	4,240	2,390	7,650	2,170	6,940	1,910	9,550	1,710	8,550	1,590	7,950	1,490	8,940	1,360	8,160	1,190	7,140	950	5,700
Vc = 150 m/min, fz = 0.8 mm/z								Vc = 150 m/min, fz = 1.0 mm/z													
800	640	710	570	640	1,020	580	930	510	1,280	450	1,130	420	1,050	400	1,200	360	1,080	320	960	250	1,000
Vc = 40 m/min, fz = 0.4 mm/z								Vc = 40 m/min, fz = 0.5 mm/z													
1,990	600	1,770	530	1,590	950	1,450	870	1,270	1,270	1,140	1,140	1,060	1,060	990	1,190	910	1,090	800	960	640	1,020
Vc = 100 m/min, fz = 0.15 mm/z								Vc = 100 m/min, fz = 0.2 mm/z													
1,190	100	1,060	80	950	150	870	140	760	190	680	170	640	160	600	180	550	170	480	140	380	150
Vc = 60 m/min, fz = 0.04 mm/z								Vc = 60 m/min, fz = 0.05 mm/z													

The above table shows the conditions for standard shank type cutters. When using long shank type cutters, the number of teeth may be different. In this case, the cutting conditions should be changed by referring to: "The usage of standard and long shanks" shown on the previous page.

Cutting conditions are generally limited by the spindle rigidity, machine power and the workpiece fixture stability. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

APPLICATION RANGE



Designation	Tool dia. øDc	Max. depth of cut Max ap	Max. ramping angle θ°	Max. plunging depth A	Max. cutting width in plunging W	Min.machinable hole dia. øD1	Max.machinable hole dia. øD2	Max. cutting width in enlarging hole ae
E/HXN03R016M...	ø16	1	2.1	0.3	3.5	22	30	12.5
E/HXN03R018M...	ø18	1	1.7	0.3	3.5	26	34	14.5
E/HXN03R020M...	ø20	1	1.4	0.3	3.5	30	38	16.5
E/HXN03R022M...	ø22	1	1.2	0.3	3.5	34	42	18.5
E/HXN03R025M...	ø25	1	1.0	0.3	3.5	40	48	21.5
E/HXN03R028M...	ø28	1	0.8	0.3	3.5	46	54	24.5
E/HXN03R030M...	ø30	1	0.7	0.3	3.5	50	58	26.5
E/HXN03R032M...	ø32	1	0.7	0.3	3.5	54	62	28.5
EXN03R035M...	ø35	1	0.6	0.3	3.5	60	68	31.5
TXN03R040M...	ø40	1	0.5	0.3	3.5	70	78	36.5
TXN03R050M...	ø50	1	0.4	0.3	3.5	90	98	46.5

· For øDc above 33 mm, slot milling, ramping or contouring is not recommended as chips may be re-cut.

DOFEED

TXN06

Super high-feed milling cutters with double sided inserts with 4 edges

A.R. = +10°, R.R. = +2° ~ +6°

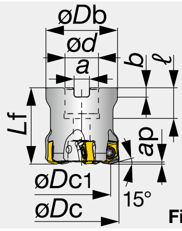
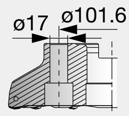


Fig.1

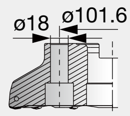
TXN06R200M47.6-12



(øDc = 200 mm)

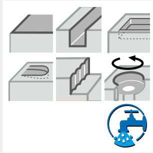
Fig.2

TXN06R200M60.0E12



(øDc = 200 mm)

Fig.3



Designation	Max. ap	øDc	z	øDc1	øDb	Lf	ød	ℓ	a	b	Kg	Air hole	Insert	Fig.
TXN06R050M22.0E04	1.5	50	4	37.6	47	50	22	20	10.4	6.3	0.4	✓	LN*U06...	1
TXN06R050M22.0E05	1.5	50	5	37.6	47	50	22	20	10.4	6.3	0.4	✓	LN*U06...	1
TXN06R050M22.2-04	1.5	50	4	37.6	47	50	22.225	20	8	5	0.4	✓	LN*U06...	1
TXN06R050M22.2-05	1.5	50	5	37.6	47	50	22.225	20	8	5	0.4	✓	LN*U06...	1
TXN06R052M22.0E04	1.5	52	4	39.6	50	50	22	20	10.4	6.3	0.5	✓	LN*U06...	1
TXN06R052M22.0E05	1.5	52	5	39.6	49	50	22	20	10.4	6.3	0.5	✓	LN*U06...	1
TXN06R063M22.0E04	1.5	63	4	50.6	59	50	22	20	10.4	6.3	0.8	✓	LN*U06...	1
TXN06R063M22.0E06	1.5	63	6	50.6	59	50	22	20	10.4	6.3	0.8	✓	LN*U06...	1
TXN06R063M22.2-04	1.5	63	4	50.6	59	50	22.225	20	8	5	0.8	✓	LN*U06...	1
TXN06R063M22.2-06	1.5	63	6	50.6	59	50	22.225	20	8	5	0.8	✓	LN*U06...	1
TXN06R066M27.0E04	1.5	66	4	53.6	63	50	27	22	12.4	7	0.8	✓	LN*U06...	1
TXN06R066M27.0E06	1.5	66	6	53.6	63	50	27	22	12.4	7	0.8	✓	LN*U06...	1
TXN06R080M27.0E05	1.5	80	5	67.6	76	63	27	22	12.4	7	1.6	✓	LN*U06...	1
TXN06R080M27.0E08	1.5	80	8	67.6	76	63	27	22	12.4	7	1.6	✓	LN*U06...	1
TXN06R080M31.7-05	1.5	80	5	67.6	76	63	31.75	32	12.7	8	1.6	✓	LN*U06...	1
TXN06R080M31.7-08	1.5	80	8	67.6	76	63	31.75	32	12.7	8	1.6	✓	LN*U06...	1
TXN06R100M31.7-06	1.5	100	6	87.6	96	63	31.75	32	12.7	8	2.2	✓	LN*U06...	1
TXN06R100M32.0E06	1.5	100	6	87.6	96	63	32	25	14.4	8	2.2	✓	LN*U06...	1
TXN06R125M38.1-08	1.5	125	8	112.6	100	63	38.1	43	15.9	10	3	✓	LN*U06...	1
TXN06R125M40.0E08	1.5	125	8	112.6	100	63	40	37	16.4	9	3	✓	LN*U06...	1
TXN06R160M40.0E10	1.5	160	10	147.6	100	63	40	37	16.4	9	5	✓	LN*U06...	1
TXN06R160M50.8-10	1.5	160	10	147.6	100	63	50.8	46	19	11	4.6	✓	LN*U06...	1
TXN06R200M47.6-12	1.5	200	12	187.6	130	63	47.625	38	25.4	14	7.7	-	LN*U06...	2
TXN06R200M60.0E12	1.5	200	12	187.6	130	63	60	38	25.7	14	7.2	-	LN*U06...	3

SPARE PARTS

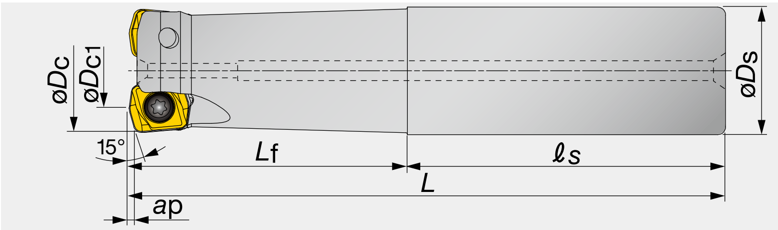
Designation	Clamping screw	Grip	Lubricant	Shell locking bolt	Shell locking bolt 1	Torx bit
TXN06R050M22.0...	CSPB-5	H-TB2W	M-1000	-	FSHM10-40H	BLDIP20/S7
TXN06R050M22.2...	CSPB-5	H-TB2W	M-1000	-	CM10X30H	BLDIP20/S7
TXN06R052M22.0...	CSPB-5	H-TB2W	M-1000	-	FSHM10-40H	BLDIP20/S7
TXN06R063M...	CSPB-5	H-TB2W	M-1000	-	CM10X30H	BLDIP20/S7
TXN06R066,080M27.0...	CSPB-5	H-TB2W	M-1000	-	CM12X30H	BLDIP20/S7
TXN06R080,100M31.7...	CSPB-5	H-TB2W	M-1000	-	CM16X40H	BLDIP20/S7
TXN06R125M...	CSPB-5	H-TB2W	M-1000	TMBA-M20H	-	BLDIP20/S7
TXN06R160M40.0...	CSPB-5	H-TB2W	M-1000	TMBA-M20H	-	BLDIP20/M7
TXN06R160M50.8...	CSPB-5	H-TB2W	M-1000	TMBA-M24H	-	BLDIP20/M7
TXN06R200M60.0...	CSPB-5	H-TB2W	M-1000	-	-	BLDIP20/M7

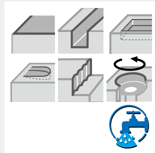
DOFEED

EXN06

Super high-feed milling endmills with double sided inserts with 4 edges

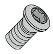
A.R. = +10°, R.R. = -2° ~ +6°





Designation	Max. ap	øDc	z	øDc1	øDs	L	Lf	ℓs	Kg	Air hole	Insert
EXN06R032M32.0-02	1.5	32	2	19.7	32	150	70	80	0.8	✓	LN*U06...
EXN06R032M32.0-02L	1.5	32	2	19.7	32	200	120	80	1.1	✓	LN*U06...
EXN06R035M32.0-02	1.5	35	2	22.7	32	150	45	105	0.9	✓	LN*U06...
EXN06R035M32.0-02L	1.5	35	2	22.7	32	200	45	155	1.2	✓	LN*U06...
EXN06R040M32.0-03	1.5	40	3	27.5	32	150	45	105	0.9	✓	LN*U06...
EXN06R040M32.0-03L	1.5	40	3	27.5	32	220	45	175	1.3	✓	LN*U06...

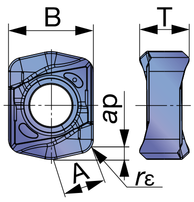
SPARE PARTS



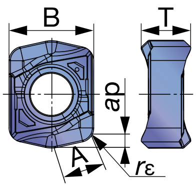
Designation	Clamping screw	Lubricant	Wrench
EXN06	CSPB-5	M-1000	IP-20D

INSERTS

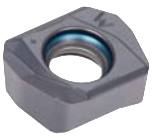
LNMU06-MJ

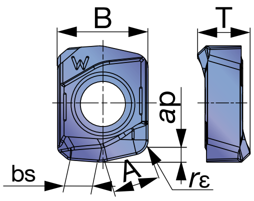


LNMU06-ML



LNGU06-W (2 cutting edges - Wiper)





	Material	AH120	AH130	AH725	AH3035
P	Steel	☆		★	★
M	Stainless		★	☆	☆
K	Cast iron	★		☆	
N	Non-ferrous				
S	Superalloys	★	☆	★	
H	Hard materials			★	★

★ : First choice
☆ : Second choice

Designation	rε	Max. ap	Coated AH120	Coated AH130	Coated AH725	Coated AH3035	A	B	T	bs
LNMU06X5ZER-MJ	2	1.5	●	●	●	●	6	12	7	-
LNMU06X5ZER-ML	2	1.5	●	●	●	●	6	12	7	-
LNGU06X5ZER-W	2	1.5			●		6	12	7	3.6

●: Standard item

STANDARD CUTTING CONDITIONS TXN06 / EXN06

ISO	Work material	Hardness	Priority	Grades	Chip-breaker	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/z) Tool dia: øDc (mm) ø32 ~ ø80	Feed when plunging fz (mm/z)
P	Carbon steels S45C, S55C, etc. C45, C55, etc.	~ 300HB	First choice	AH725	MJ	100 - 300	0.5 - 1.5	0.15
			For wear resistance	AH120	MJ	100 - 300	0.5 - 1.5	0.15
			For impact resistance	AH3035	MJ	100 - 300	0.5 - 1.5	0.15
	Alloy steels SCM440, SCr415, etc. 42CrMo4, 17Cr3, etc.	~ 300HB	First choice	AH725	MJ	100 - 200	0.5 - 1.5	0.15
			For wear resistance	AH120	MJ	100 - 200	0.5 - 1.5	0.15
			For impact resistance	AH3035	MJ	100 - 200	0.5 - 1.5	0.15
	Prehardened steels NAK80, PX5, etc.	30 ~ 40HRC	-	AH3035	ML	100 - 200	0.5 - 1	0.15
M	Stainless steels SUS304, SUS316, etc. X5CrNi18-10, X5CrNiMo17-12-2, etc.	~ 200HB	First choice	AH130	ML	100 - 150	0.3 - 0.7	0.1
		~ 200HB	For impact resistance	AH130	MJ	100 - 150	0.3 - 0.8	0.1
K	Grey cast irons FC250, FC300 / GG25, GGG30, etc.	150 ~ 250HB	First choice	AH120	MJ	100 - 300	0.5 - 1.5	0.15
		150 ~ 250HB	For low cutting force	AH120	ML	100 - 300	0.5 - 1	0.15
	Ductile cast irons FCD400 / GGG40, etc.	150 ~ 250HB	First choice	AH120	MJ	80 - 200	0.5 - 1.5	0.15
		150 ~ 250HB	For low cutting force	AH120	ML	80 - 200	0.5 - 1	0.15
S	Titanium alloy Ti-6Al-4V, etc.	~ 40HRC	-	AH725	ML	30 - 60	0.3 - 0.7	0.08
H	Hardened steels SKD61 X40CrMoV5-1, etc.	40 ~ 50HRC	-	AH3035	MJ	80 - 130	0.1 - 0.3	0.05
	Hardened steels SKD11 X153CrMoV12, etc.	50 ~ 60HRC	-	AH725	MJ	50 - 70	0.03 - 0.07	0.03

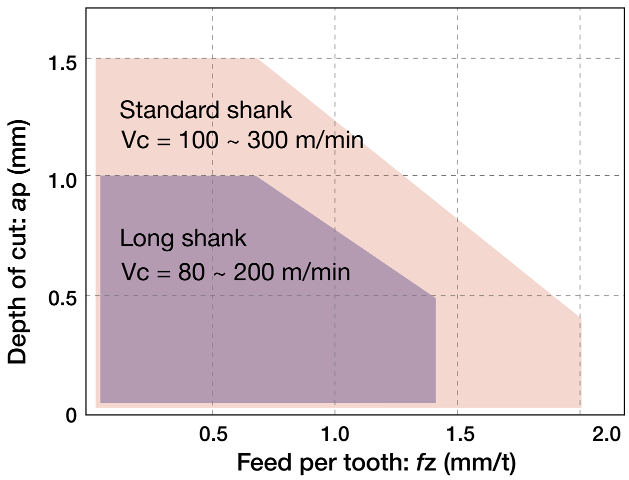
Always use an airgun to clear cavities and slots completely of chips and debris.

Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.

CAUTIONARY POINTS IN USE

The usage of standard and long shanks

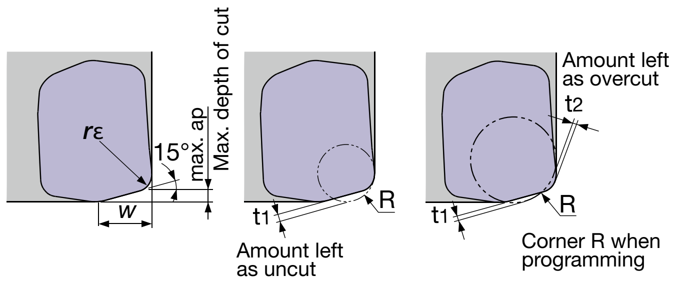
When using a long shank, always lower the cutting conditions (Vc, fz, ap) to 70% of the maximum conditions for the standard shank.



Tool dia.: øDc = ø32 ~ 40 mm
Work material: S55C / C55 (200HB)
L/D ratio of overhang
Standard shank: L/D ≤ 3
Long shank: L/D = 4

CAM programming

When programming for CAM, the tool should be considered as a round insert cutter. Usually, the corner radius should be set as R = 3 mm. If a larger radius is used, overcutting will occur. The following table shows the amount left as uncut (t_1) and overcut (t_2).



Max. depth of cut max. ap(mm)	Corner radius rε	W (mm)	Corner R when program-ming	Amount left as uncut t1	Amount left as overcut t2
1.5	2	6	2	1	-
			3	0.77	-
			4	0.54	0.26

Each value in the table is calculated theoretically at the maximum condition.

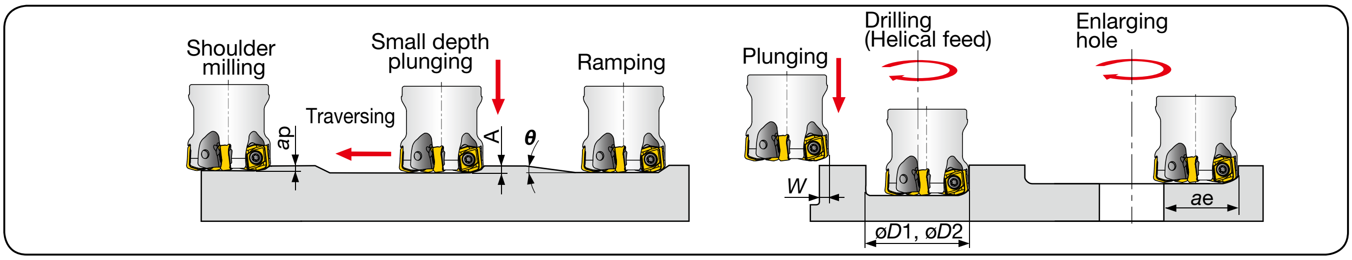
Tool dia.: øDc (mm), Number of revolutions: n (min^{-1}), Feed speed: Vf (mm/min), Max. depth of cut: ap = 1.5 mm

ø32, z = 2		ø35, z = 2		ø40, z = 3		ø50			ø63			ø80		
							Vf			Vf			Vf	
n	Vf	n	Vf	n	Vf	n	Standard (z = 4)	Close (z = 5)	n	Standard (z = 4)	Close (z = 6)	n	Standard (z = 5)	Close (z = 8)
1,990	3,980	1,820	3,640	1,590	4,770	1,270	5,080	6,350	1,010	4,040	6,060	800	4,000	6,400
Vc = 200 m/min, fz = 1 mm/z														
1,490	2,980	1,360	2,720	1,190	3,570	950	3,800	4,750	760	3,040	4,560	600	3,000	4,800
Vc = 150 m/min, fz = 1.0 mm/z														
1,490	2,380	1,360	2,180	1,190	2,860	950	3,040	3,800	760	2,430	3,650	600	2,400	3,840
Vc = 150 m/min, fz = 0.8 mm/z														
1,190	1,190	1,090	1,090	950	1,430	760	1,520	1,900	610	1,220	1,830	480	1,200	1,920
Vc = 120 m/min, fz = 0.5 mm/z														
1,190	1,430	1,090	1,310	950	1,710	760	1,820	2,280	610	1,470	2,200	480	1,440	2,300
Vc = 120 m/min, fz = 0.6 mm/z														
1,990	2,390	1,820	2,180	1,590	2,860	1,270	3,050	3,810	1,010	2,430	3,640	800	2,400	3,840
Vc = 200 m/min, fz = 0.6 mm/z														
1,990	3,180	1,820	2,910	1,590	3,820	1,270	4,060	5,080	1,010	3,230	4,850	800	3,200	5,120
Vc = 200 m/min, fz = 0.8 mm/z														
1,490	2,980	1,360	2,720	1,190	3,570	950	3,800	4,750	760	3,040	4,560	600	3,000	4,800
Vc = 150 m/min, fz = 1 mm/z														
1,490	2,380	1,360	2,180	1,190	2,860	950	3,040	3,800	760	2,430	3,650	600	2,400	3,840
Vc = 150 m/min, fz = 0.8 mm/z														
400	400	360	360	320	480	250	500	630	200	400	600	160	400	640
Vc = 40 m/min, fz = 0.5 mm/z														
990	400	910	360	800	480	640	510	640	510	410	610	400	400	640
Vc = 100 m/min, fz = 0.2 mm/z														
600	60	550	60	480	70	380	80	100	300	60	90	240	60	100
Vc = 60 m/min, fz = 0.05 mm/z														

The above table shows the conditions for standard shank type cutters. When using long shank type cutters, the number of teeth may be different. In this case, the cutting conditions should be changed by referring to: "The usage of standard and long shanks" shown on the previous page.

Cutting conditions are generally limited by the spindle rigidity, machine power and the workpiece fixture stability. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

APPLICATION RANGE



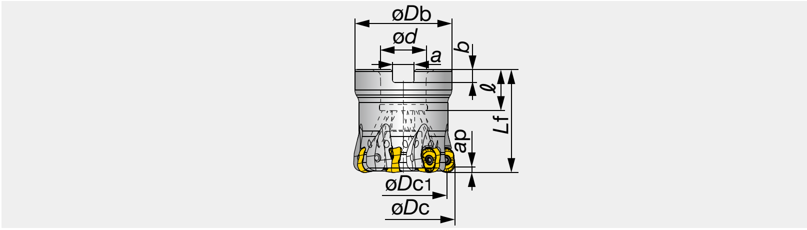
Designation	Tool dia. øDc	Max. depth of cut Max. ap	Max. ramping angle θ°	Max. plunging depth A	Max. cutting width in plunging W	Min.machinable hole dia. øD1	Max.machinable hole dia. øD2	Max. cutting width in enlarging hole ae
EXN06R032M32.0-□□□	ø32	1.5	2	0.5	6	47	59	25
EXN06R035M32.0-□□□	ø35	1.5	1.7	0.5	6	53	65	28
EXN06R040M32.0-□□□	ø40	1.5	1.3	0.5	6	63	75	33
TXN06R050M...	ø50	1.5	0.9	0.5	6	83	95	43
TXN06R052M...	ø52	1.5	0.8	0.5	6	85	97	45
TXN06R063M...	ø63	1.5	0.6	0.5	6	109	121	56
TXN06R066M...	ø66	1.5	0.5	0.5	6	112	124	59
TXN06R080M...	ø80	1.5	0.5	0.5	6	143	155	73
TXN06R100M...	ø100	1.5	0.34	0.5	6	183	195	93
TXN06R125M...	ø125	1.5	0.26	0.5	6	233	245	118
TXN06R160M...	ø160	1.5	0.2	0.5	6	303	315	153
TXN06R200M...	ø200	1.5	0.15	0.5	6	383	395	193

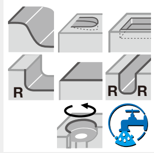
· For *øDc* above 100 mm, slot milling, ramping or contouring is not recommended as chips may be re-cut.

TXLN

Radius cutter with double sided inserts with 4 edges

A.R. = +3°, R.R. = -13°





Designation	Max. ap	øDc	z	øDc1	øDb	Lf	ød	ℓ	a	b	Kg	Air hole	Insert
TXLN04M040B16.0R06	4	40	6	32	35	40	16	18	8.4	5.6	0.35	✓	LNMX04...
TXLN04M050B22.0R07	4	50	7	42	47	50	22	20	10.4	6.3	0.45	✓	LNMX04...

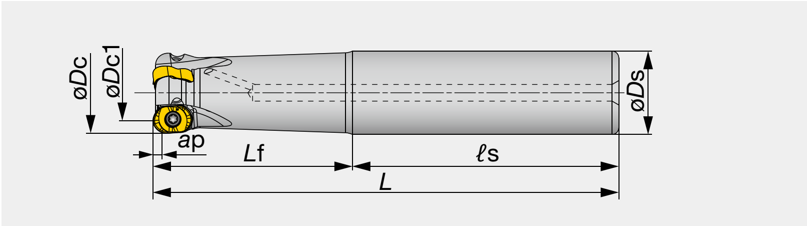
SPARE PARTS

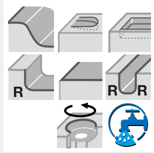
Designation	Clamping screw	Grip	Lubricant	Shell locking bolt	Torx bit
TXLN04M040B16.0R06	CSPD-3	SW6-SD	M-1000	FSHM8-30H	BLD IP10/S7
TXLN04M050B22.0R07	CSPD-3	SW6-SD	M-1000	CM10X30H	BLD IP10/S7

EXLN

Radius cutter with double sided inserts with 4 edges

A.R. = +3°, R.R. = -12° ~ -14°





Designation	Max. ap	øDc	z	øDc1	øDs	ℓs	Lf	L	Kg	Air hole	Insert
EXLN04M020C20.0R02	4	20	2	12	20	80	50	130	0.28	✓	LNMX04...
EXLN04M025C25.0R03	4	25	3	17	25	80	60	140	0.46	✓	LNMX04...
EXLN04M032C32.0R04	4	32	4	24	32	80	70	150	0.83	✓	LNMX04...
EXLN04M032C32.0R05	4	32	5	24	32	80	70	150	0.83	✓	LNMX04...

SPARE PARTS

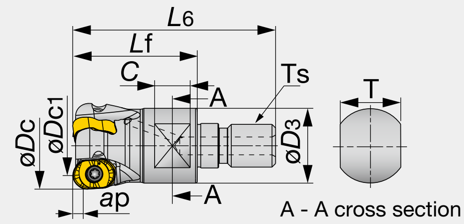
Designation	Clamping screw	Mono block type wrench
EXLN04...	CSPD-3	IP-10D

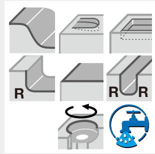
DOTWISTBALL

HXLN04-M

Radius cutter with double sided inserts with 4 edges, Modular head with metric threaded connection

A.R. = +3°, R.R. = -12° ~ -14°





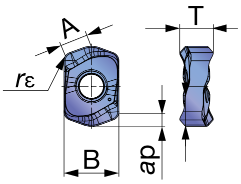
Designation	Max. ap	øDc	z	øDc1	L6	Lf	C	T	øD3	Ts	Kg	Air hole	Insert
HXLN04M020M10R02	4	20	2	12	49	30	10	15	18	M10	0.07	✓	LNMX04...
HXLN04M025M12R03	4	25	3	17	57	35	10	17	21	M12	0.16	✓	LNMX04...
HXLN04M032M16R04	4	32	4	24	63	40	12	22	29	M16	0.2	✓	LNMX04...

SPARE PARTS

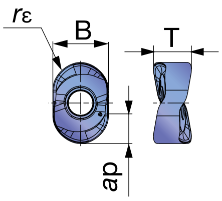
Designation	Clamping screw	Lubricant	Wrench
HXLN04...	CSPD-3	M-1000	IP-10D

INSERTS

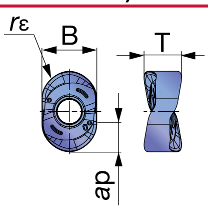
LNMX-HJ



LNMX-MJ (Radius insert)



LNMX-ML (Radius insert)



			AH120	AH3135			
P	Steel		☆	★			
M	Stainless			★			
K	Cast iron		★				
N	Non-ferrous						
S	Superalloys		★	☆			
H	Hard materials		★	★			
Designation	**rε**	**Max. ap**	Coated AH120	Coated AH3135	**A**	**B**	**T**
LNMX0405ZER-HJ	1.3	1.3	●	●	4.3	8.2	5.6
LNMX0405R4-MJ	4	4	●	●	-	8.2	5.6
LNMX0405R4-ML	4	4	●	●	-	8.2	5.6

★ : First choice
☆ : Second choice

●: Standard item

STANDARD CUTTING CONDITIONS

For HJ type

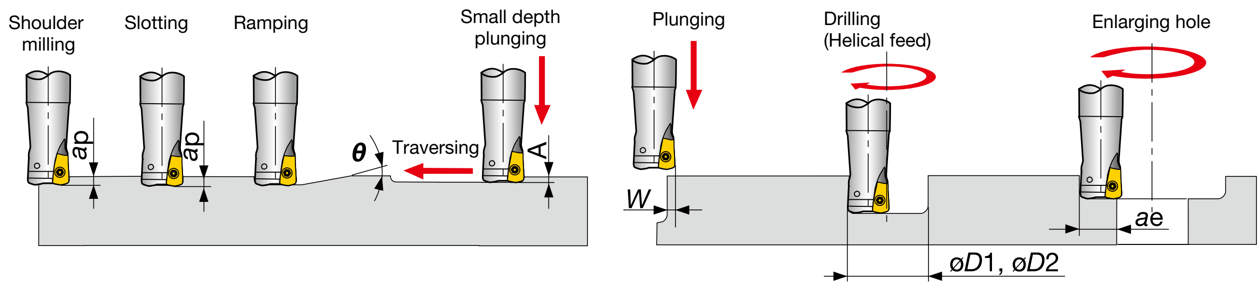
ISO	Workpiece materials		Hardness	Priority	Grades	Chipbreaker	Cutting speed Vc (m/min)	Feed per tooth fz (mm/z)
P	Low carbon steels C15, C20, etc.		- 300 HB	First choice	AH3135	HJ	150 - 250	0.5 - 1.3
				Second choice	AH120	HJ	150 - 250	0.5 - 1.3
	Carbon steels, Alloy steels C55, 42CrMoS4, etc.		- 300 HB	First choice	AH3135	HJ	150 - 250	0.5 - 1.3
				Second choice	AH120	HJ	150 - 250	0.5 - 1.3
	Prehardened steels NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3135	HJ	100 - 200	0.3 - 0.7
				Second choice	AH120	HJ	100 - 200	0.3 - 0.7
M	Stainless steels X5CrNi18-9, X5CrNiMo17-12-2, etc		- 200 HB	First choice	AH3135	HJ	100 - 200	0.3 - 0.7
			- 200 HB	First choice	AH3135	HJ	100 - 300	0.3 - 0.7
K	Grey cast irons 250, 300, etc.		150 - 250 HB	First choice	AH120	HJ	150 - 250	0.5 - 1.3
	Ductile cast irons 400-15, 600-3, etc.		150 - 250 HB	First choice	AH120	HJ	150 - 250	0.5 - 1.3
H	Hardened steel	SKD61, etc	40 - 50 HRC	First choice	AH3135	HJ	50 - 150	0.1 - 0.5
				Second choice	AH120	HJ	50 - 150	0.1 - 0.5
		SKD11, etc	50 - 60 HRC	First choice	AH120	HJ	50 - 70	0.05 - 0.2

Note: Recommended cutting conditions are just for reference in general machining.

For MJ, ML type

ISO	Workpiece materials		Hardness	Priority	Grades	Chip-breaker	Cutting speed Vc (m/min)	Feed per tooth fz (mm/z)
P	Low carbon steels C15, C20, etc.		- 300 HB	First choice	AH3135	MJ	150 - 250	0.2 - 0.6
			- 300 HB	Second choice	AH3135	ML	150 - 250	0.2 - 0.6
	Carbon steels, Alloy steels C55, 42CrMoS4, etc.		- 300 HB	First choice	AH3135	MJ	150 - 250	0.2 - 0.6
			- 300 HB	Second choice	AH3135	ML	150 - 250	0.2 - 0.6
	Prehardened steels NAK80, PX5, etc.		30 - 40 HRC	First choice	AH3135	MJ	100 - 200	0.15 - 0.4
			30 - 40 HRC	Second choice	AH3135	ML	100 - 200	0.15 - 0.4
M	Stainless steels X5CrNi18-9, X5CrNiMo17-12-2, etc		- 200 HB	First choice	AH3135	MJ	100 - 200	0.2 - 0.6
			- 200 HB	Second choice	AH3135	ML	100 - 200	0.2 - 0.6
	Stainless steels X12Cr113, X20Cr13, etc		- 200 HB	First choice	AH3135	MJ	100 - 300	0.2 - 0.6
			- 200 HB	Second choice	AH3135	ML	100 - 300	0.2 - 0.6
K	Grey cast irons 250, 300, etc.		150 - 250 HB	First choice	AH120	MJ	150 - 250	0.2 - 0.6
			150 - 250 HB	Second choice	AH120	ML	150 - 250	0.2 - 0.6
	Ductile cast irons 400-15, 600-3, etc.		150 - 250 HB	First choice	AH120	MJ	150 - 250	0.2 - 0.6
			150 - 250 HB	Second choice	AH120	ML	150 - 250	0.2 - 0.6
H	Hardened steel	SKD61, etc	40 - 50 HRC	First choice	AH3135	MJ	50 - 150	0.1 - 0.3
			40 - 50 HRC	Second choice	AH3135	ML	50 - 150	0.1 - 0.3
		SKD11, etc	50 - 60 HRC	First choice	AH120	MJ	50 - 70	0.05 - 0.15
			50 - 60 HRC	Second choice	AH120	ML	50 - 70	0.05 - 0.15

APPLICATION RANGE



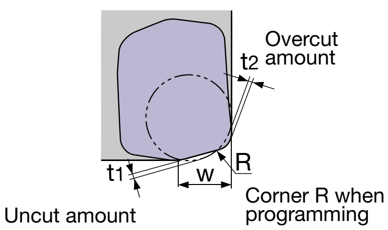
For HJ type

Designation	øDc	øDc1	Max. depth of cut ap	Max. ramping angle θ°	Max. plunging depth A	Max. cutting width in plunging W	Min. machining øD1	Max. machining øD2	Max. cutting width in enlarging ae
EXLN04M020C20.0R02	20	12	1.3	4.9	0.75	4.1	27	38	15.5
EXLN04M025C25.0R03	25	17	1.3	3	0.75	4.1	37	48	20.5
EXLN04M032C32.0R04	32	24	1.3	2	0.75	4.1	51	62	27.5
EXLN04M032C32.0R05	32	24	1.3	2	0.75	4.1	51	62	27.5
TXLN04M040B16.0R06	40	32	1.3	1.4	0.75	4.1	67	78	35.5
TXLN04M050B22.0R07	50	42	1.3	1	0.75	4.1	87	98	45.5
HXLN04M020M10R02	20	12	1.3	4.9	0.75	4.1	27	38	15.5
HXLN04M025M12R03	25	17	1.3	3	0.75	4.1	37	48	20.5
HXLN04M032M16R04	32	24	1.3	2	0.75	4.1	51	62	27.5

For MJ, ML type

Designation	øDc	øDc1	Max. depth of cut ap	Max. ramping angle θ°	Max. plunging depth A	Max. cutting width in plunging W	Min. machining øD1	Max. machining øD2	Max. cutting width in enlarging ae
EXLN04M020C20.0R02	20	12	4	4.7	0.8	4	28	38	15
EXLN04M025C25.0R03	25	17	4	3	0.8	4	38	48	20
EXLN04M032C32.0R04	32	24	4	2	0.8	4	50	62	27
EXLN04M032C32.0R05	32	24	4	1.7	0.7	4	50	62	27
TXLN04M040B16.0R06	40	32	4	1.3	0.7	4	68	78	36
TXLN04M050B22.0R07	50	42	4	1	0.7	4	88	98	46
HXLN04M020M10R02	20	12	4	4.7	0.8	4	28	38	15
HXLN04M025M12R03	25	17	4	3	0.8	4	38	48	20
HXLN04M032M16R04	32	24	4	2	0.8	4	50	62	27

TOOL GEOMETRY ON PROGRAM



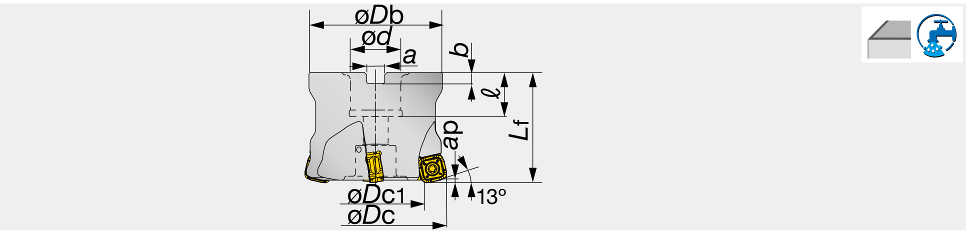
Max. depth of cut max. ap (mm)	W (mm)	Programmed corner R (mm)	Amount left uncut t1 (mm)	Amount left overcut t2 (mm)
1.3	4.1	R1.5	0.8	0
1.3	4.1	R2.0	0.65	0
1.3	4.1	R2.5	0.5	0.05
1.3	4.1	R3.0	0.36	0.2

DOFEEDQUAD

TXQ

High-feed cutter for face milling

A.R. = +7°, R.R. = -8° ~ -4.5°



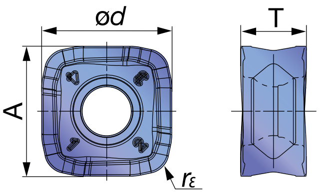
Designation	Max. ap	øDc	z	øDc1	øDb	Lf	ød	ℓ	a	b	Kg	Air hole	Insert
TXQ12R050M22.0E03	2	50	3	33.8	47	50	22	20	10.4	6.3	0.4	✓	SQMU1206ZSR-MJ
TXQ12R050M22.2-03	2	50	3	33.8	47	50	22.225	20	8	5	0.4	✓	SQMU1206ZSR-MJ
TXQ12R052M22.0E03	2	52	3	35.8	49	50	22	20	10.4	6.3	0.5	✓	SQMU1206ZSR-MJ
TXQ12R063M22.0E04	2	63	4	46.8	59	50	22	20	10.4	6.3	0.8	✓	SQMU1206ZSR-MJ
TXQ12R063M22.2-04	2	63	4	46.8	59	50	22.225	20	8	5	0.8	✓	SQMU1206ZSR-MJ
TXQ12R066M27.0E04	2	66	4	49.8	63	50	27	22	12.4	7	0.9	✓	SQMU1206ZSR-MJ
TXQ12R080M27.0E05	2	80	5	63.8	76	63	27	22	12.4	7	1.6	✓	SQMU1206ZSR-MJ
TXQ12R080M31.7-05	2	80	5	63.8	76	63	31.75	32	12.7	8	1.5	✓	SQMU1206ZSR-MJ
TXQ12R100M31.7-06	2	100	6	83.8	96	63	31.75	32	12.7	8	2.6	✓	SQMU1206ZSR-MJ
TXQ12R100M32.0E06	2	100	6	83.8	96	63	32	25	14.4	8	3	✓	SQMU1206ZSR-MJ
TXQ12R125M38.1-07	2	125	7	108.8	98	63	38.1	44	15.9	10	3.3	✓	SQMU1206ZSR-MJ
TXQ12R125M40.0E07	2	125	7	108.8	98	63	40	32	16.4	9	3.2	✓	SQMU1206ZSR-MJ

SPARE PARTS

Designation	Clamping screw	Grip	Lubricant	Shell locking bolt	Shell locking bolt 1	Torx bit
TXQ12R050, 052M22.0...	CSPB-4	H-TBS	M-1000	-	FSHM10-40H	BLDIP15/S7
TXQ12R063M...	CSPB-4	H-TBS	M-1000	-	CM10X30H	BLDIP15/S7
TXQ12R066, 080M27.0...	CSPB-4	H-TBS	M-1000	-	CM12X30H	BLDIP15/S7
TXQ12R080, 100M31.7...	CSPB-4	H-TBS	M-1000	-	CM16X40H	BLDIP15/S7
TXQ12R100M32.0E06	CSPB-4	H-TBS	M-1000	-	CM16X40H	BLDIP15/S7
TXQ12R125M...	CSPB-4	H-TBS	M-1000	TMBA-M20H	-	BLDIP15/S7

INSERTS

SQMU-MJ



		AH120	AH130	AH725	T3130
P	Steel	☆		★	☆
M	Stainless		★	☆	
K	Cast iron	★		☆	
N	Non-ferrous				
S	Superalloys	★	☆	★	
H	Hard materials			★	

★ : First choice
☆ : Second choice

Designation	rε	Max. ap	Coated AH120	Coated AH130	Coated AH725	Coated T3130	A	T	ød
SQMU1206ZSR-MJ	2	2	●	●	●	●	11.7	6	11.7

●: Standard item

STANDARD CUTTING CONDITIONS

ISO	Work materials	Hardness	Priority	Grades	Chipbreaker Vc (m/min)	Cutting speed fz (mm/z)
P	High carbon steels (S45C / C45, etc.)	~ 300HB	First choice	AH725	100 - 300	0.5 - 2
			For wear resistance	T3130	100 - 300	0.5 - 2
			For impact resistance	AH130	100 - 300	0.5 - 2
	Alloyed steels (SCM440 / 42CrMo4, etc.)	~ 300HB	First choice	AH725	100 - 200	0.5 - 1.5
			For wear resistance	T3130	100 - 200	0.5 - 1.5
			For impact resistance	AH130	100 - 200	0.5 - 1.5
	Prehardened steels (PX5, NAK80, etc.)	30 ~ 40HRC	-	AH725	100 - 200	0.5 - 1
M	Stainless steel (SUS304 / X5CrNi18-9, etc.)	~ 200HB	-	AH130	100 - 150	0.3 - 0.8
K	Grey cast iron (FC250 / 250, etc.)	-	-	AH120	100 - 300	0.5 - 2
	Ductile cast irons (FCD600 / 600-3, etc.)	-	-	AH120	80 - 200	0.5 - 2
S	Titanium alloy (Ti-6Al-4V, etc.)	~ 40HRC	-	AH725	30 - 60	0.3 - 0.7
H	Hardened steels (SKD61 / X40CrMoV5-1, etc.)	40 ~ 50HRC	-	AH725	80 - 130	0.1 - 0.3
		50 ~ 60HRC	-	AH725	50 - 70	0.03 - 0.07

Tool dia.: øDc (mm), Number of revolutions: n (min^{-1}), Feed speed: Vf (mm/min), Max. depth of cut: ap = 2 mm

ø50		ø63		ø80		ø100		ø125		
n	Vf	n	Vf	n	Vf	n	Vf	n	Vf	
1,270	4,570	1,010	4,850	790	4,740	630	4,540	500	4,200	Vc = 200 m/min, fz = 1.2 mm/z
950	2,850	750	3,000	590	2,950	470	2,820	380	2,660	Vc = 150 m/min, fz = 1.0 mm/z
950	2,280	750	2,400	590	2,360	470	2,260	380	2,130	Vc = 150 m/min, fz = 0.8 mm/z
760	1,140	600	1,200	470	1,180	380	1,140	300	1,050	Vc = 120 m/min, fz = 0.5 mm/z
1,270	4,570	1,010	4,850	790	4,740	630	4,540	500	4,200	Vc = 200 m/min, fz = 1.2 mm/z
950	3,420	750	3,600	590	3,540	470	3,380	380	3,190	Vc = 150 m/min, fz = 1.2 mm/z
250	370	200	400	150	380	120	360	100	350	Vc = 40 m/min, fz = 0.5 mm/z
630	380	500	400	390	390	310	370	250	350	Vc = 100 m/min, fz = 0.2 mm/z
380	60	300	60	235	60	190	60	150	50	Vc = 60 m/min, fz = 0.05 mm/z

· Slot or pocket milling is not recommended since chip re-cutting can easily occur.
· Tool overhang length must be as short as possible to avoid chatter. When the tool overhang length is long, decrease the number of revolutions and feed.

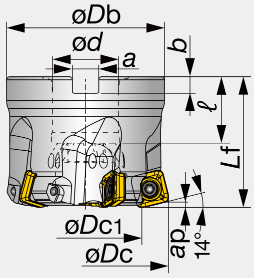
Cutting conditions are generally limited by the spindle rigidity, machine power and the workpiece fixture stability. When setting the conditions, start from half of the values of the standard cutting conditions and then increase the value gradually while making sure the machine is running normally.

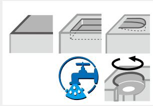
MILLQUADFEED

TXSW

Super high-feed miling cutter with large depth of cut; Bore type

A.R. = +5°, R.R. = 0°





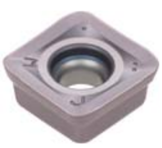
Designation	Max. ap	øDc	z	øDc1	øDb	Lf	ød	ℓ	a	b	Kg	Air hole	Insert
TXSW15M050B22.0R03	2.5	50	3	24.1	47	50	22	20	10.4	6.3	0.4	✓	SWMT15...
TXSW15M063B22.0R04	2.5	63	4	37.1	59	50	22	20	10.4	6.3	0.66	✓	SWMT15...
TXSW15J080B31.7R05	2.5	80	5	54.1	76	63	31.75	32	12.7	8	1.31	✓	SWMT15...
TXSW15M080B27.0R05	2.5	80	5	54.1	76	63	27	22	12.4	7	1.41	✓	SWMT15...
TXSW15J100B31.7R06	2.5	100	6	74.1	96	63	31.75	32	12.7	8	2.25	✓	SWMT15...
TXSW15M100B32.0R06	2.5	100	6	74.1	96	63	32	25	14.4	8	2.26	✓	SWMT15...
TXSW15J125B38.1R07	2.5	125	7	99.1	100	63	38.1	43	15.9	10	2.91	✓	SWMT15...
TXSW15M125B40.0R07	2.5	125	7	99.1	100	63	40	37	16.4	9	2.83	✓	SWMT15...
TXSW15J160B50.8R08	2.5	160	8	134.1	100	63	50.8	46	19	11	3.93	✓	SWMT15...
TXSW15M160B40.0R08	2.5	160	8	134.1	100	63	40	37	16.4	9	4.23	✓	SWMT15...

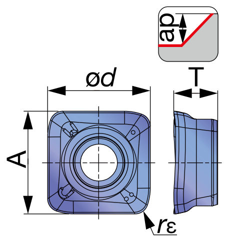
SPARE PARTS

Designation	Clamping screw	Grip	Lubricant	Shell locking bolt	Shell locking bolt 1	Torx bit
TXSW15M050B22.0R03	TS50115I	H-TB2W	M-1000	-	SR PS 118-0273	BT20S
TXSW15M063B22.0R04	TS50115I	H-TB2W	M-1000	-	FSHM10-40H	BT20S
TXSW15J080B31.7R05	TS50115I	H-TB2W	M-1000	-	CM16X40H	BT20S
TXSW15M080B27.0R05	TS50115I	H-TB2W	M-1000	-	CM12X30H	BT20S
TXSW15*100B...	TS50115I	H-TB2W	M-1000	-	CM16X40H	BT20S
TXSW15*125B...	TS50115I	H-TB2W	M-1000	TMBA-M20H	-	BT20M
TXSW15J160B50.8R08	TS50115I	H-TB2W	M-1000	TMBA-M24H	-	BT20M
TXSW15M160B40.0R08	TS50115I	H-TB2W	M-1000	TMBA-M20H	-	BT20M

INSERT

SWMT-MJ





	AH120	AH3135
P Steel	☆	★
M Stainless		★
K Cast iron	★	
N Non-ferrous		
S Superalloys	★	☆
H Hard materials	★	★

★ : First choice
☆ : Second choice

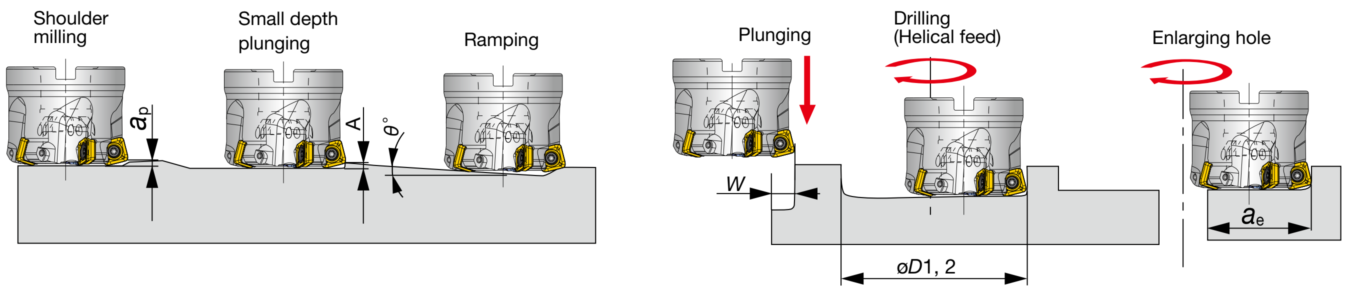
Designation	rε	Max. ap	Coated AH120	Coated AH3135	A	ød	T
SWMT1506ZER-MJ	2	2.5	●	●	15.9	15.9	6.8

●: Standard item

STANDARD CUTTING CONDITIONS

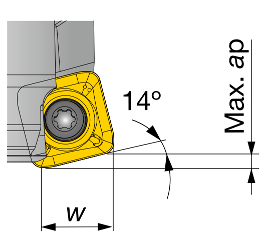
ISO	Workpiece materials		Hardness	Priority	Grades	Chip-breaker	Cutting speed Vc (m/min)	Feed per tooth fz (mm/z)
P	Low carbon steel (S15C / C15E4, SS400 / E275A, etc.)		- 300 HB	First choice	AH3135	MJ	100 - 300	0.5 - 2
			- 300 HB	Second choice	AH120	MJ	100 - 300	0.5 - 2
	Carbon steel and alloy steel (S55C / C55, SCM440 / 42CrMo4, etc.)		- 300 HB	First choice	AH3135	MJ	100 - 200	0.5 - 2
			- 300 HB	Second choice	AH120	MJ	100 - 200	0.5 - 2
	Prehardened steel (NAK80, PX5, etc.)		30 - 40 HRC	First choice	AH3135	MJ	100 - 200	0.5 - 1.5
			30 - 40 HRC	Second choice	AH120	MJ	100 - 200	0.5 - 1.5
M	Stainless steel (SUS304 / X5CrNi18-9, SUS316 / X5CrNiMo17-12-3, etc.)		- 200 HB	First choice	AH3135	MJ	100 - 150	0.3 - 1
K	Grey cast iron (FC250 / 250, FC300 / 300, etc.)		150 -250 HB	First choice	AH120	MJ	100 - 300	0.5 - 2
	Ductile cast iron (FC400, FCD600 / 600-3, etc.)		150 -250 HB	First choice	AH120	MJ	80 - 200	0.5 - 2
S	Titanium alloys (Ti-6Al-4V, etc.)		- 40 HRC	First choice	AH3135	MJ	30 - 60	0.3 - 0.7
	Superalloys (Inconel718, etc.)		- 40 HRC	First choice	AH120	MJ	20 - 50	0.1 - 0.3
H	Hardened steel	(SKD61 / X40CrMoV5-1, etc.)	40 - 50 HRC	First choice	AH3135	MJ	80 - 130	0.1 - 0.3
		(SKD11 / X153CrMoV12, etc.)	50 - 60 HRC	First choice	AH120	MJ	50 - 70	0.03 - 0.07

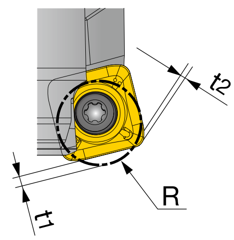
APPLICATION RANGE



Designation	øDc	Max. depth of cut ap	Max. plunging depth A	Max. ramping angle θ°	Max. cutting width in plunging W	Min. machining diameter øD1	Max. machining diameter øD2	Max. cutting width in enlarging ae
TXSW15M050B***	50	2.5	0.7	4.8	15	70	95	36
TXSW15M063B***	63	2.5	0.7	2.9	15	96	121	49
TXSW15J, M080B***	80	2.5	0.7	2	15	130	155	66
TXSW15J, M100B***	100	2.5	0.7	1.4	15	170	195	86
TXSW15J, M125B***	125	2.5	0.7	1	15	220	245	111
TXSW15J, M160B***	160	2.5	0.7	0.7	15	290	315	146

TOOL GEOMETRY ON PROGRAM





Max. ap (mm)	Actual corner radius rε (mm)	W (mm)	Programmed corner radius R (mm)	Uncut amount t1 (mm)	Overcut amount t2 (mm)
2.5	2	12.7	4	1.99	-
2.5	2	12.7	4.5	1.88	-
2.5	2	12.7	5	1.78	0.01

- When programming for CAM, the tool should be considered as a radius cutter. Usually, the corner radius should be set in R = 4.5 mm. If a larger radius is used, overcutting may occur. The above table shows the uncut (t1) and overcut (t2) amounts for the programmed corner radius.

FIELD TEST REPORTS

Success Stories

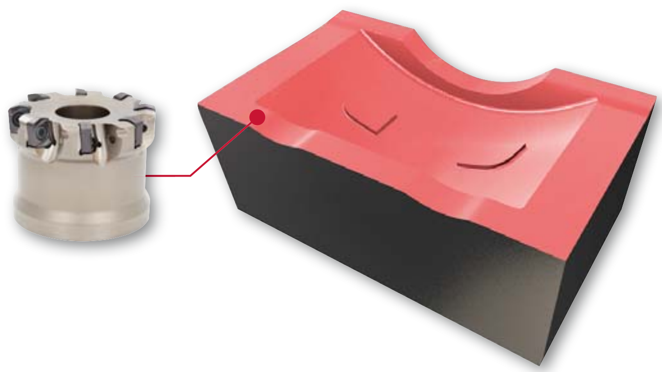
DOFEED

Industry: Die&Mold / 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



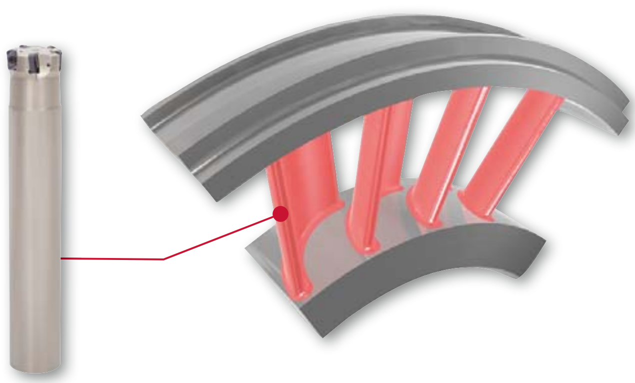
Result:
AH3035 showed better chipping resistance than its competition, improving tool life by 50%.

Industry: Power Generation / 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 = 1860 mm/min
ap = 0.5 mm
ae = 30 mm

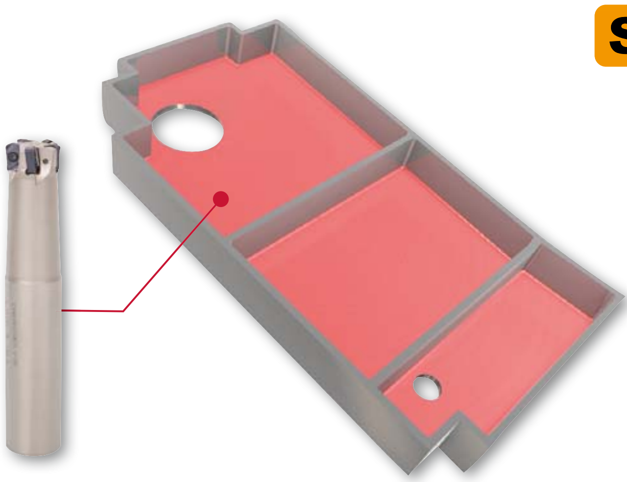
Process: Shoulder milling, Wet
Machine: Vertical M/C, BT50



Result:
Cutting speed tripled, while super high feed milling offered 160% higher productivity.

Industry: Aerospace / Component
Material: Ti-6Al-4V (36HRC)
Cutter: EXN03R025M25.0-05 (ø25, z=5)
Insert: LNMU0303ZER-ML
Grade: AH725

S



Cutting conditions:

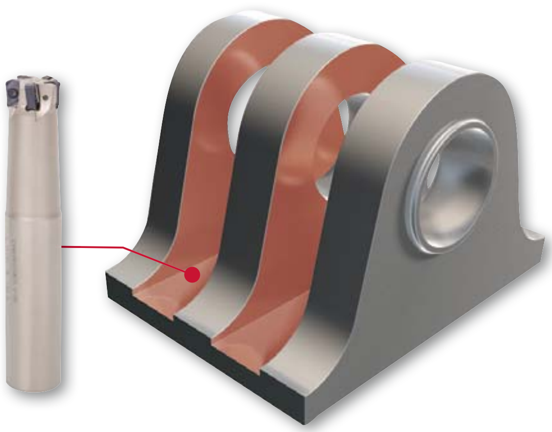
Vc **=** 50 m/min
fz **=** 0.7 mm/z
Vf **=** 2230 mm/min
ap **=** 0.5 mm
ae **=** 25 mm

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

Result:
Feed rate increased 730%, drastically improving metal removal rate by 330%.

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

S



Cutting conditions:

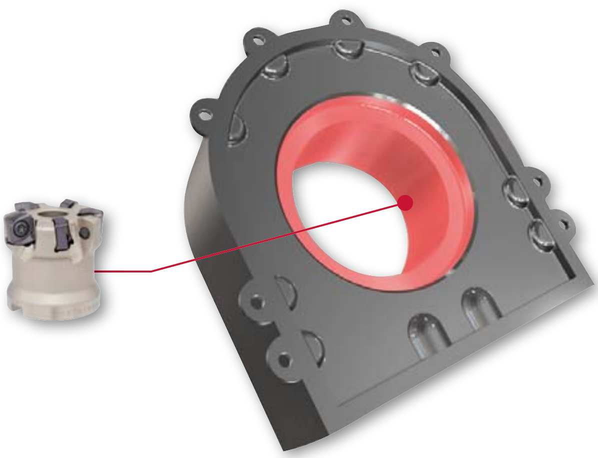
Vc **=** 40 m/min
fz **=** 0.7 mm/z
Vf **=** 1800 mm/min
ap **=** 0.8 mm
ae **=** variable

Process: Rough pocket milling, Wet
Machine: HMC Heller H5000

Result:
DoFeed prevented built up edge and coating peel-off, which significantly improved tool life.
Parts production rate was 250% more than the competitor, due to a sharp ML chipbreaker and tough AH130 grade.

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

K



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

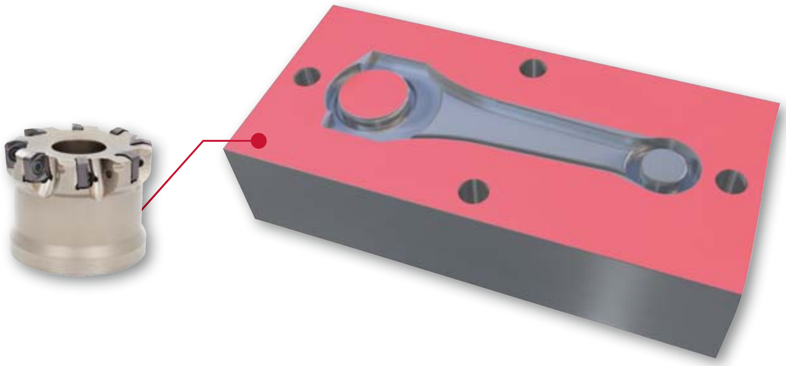
Result:
Dofeed´s positive geometry reduced cutting force while improving metal removal rate.

H

Industry: **Die&Mold** / 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

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

Result:
Dofeed wiper inserts improved metal removal rate and left a good surface roughness for mold face milling, eliminating the semi-finishing process.

M

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

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

Result:
Due to its close-pitch structure, DoFeed improved output by 40% while using at a higher cutting speed.
AH3035 improved tool life 150% due to its excellent thermal shock resistance.

M

Industry: **Power Generation** / Impeller wing
Material: SRUD, SUS630

	Roughing	**Semi-finishing**
Cutter:	TXN06R080M31.7E08 (ø80, z=8)	TXN03R040M16.0E06 (ø40, z=6)
Insert:	LNMU06X5ZER-MJ	LNMU0303ZER-MJ
Grade:	AH3035	AH3035

Cutting conditions:

	Roughing	**Semi-finishing**
	Vc **=** 46.7 m/min	***Vc*** **=** 35 m/min
	fz **=** 0.67 mm/z	***fz*** **=** 0.54 mm/z
	Vf **=** 997 mm/min	***Vf*** **=** 900 mm/min
	ap **=** 0.7 mm	***ap*** **=** 0.7 mm
	ae **=** variable	***ae*** **=** variable

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

Result:
Both types of DoFeed inserts performed smooth machining in precipitation hardened stainless steel even during long overhang tooling due to their low cutting force. Insert tool life doubled compared to the competition.

MILLQUADFEED
TUNGALOY

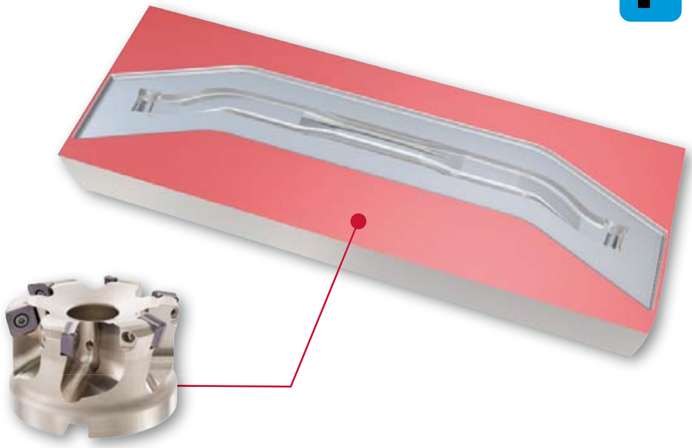
P

Industry: **Die&Mold** / Forging die
Material: SKT4/55NiCrMoV7 (35HRC)
Cutter: TXSW15J100B31.7R06 (ø100, z=6)
Insert: SWMT1506ZER-MJ
Grade: AH3135

Cutting conditions:

Vc = 100 m/min
fz = 0.4 mm/z
Vf = 763 mm/min
ap = 2.5 mm
ae = 70 mm

Process: Face milling, Air blow
Machine: V-M/C, BT50, 30kw



Result:
MillQuad-Feed´s capability for a large depth of cut reduced the number of passes required, thus improving metal removal by 110%. Its robust cutting edge eliminated instability concerns in machining the extremely hard surface of a forging die.

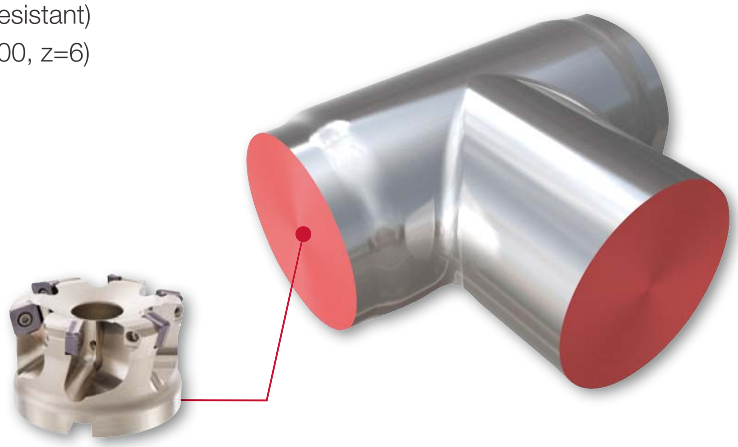
P

Industry: **Power Generation** / Joint for power plant
Material: High Chromium steel (heat resistant)
Cutter: TXSW15J100B31.7R06 (ø100, z=6)
Insert: SWMT1506ZER-MJ
Grade: AH3135

Cutting conditions:

Vc = 120 m/min
fz = 1.0 mm/z
Vf = 2280 mm/min
ap = 2.0 mm
ae = 70 mm

Process: Face milling, Dry
Machine: V-M/C, BT50, 22kw



Result:
MillQuad-Feed, with the wear resistant AH3135 grade allowed for increased cutting speed and double depth of cut without sacrificing tool life. As a result MillQuad-Feed improved material removal rate by 240%.

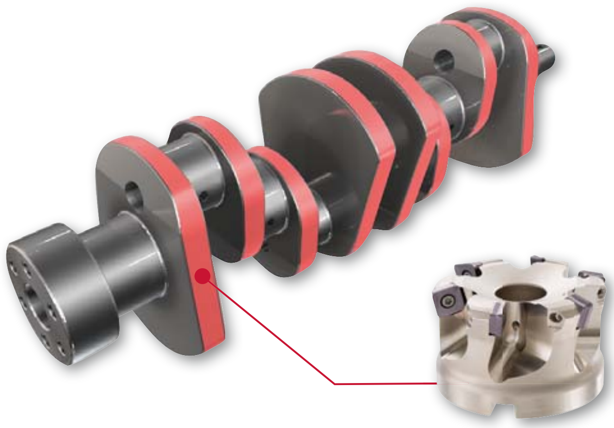
P

Industry: **Heavy Industry** / Ship´s Crankshaft
Material: FCMP45-06
Cutter: TXSW15J100B31.7R06 (ø100, z=6)
Insert: SWMT1506ZER-MJ
Grade: AH3135

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



Result:
AH3135´s excellent combination of wear and fracture resistances assured stability and eliminated chipping and fracture during extreme machining, while also removing 136% more material than its competition.

K

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

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

Result:
MillQuad-Feed's capability allowed for a 340% increase of metal removal rate over its competition.

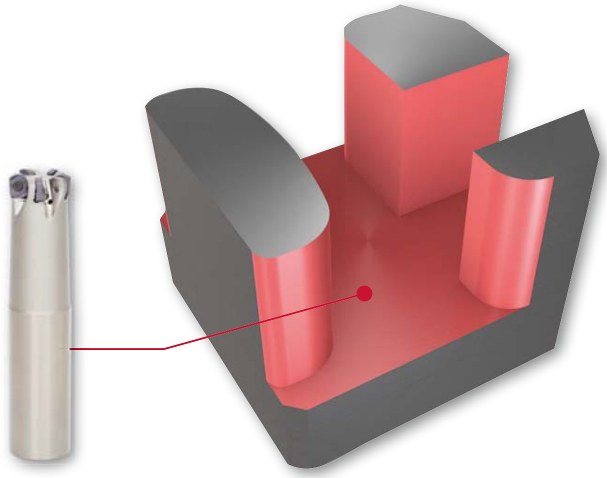
P

Industry: **Power Generation** / Planetary carrier
Material: Stainless steel X5CrNiNb 18-10
Cutter: EXLN04M32C32.0R05 (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



Result:
The total machining time was decreased by 25%, due to DoTwistBall´s excellent chip evacuation. Chip re-cutting was also eliminated, thus doubling tool life against the competition.

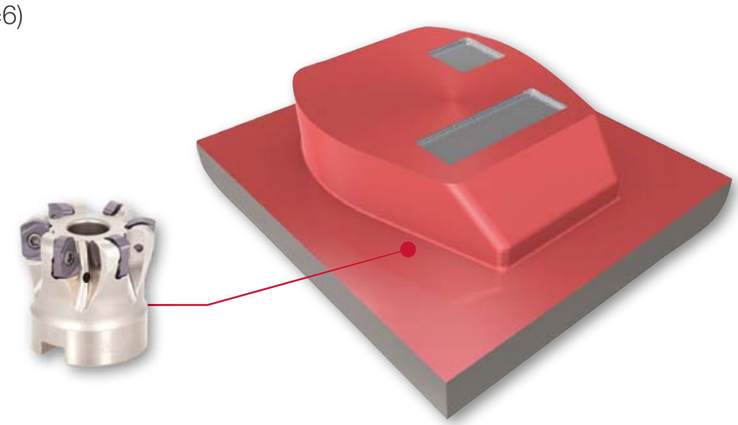
H

Industry: **Die&Mold** / Die
Material: DAC10 (48HRC)
Cutter: TXLN04M040B16.0R06 (ø40, z=6)
Insert: LNMX0405ZER-HJ
Grade: AH120

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: Mitsubishi BT50



Result:
DoTwist-Ball extended tool life by 400% beyond its competition.

DOFEEDQUAD

TUNGALOY

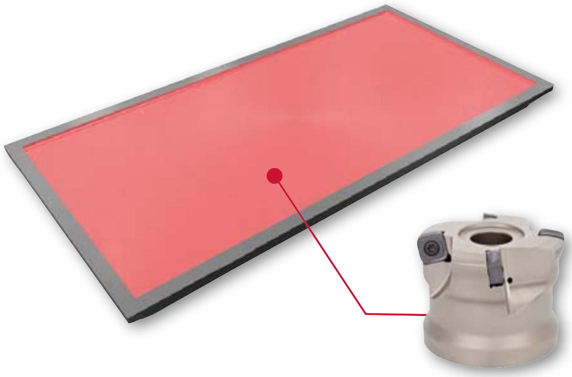
P

Industry: Die&Mold / Die for Ceramic tile
Material: Die steel (32-38 HRC)
Cutter: TXQ12R063M22.0E04 (ø63, z=4)
Insert: SQMU1206ZSR-MJ
Grade: AH130

Cutting conditions:

Vc = 250 m/min
fz = 1.58 mm/z
Vf = 8000 mm/min
ap = 0.6 mm
ae = variable

Process: Pocket milling (including ramping), Wet
Machine: Vertical M/C (BT50)



Result:
DoFeedQuad was able to machine at double the feed rate of its competition due to its tough cutting edge. The AH130 grade also provided double the tool life due to its high thermal crack resistance.

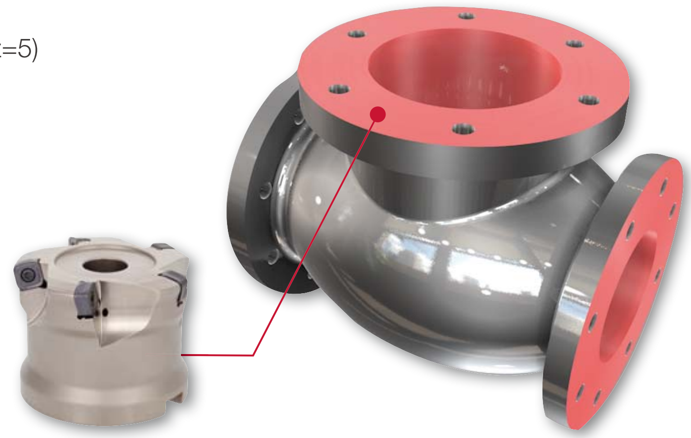
M

Industry: Heavy Industry / 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



Result:
Due to its 8 cornered insert, DoFeedQuad provided a 250% boost in productivity.

TUNGMEISTER

TUNGALOY

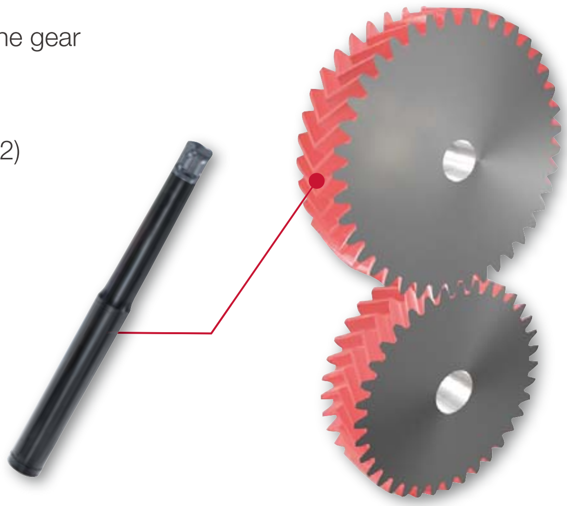
P

Industry: General Engineering / 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



Result:
TungMeister´s VFX geometry improved workflow and ease of use due to its simple head changeability while still seated in the machine spindle.

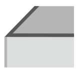
OTHER PRODUCTS

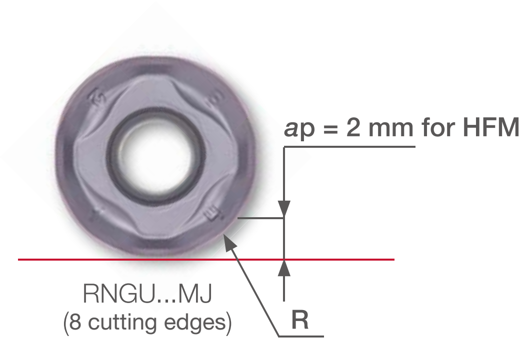
Complementary Lines

DOTripleMILL RNGU...MJ

Round insert applicable for both high-feed and high depth of cut machining

- Double-sided round insert with **dovetail clamping system** enables productive and safe high-feed machining
- **Maximum feed rate: 1.5 mm/z (ap ≦ 1 mm)**
  0.8 mm/z (ap ≦ 2 mm)
- **Tool diameters ø60.9 - ø170.9 mm**

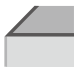


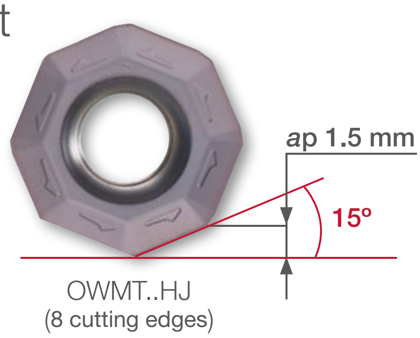


DOOCTO HJ Chipbreaker

Low cutting force with positive insert

- **Large diameter cutters** are suitable for high-feed face milling with large width of cut
- **Maximum feed rate: 2.0 mm/z**
- **Tool diameters ø67.2 - ø319.2 mm**





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