

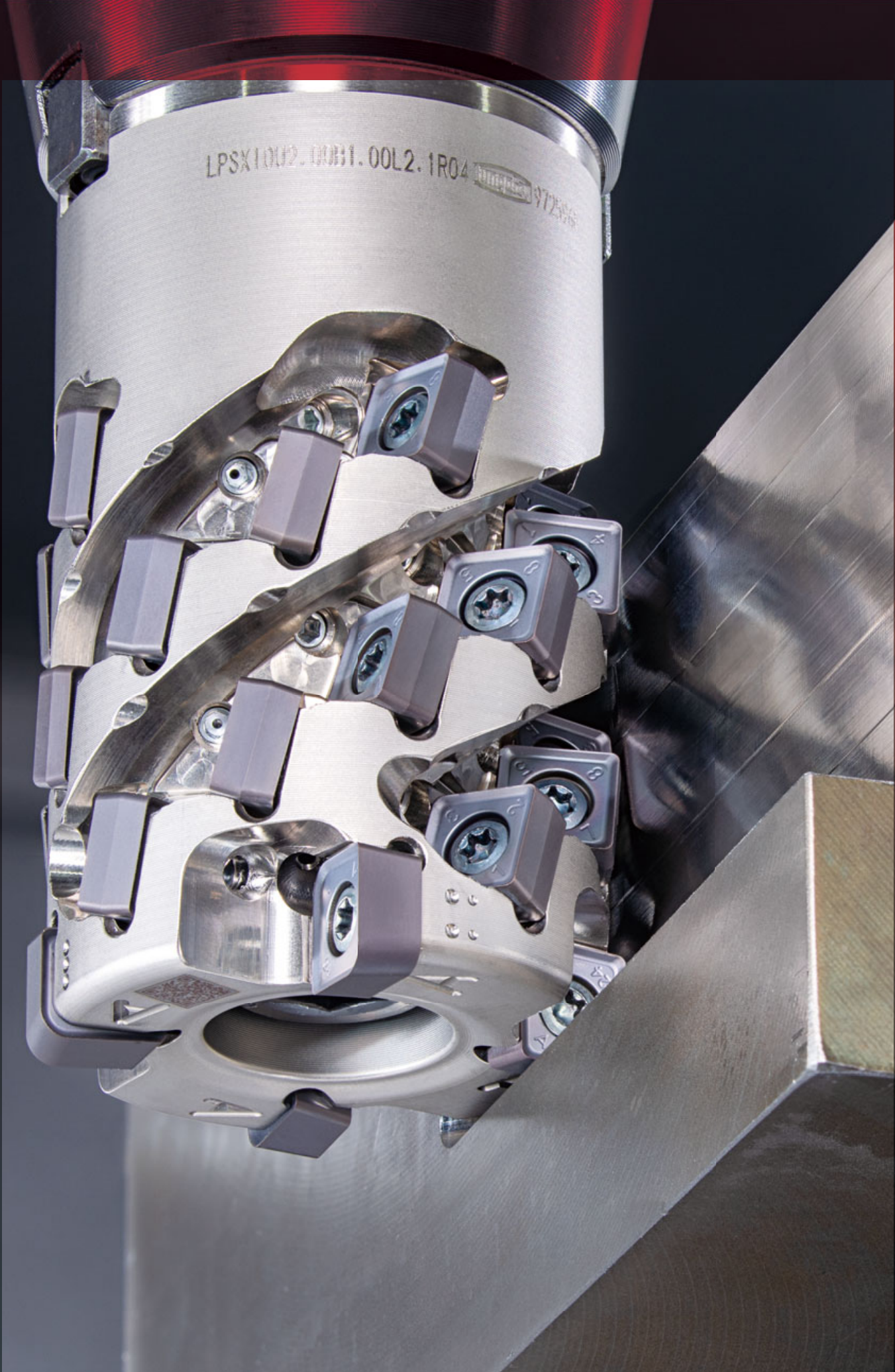
Square shoulder milling cutter for titanium alloys and cast iron

# EXTENDED <sup>ORCE</sup> FMILL

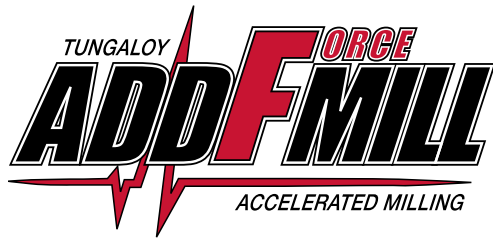
Tungaloy Report No. 560-G

**Extended-flute rough milling cutter with double-sided inserts** for maximum productivity and cost efficiency





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



## EXTENDED<sup>FORCE</sup> FMILL

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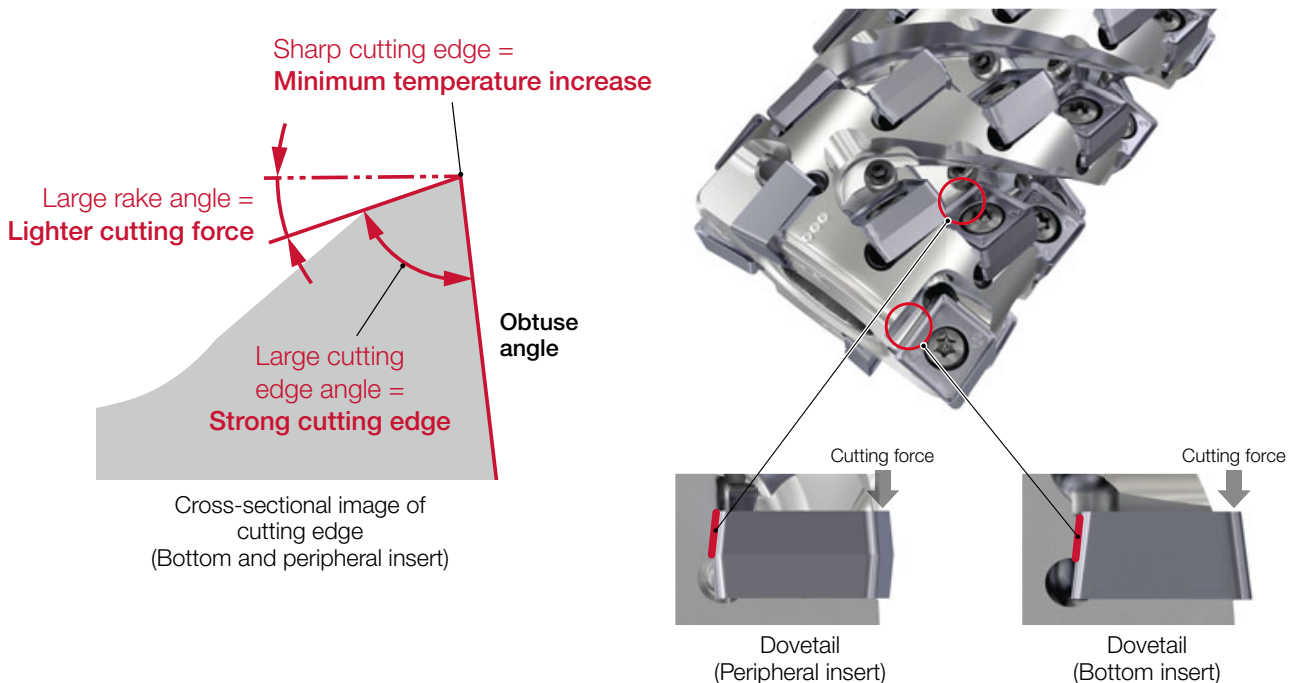
Indexable extended-flute cutters for high-efficiency rough milling operations of titanium alloy and cast iron parts

## Rough milling cutter with exceptional reliability for titanium alloys and cast iron parts

### ■ Rough milling cutter optimized for machining titanium alloy parts

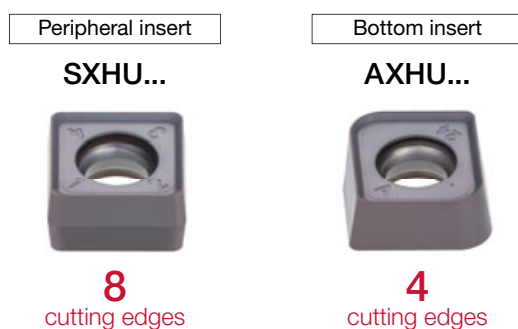
Titanium alloys generally exhibit excellent elastic deformation ability and low thermal conductivity. To meet these challenges, Tungaloy has developed the insert with unique and optimal features:

- A combination of sharp cutting edge and large rake angle generates lighter cutting action and reduced cutting forces.
- An obtuse-angled cutting edge design ensures the cutting edge's robustness and sharpness.
- The dovetail interlocking of the insert and pocket adds to tool reliability during aggressive machining.



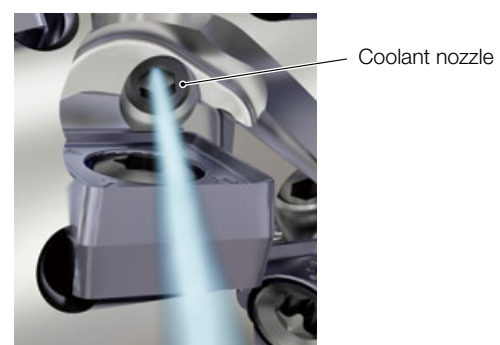
### ■ Multiple edge double-sided inserts for maximum cost efficiency

8 total cutting edges for the peripheral insert and 4 for the bottom insert for maximum cost efficiency.



### ■ Precision coolant

Coolant jet is directed precisely to the cutting point through the fixed coolant nozzle, exerting maximum cooling effect for the cutting edge and workpiece.

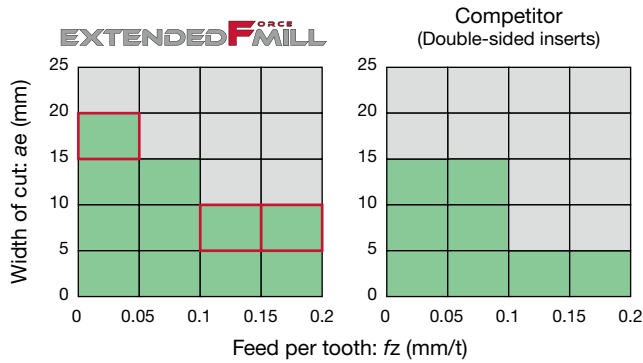


# CUTTING PERFORMANCE

## Application range comparisons

### Ti-6Al-4V (34HRC)

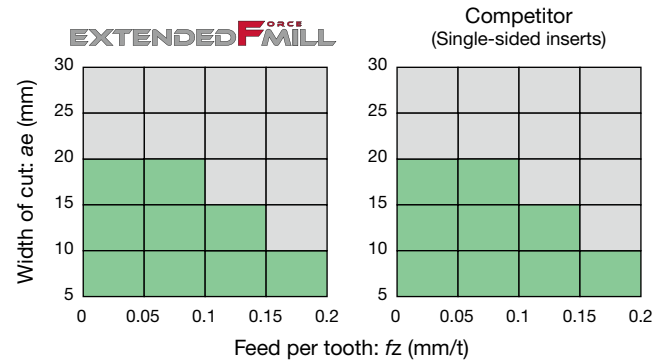
#### ExtendedForceMill vs competitor's double-sided inserts



Shoulder milling	Cutter	: LPSX10M050B22.0L076R04 (DC = 50 mm, ZEFP = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	4
	Cutting speed	: Vc = 55 m/min
	Depth of cut	: ap = 75 mm
	Coolant	: Wet
	Machine	: Vertical M/C, BT50

ExtendedForceMill generated lower cutting loads vs the competitor and allowed machining over a broader application range.

#### ExtendedForceMill vs competitor's single-sided inserts



Shoulder milling	Cutter	: LPSX10M050B22.0L054R04 (DC = 50 mm, ZEFP = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	4
	Cutting speed	: Vc = 55 m/min
	Depth of cut	: ap = 50 mm
	Coolant	: Wet
	Machine	: Vertical M/C, BT50

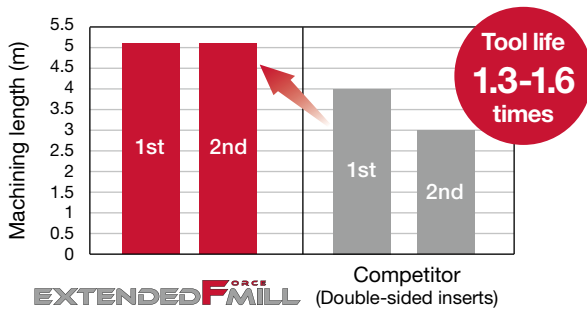
ExtendedForceMill double-sided inserts were as efficient as competitor's single-sided positive inserts with no compromise on cutting parameters.

Light cutting geometry of ExtendedForceMill negative inserts allows the use of productive cutting parameters as used with the positive inserts.

## Tool life comparisons

### Ti-6Al-4V (34HRC)

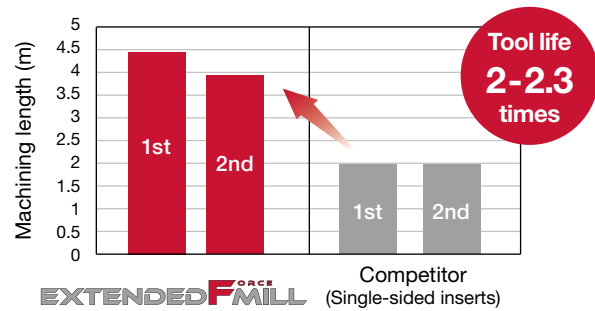
#### ExtendedForceMill vs competitor's double-sided inserts



Shoulder milling	Cutter	: LPSX10M050B22.0L076R04 (DC = 50 mm, ZEFP = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	1
	Cutting speed	: Vc = 55 m/min
	Feed per tooth	: fz = 0.15 mm/t
	Depth of cut	: ap = 24 mm
	Width of cut	: ae = 10 mm
	Coolant	: Wet
	Machine	: Vertical M/C, BT50

ExtendedForceMill provided longer tool life vs the competitor's double-sided inserts thanks to its sharp cutting edge.

#### ExtendedForceMill vs competitor's single-sided inserts



Shoulder milling	Cutter	: LPSX10M050B22.0L076R04 (DC = 50 mm, ZEFP = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	1
	Cutting speed	: Vc = 55 m/min
	Feed per tooth	: fz = 0.15 mm/t
	Depth of cut	: ap = 17 mm
	Width of cut	: ae = 15 mm
	Coolant	: Wet
	Machine	: Vertical M/C, BT50

ExtendedForceMill provided longer tool life vs the competitor's single-sided inserts.

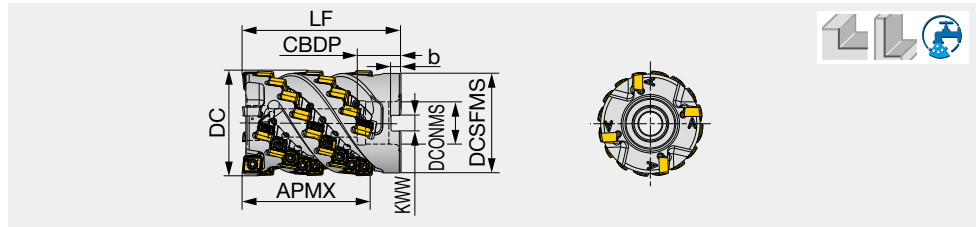
Up-sharp cutting edge helps prevent the cutting point temperatures from increasing during machining, while its thick, strong design eliminates edge chipping. ExtendedForceMill provides long, predictable tool life.

# EXTENDED FORCE FMILL

## LPSX10

Square shoulder mill for roughing, with screw clamp system

GAMP: Bottom insert +0.3°, Peripheral insert +15.5°  
GAMF: Bottom insert -18°, Peripheral insert -22°



Designation	APMX	DC	ZEFP	CICT	DCSMFS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
LPSX10M050B22.0L054R04	54	50	4	28	45	22	20	68	6.3	10.4	0.63	With	AXHU10..., SXHU10...
LPSX10M050B22.0L076R04	76.5	50	4	40	45	22	20	91	6.3	10.4	0.87	With	AXHU10..., SXHU10...

Note: Coolant needs to be supplied from the end of the arbor inlay. Coolant cannot be supplied from the set bolt.

### SPARE PARTS

Designation	Clamping screw	Grip	Torx bit	Coolant nozzle	Shell locking bolt
LPSX10M050B22.0L054R04	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	CAP-CM10X1.5X55-H
LPSX10M050B22.0L076R04	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	CM10X80

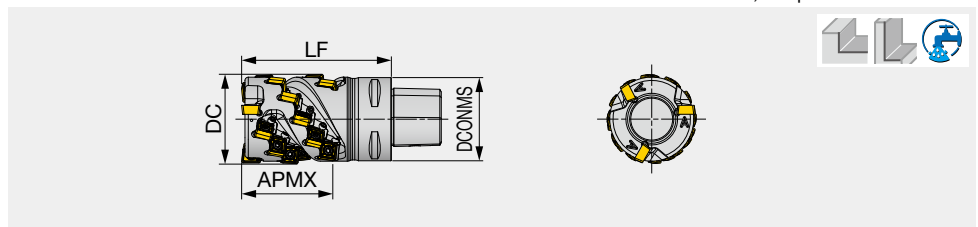
Recommended clamping torque: 3.5 N·m

## LPSX10\*\*C

Square shoulder mill for roughing, with screw clamp system, with TungCap connection

# TUNGCAP

GAMP: Bottom insert +0.3°, Peripheral insert +15.5°  
GAMF: Bottom insert -18°, Peripheral insert -22°



Designation	APMX	DC	ZEFP	CICT	DCONMS	LF	WT(kg)	Air hole	Insert
LPSX10M054C5L055R03	54	54	3	21	50	90	1.34	With	AXHU10..., SXHU10...
LPSX10M066C6L054R04	54	66	4	28	63	90	2.05	With	AXHU10..., SXHU10...

### SPARE PARTS

Designation	Clamping screw	Grip	Torx bit	Coolant nozzle
LPSX10M...	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08

Recommended clamping torque: 3.5 N·m

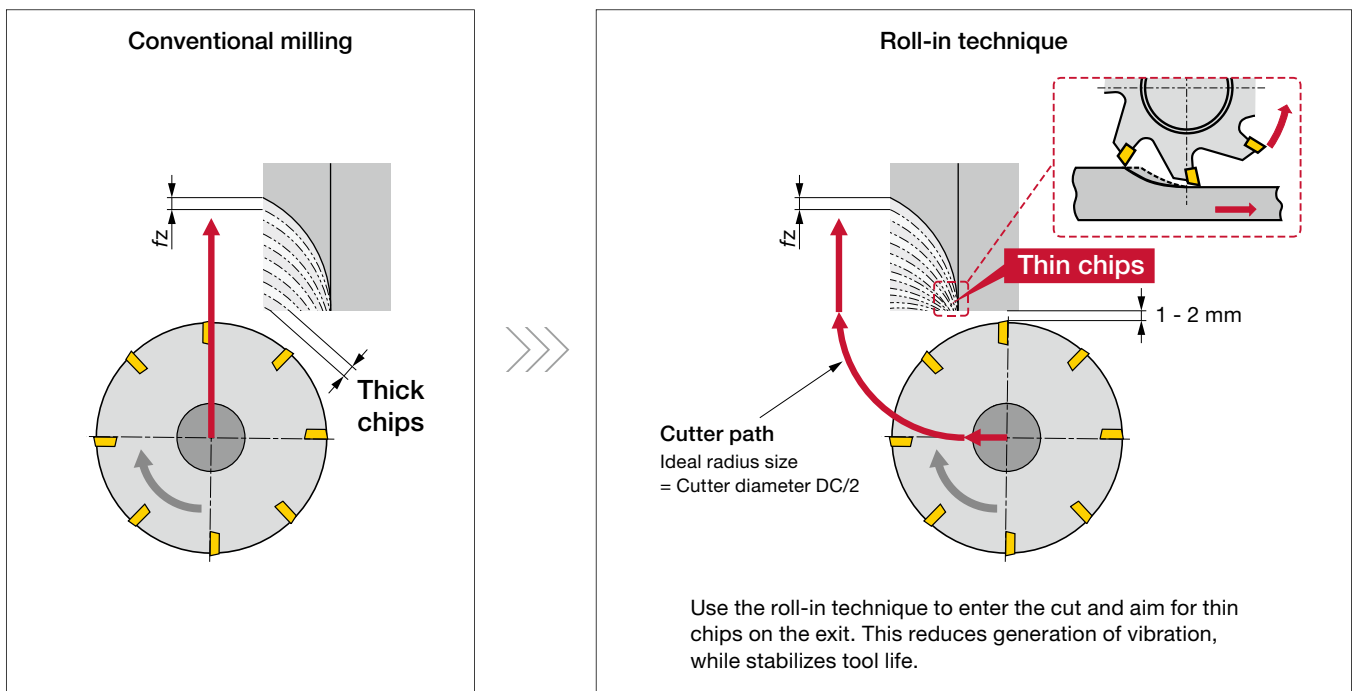


## STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed Vc (m/min)	Feed per tooth fz (mm/t)
<b>K</b>	Grey cast iron FC250, FC300, etc. 250, 300, etc.	150 - 250 HB	First choice	AH8015	100 - 300	0.1 - 0.25
	Ductile cast iron FCD400, FCD600, etc. 400-15S, 600-3, etc.	150 - 250 HB	First choice	AH8015	100 - 200	0.1 - 0.25
<b>S</b>	Titanium alloys Ti-6Al-4V, etc.	-	First choice	AH130	30 - 60	0.06 - 0.2
	Superalloys Inconel 718, etc.	-	First choice	AH130	20 - 50	0.05 - 0.1

### ■ Tips on cutter entry into the cut

In conventional end milling method, the cutter generates thick chips when exiting the cut, which causes vibrations and edge chipping. To avoid such results, use the roll-in technique, as shown below, in which the cutter is rolled into the cut in the same direction as the cutter rotation.



## ■ Cautions when installing the inserts

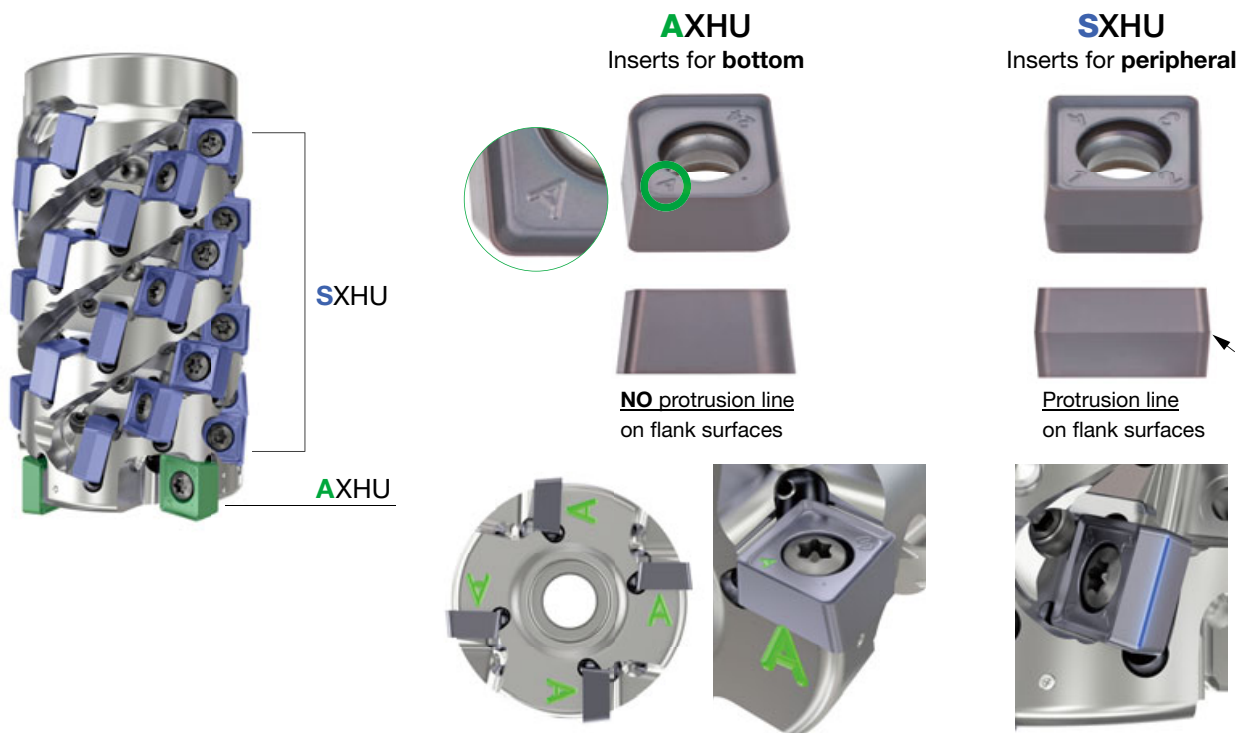
Please make sure the correct inserts are mounted in their respective pockets as shown below. Incorrect installation may result in tool damage and possible human injury.



Scan the QR code to watch the tutorial video

### Insert Positioning

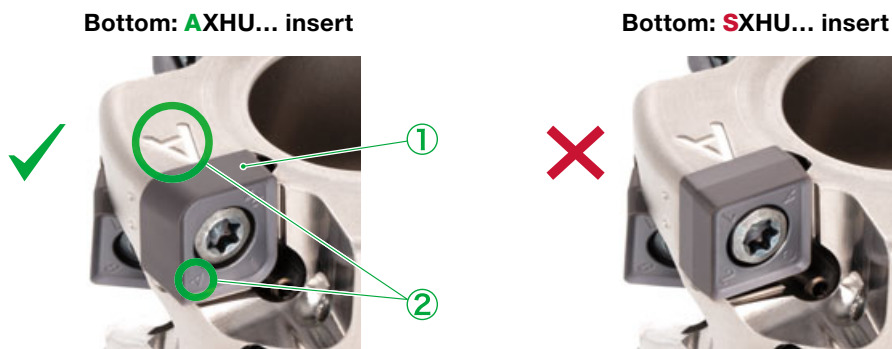
Mount the AXHU inserts on the bottom pockets marked with the matching “A” sign on the cutter body. On the remaining peripheral pockets, install the SXHU inserts.



### Check points

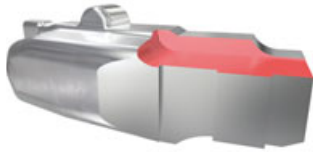

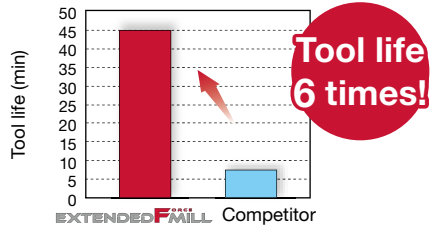
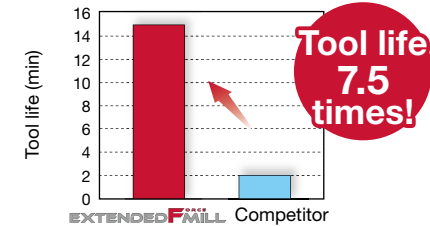

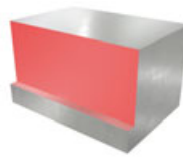
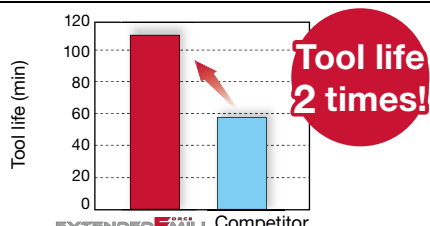
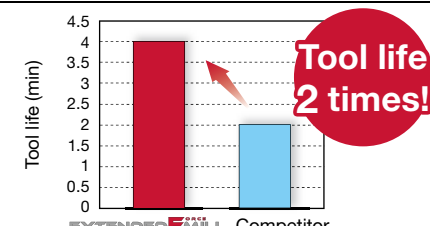
Ensure the following two points for the correct installation of the bottom inserts:

- ① The bottom inserts have a flat flank surface with NO protruded line.
- ② An “A” sign appears on the rake surface of the bottom inserts.



# EXTENDED<sup>FORCE</sup>F<sup>MILL</sup>

## PRACTICAL EXAMPLES

Workpiece type		Parts for aerospace	Parts for aerospace
Cutter		LPSX10U2.00B1.00L2.0R04 (DC = 50.8mm (2"), ZEFP = 4)	LPSX10U2.50B1.00L3.0R05 (DC = 63.5mm (2.5"), ZEFP = 5)
Insert (for bottom)		AXHU100408PER-MM	AXHU100408PER-MM
Insert (for peripheral)		SXHU100408EN-MM	SXHU100408EN-MM
Grade		AH130	AH130
Workpiece material		Ti-6Al-4V	Ti-6Al-4V
		 <b>S</b>	 <b>S</b>
Cutting conditions	Cutting speed: Vc (m/min)	45.6	61
	Feed per tooth: fz (mm/t)	0.1	0.1
	Feed speed: Vf (mm/min)	114	122
	Depth of cut : ap (mm)	50.8	14
	Width of cut : ae (mm)	Up to 38.1	4.4
	Machining	Shoulder milling	Shoulder milling
	Coolant	Internal	Internal
Machine		Vertical M/C, CAT50	Vertical M/C, CAT50
Results		 <p>Thanks to robust cutting edge, <b>ExtendedForceMill</b> offered longer tool life without chipping.</p>	 <p>Thanks to AH130 grade, <b>ExtendedForceMill</b> offered longer tool life without chipping. Additionally, an optimized arrangement of cutting edges allowed stable machining without chattering even at an increased cutting speed and with greater number of teeth.</p>
Workpiece type		Parts for aerospace	Parts for aerospace
Cutter		LPSX10M050B22.0L054R04 (DC = 50 mm, ZEFP = 4)	LPSX10M050B22.0L054R04 (DC = 50 mm, ZEFP = 4)
Insert (for bottom)		AXHU100408PER-MM	AXHU100408PER-MM
Insert (for peripheral)		SXHU100408EN-MM	SXHU100408EN-MM
Grade		AH130	AH130
Workpiece material		Ti-6Al-4V	Ti-6Al-4V
		 <b>S</b>	 <b>S</b>
Cutting conditions	Cutting speed: Vc (m/min)	47	55
	Feed per tooth: fz (mm/t)	0.058	0.15
	Feed speed: Vf (mm/min)	70	210
	Depth of cut : ap (mm)	45	25
	Width of cut : ae (mm)	6	5
	Machining	Shoulder milling	Shoulder milling
	Coolant	Internal	Internal
Machine		Vertical M/C, BT50	Vertical M/C, BT50
Results		 <p>Thanks to robust cutting edge, <b>ExtendedForceMill</b> offered longer tool life without chipping.</p>	 <p>Thanks to sharp edge preparation and obtused cutting edge design, <b>ExtendedForceMill</b> offered longer tool life without chipping.</p>

# FIXED TORQUE WRENCH

Achieves high cutting edge precision thanks to uniform clamping force

## Easy setting

### Handle

Multi-component handle optimally designed for the hand enables ideal power transmission.



### Mechanism

Driver clicks to alert the operator when the preset torque is attained. Driver has unlimited loosening torque. Driver mechanism is industrial-lubricant-resistant.

## High repeatability & robustness

### Robustness / Fitting

Wiha ChromTop® finish on tip for a perfect fit every time. Durability thanks to high quality chrome-vanadium-molybdenum steel, through hardened, chrome-plated.

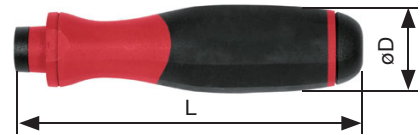
### Versatility

Extra slim blade geometry is particularly suitable for applications with confined narrow access.



## Handle

Ex) **TW - D - 0.6NM**

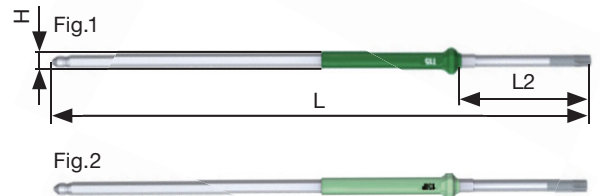


Designation	Stock	Torque (N-m)	Accuracy (%)	øD	L
TW-D-0.6NM	●	0.6	10	34	130
TW-D-0.9NM	●	0.9	10	34	130
TW-D-1.1NM	●	1.1	10	34	130
TW-D-1.4NM	●	1.4	10	34	130
TW-D-2.5NM	●	2.5	10	34	130
TW-D-3.0NM	●	3.0	10	34	130
TW-D-3.5NM	●	3.5	10	34	130

1 piece per package

## Blade

Ex) **TW - B - T6**



Designation	Stock	TORX geom.	H	L	L2	Fig.
TW-B-T6	●	T6	4	175	42	1
TW-B-T7	●	T7	4	175	42	1
TW-B-T8	●	T8	4	175	42	1
TW-B-T9	●	T9	4	175	42	1
TW-B-T10	●	T10	4	175	42	1
TW-B-T15	●	T15	4	175	42	1
TW-B-6IP	●	6IP	4	175	42	2
TW-B-7IP	●	7IP	4	175	42	2
TW-B-8IP	●	8IP	4	175	42	2
TW-B-10IP	●	10IP	4	175	42	2
TW-B-15IP	●	15IP	4	175	42	2

1 piece per package

## Tungaloy Corporation (Head office)

11-1 Yoshima-Kogyodanchi  
Iwaki-city, Fukushima 970-1144 Japan  
Phone: +81-246-36-8501  
Fax: +81-246-36-8542  
www.tungaloy.co.jp

## Tungaloy-NTK America Inc.

3726 N Ventura Drive  
Arlington Heights, IL 60004, U.S.A.  
Phone: +1-888-554-8394  
Fax: +1-888-554-8392  
www.tungaloy.com/us

## Tungaloy Canada

432 Elgin St. Unit 3  
Brantford, Ontario N3S 7P7, Canada  
Phone: +1-519-758-5779  
Fax: +1-519-758-5791  
www.tungaloy.com/ca

## Tungaloy-NTK De Mexico S.A.

C. Los Arellano 113,  
Parque Industrial Siglo XXI  
Aguascalientes, AGS, Mexico 20290  
Phone: +52-449-929-5410  
Fax: +52-449-929-5411  
www.tungaloy.com/mx

## Tungaloy-NTK do Brasil Ltda.

Avd. Independencia N4158 Residencial Flora  
13280-000 Vinhedo, São Paulo, Brasil  
Phone: +55-19-38262757  
Fax: +55-19-38262757  
www.tungaloy.com/br

## Tungaloy-NTK Germany GmbH.

Katzbergstr. 3a  
D-40764 Langenfeld, Germany  
Phone: +49-2173-90420-0  
Fax: +49-2173-90420-19  
www.tungaloy.com/de

## Tungaloy France s.a.s

Les Fjords  
19 avenue de Norvège  
91140 Villebon Sur Yvette, France  
Phone: +33-1-6486-4300  
Fax: +33-1-6907-7817  
www.tungaloy.com/fr

## Tungaloy Italia S.r.l.

Viale Sarca 336/Edificio 13  
20126 Milano, Italy  
Phone: +39-02-252012-1  
Fax: +39-02-252012-65  
www.tungaloy.com/it

## Tungaloy Czech s.r.o.

Turanka 1583/115g,  
627 00 Brno, Czech Republic  
Phone: +420-532 123 391  
www.tungaloy.com/cz

## Tungaloy Ibérica S.L.

C/Miquel Servet, 43B, Nau 7  
Pol. Ind. Bufalvent  
ES-08243 Manresa (BCN), Spain  
Phone: +34 93 113 1360  
www.tungaloy.com/es

## Tungaloy Scandinavia AB

Bultgatan 38  
442 40 Kungälv, Sweden  
Phone: +46-462119200  
Fax: +46-462119207  
www.tungaloy.com/se

## Tungaloy Rus, LLC

Andropova avenue, h.18/7,  
11 floor, office 3, 115432,  
Moscow, Russia  
Phone: +7-499-683-01-80  
Fax: +7-499-683-01-81  
www.tungaloy.com/ru

## Tungaloy Polska Sp. z o.o.

Ul. Irysowa 1, 55-040 Bielany  
Wroclawskie, Poland  
Phone: +48 607 907 237  
www.tungaloy.com/pl

## Tungaloy-NTK UK Ltd.

Suite 3, Pioneer House, Mill Street,  
Cannock, WS11 0EF, UK  
Phone: +44 121 4000 231  
Fax: +44 121 270 9694  
www.tungaloy.com/uk

## Tungaloy Hungary Kft

Erzsébet királyné útja 125  
H-1142 Budapest, Hungary  
Phone: +36 1 781-6846  
Fax: +36 1 781-6866  
www.tungaloy.com/hu

## Tungaloy Turkey

Serifali Mah.bayraktar Bulvari Kule Sk. No:26  
34775 Umraniye / Istanbul / Turkey  
Phone: +90 216 540 04 67  
Fax: +90 216 540 04 87  
www.tungaloy.com/tr

## Tungaloy Benelux b.v.

Tjalk 70  
NL-2411 NZ Bodegraven, Netherlands  
Phone: +31 172 630 420  
Fax: +31 172 630 429  
www.tungaloy.com/nl

## Tungaloy Croatia

Ulica bana Josipa Jelačića 87,  
10430, Samobor, Croatia  
Phone: +385 1 3326 604  
Fax: +385 1 3327 683  
www.tungaloy.com/hr

## Tungaloy Cutting Tool (Shanghai) Co. Ltd.

Room 701, 7th Floor,  
No.1 Lane 388 Kang'an Road,  
Pudong New Area, Shanghai, China  
Phone: +86-21-3632-1880  
Fax: +86-21-3621-1918  
www.tungaloy.com/cn

## Tungaloy Cutting Tools Taiwan Co. Ltd.

9F. No.293, Zhongyang Rd,  
Xinzhuang Dist, New Taipei City,  
24251 Taiwan  
Phone: +886-2-8521-9986  
Fax: +886-2-8521-8935  
www.tungaloy.com/tw

## Tungaloy-NTK Cutting Tool (Thailand) Co.,Ltd.

Interlink tower 4th Fl.  
1858/5-7 Bangna-Trad Road  
km.5 Bangna, Bangna, Bangkok 10260  
Thailand  
Phone: +66-2-751-5711  
Fax: +66-2-751-5715  
www.tungaloy.com/th

## Tungaloy Singapore (Pte.), Ltd.

62 Ubi Road 1, #08-09 Oxley BizHub 2  
Singapore 408734  
Phone: +65-6391-1833  
Fax: +65-6299-4557  
www.tungaloy.com/sing

## Tungaloy-NTK Vietnam LLC

Floor 3, Licogi 13 Tower, No.164 Khuat Duy  
Tien Street, Thanh Xuan Ward, Ha Noi,  
Vietnam  
Phone: +84 24 63282086  
www.tungaloy.com/vn

## Tungaloy India Pvt. Ltd.

One International Center,  
Unit # 902-A, 9th Floor,  
Tower 1, Senapati Bapat Marg,  
Elphinstone Road (West),  
Mumbai 400013, India  
Phone: +91-22-6124-8803  
Fax: +91-22-6124-8899  
www.tungaloy.com/in

## Tungaloy-NTK Korea

1040 Gachang-ro, Gachang-myeon,  
Dalseong-gun, Daegu, 42936, Korea  
Phone: +82-53-760-7698  
Fax: +82-53-768-9912  
www.tungaloy.com/kr

## Tungaloy Malaysia Sdn Bhd

50 K-2, Kelana Mall, Jalan SS6/14  
Kelana Jaya, 47301  
Petaling Jaya, Selangor Darul Ehsan  
Malaysia  
Phone: +603-7805-3222  
Fax: +603-7804-8563  
www.tungaloy.com/my

## Tungaloy Australia Pty Ltd

Unit 68 1470 Ferntree Gully Road  
Knoxfield 3180 Victoria, Australia  
Phone: +61-3-9755-8147  
Fax: +61-3-9755-6070  
www.tungaloy.com/au

## PT. Tungaloy Indonesia

Ruko Blok AA.10 No3&5, Grand Wisata,  
Lembangjaya, Tambun Selatan, Bekasi,  
17510 Indonesia  
Phone: +62-21-8261-5808  
Fax: +62-21-8261-5809  
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