

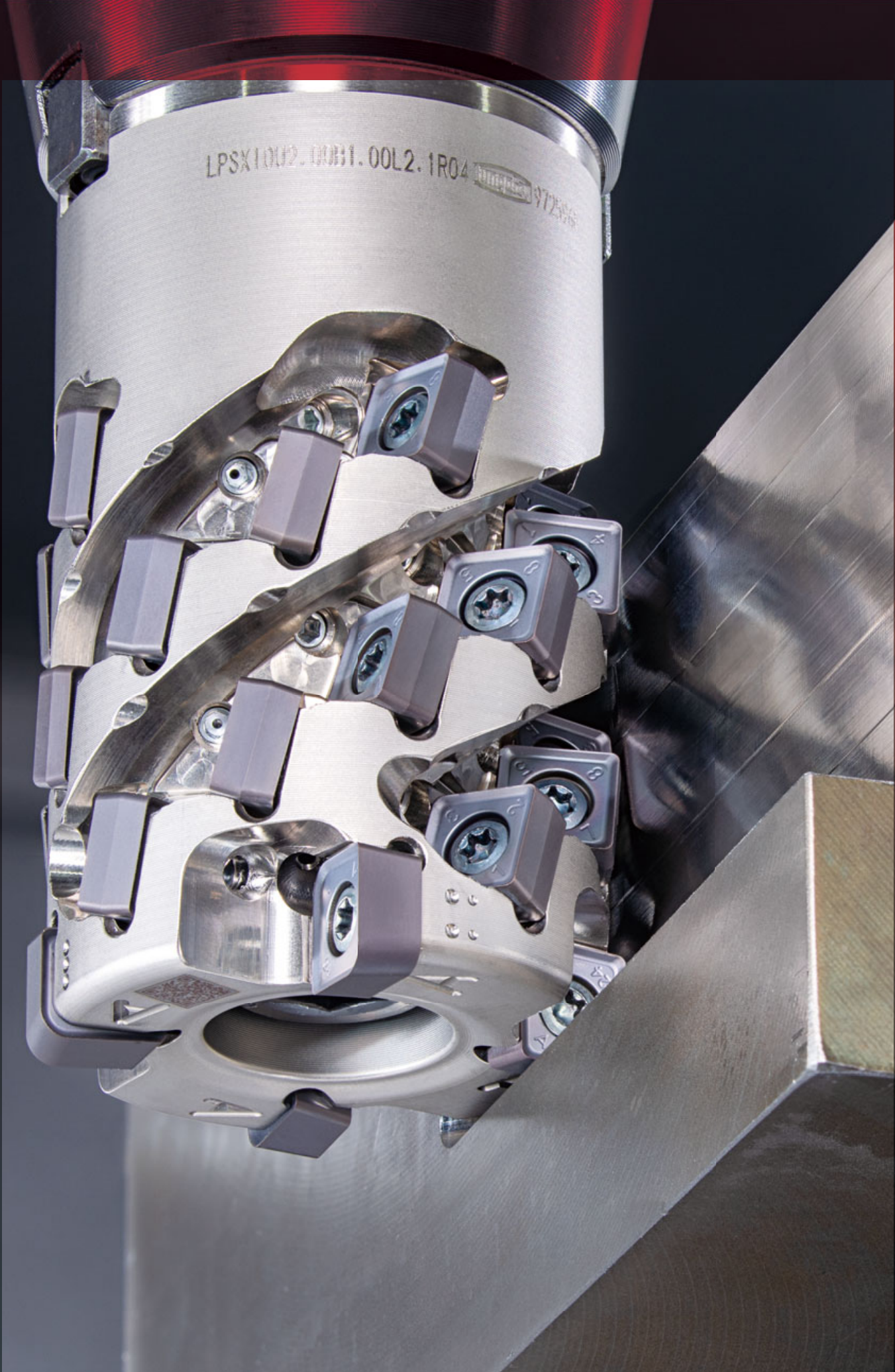
Square shoulder milling cutter for titanium alloys and cast iron

EXTENDED ^{ORCE} FMILL

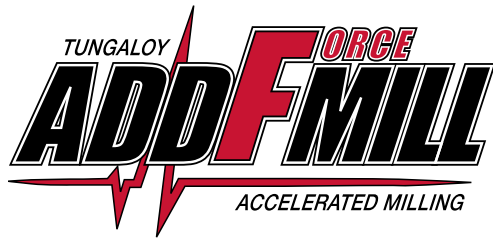
Tungaloy Report No. 560-US

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





INDUSTRY 4.0
FEED the SPEED!



EXTENDED^{ORCE}FMILL



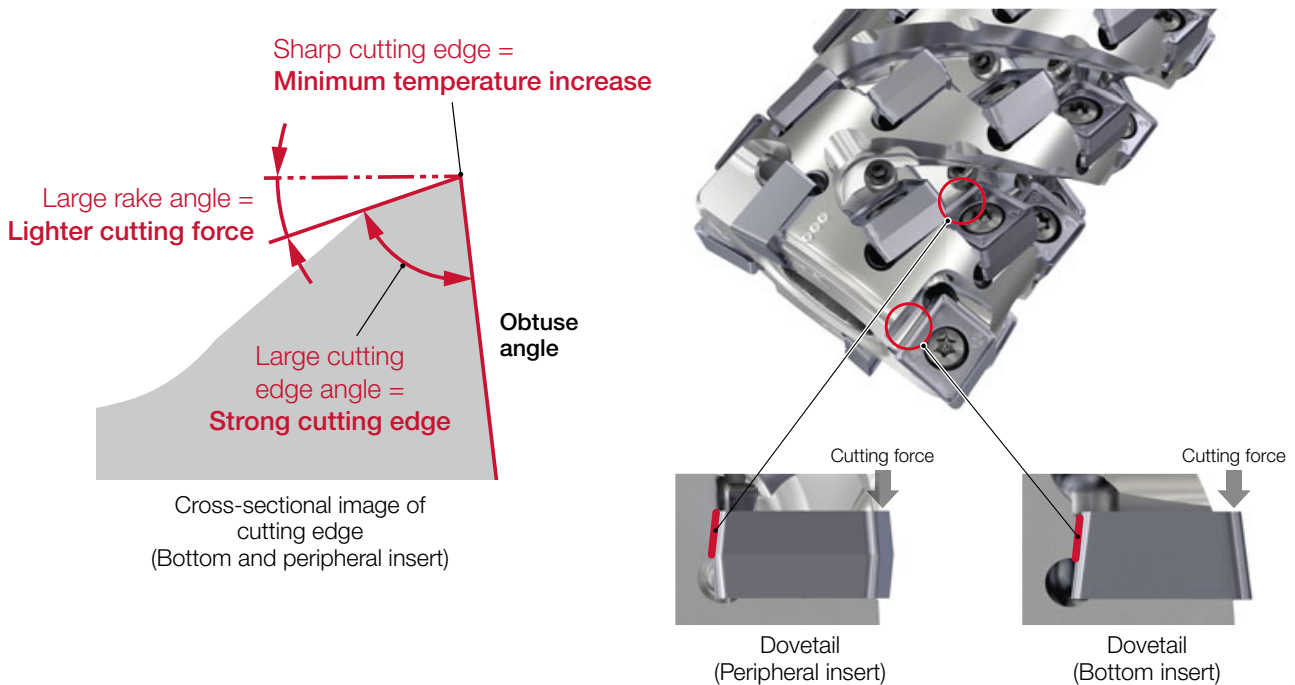
Indexable extended-flute cutters for high-efficiency rough milling operations of titanium alloy and cast iron parts

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

■ Rough milling cutter optimized for machining titanium alloy parts

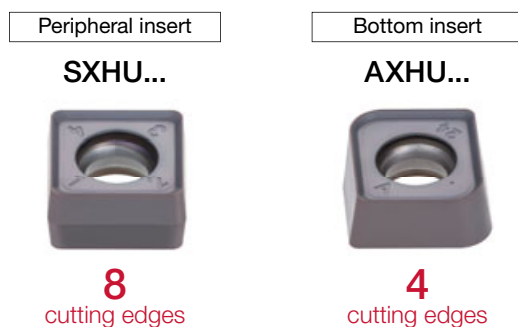
Titanium alloys generally exhibit excellent elastic deformation ability and low thermal conductivity. To meet these challenges, Tungaloy has developed the insert with unique and optimal features:

- 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.



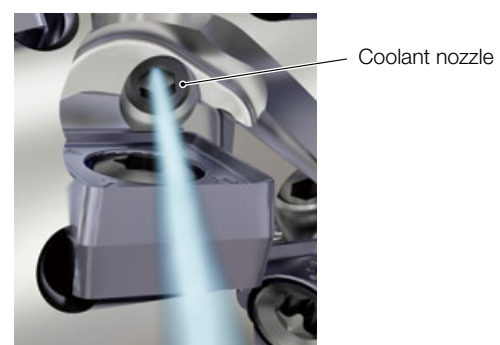
■ Multiple edge double-sided inserts for maximum cost efficiency

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.

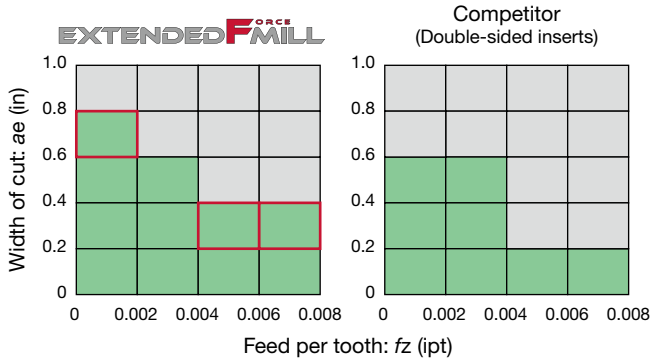



CUTTING PERFORMANCE

Application range comparisons

Ti-6Al-4V (34HRC)

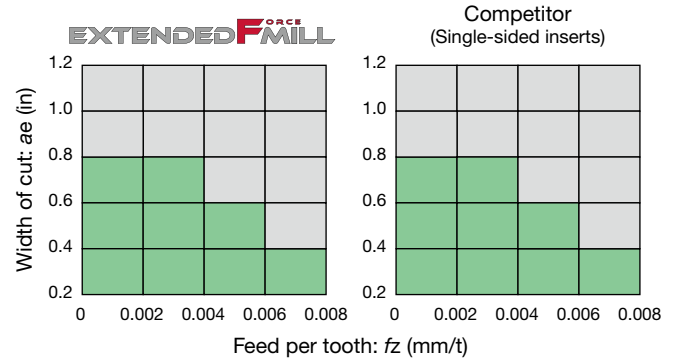
ExtendedForceMill vs competitor's double-sided inserts




	Cutter	: LPSX10U2.00B0.75L3.0R04 (DC = 2", ZEPF = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	4
	Cutting speed	: Vc = 180 sfm
	Depth of cut	: ap = 2.953"
	Coolant	: Wet
	Machine	: Vertical M/C, CAT50

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

ExtendedForceMill vs competitor's single-sided inserts



	Cutter	: LPSX10U2.00B1.00L2.1R04 (DC = 2", ZEPF = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	4
	Cutting speed	: Vc = 180 sfm
	Depth of cut	: ap = 1.969"
	Coolant	: Wet
	Machine	: Vertucak M/C, CAT50

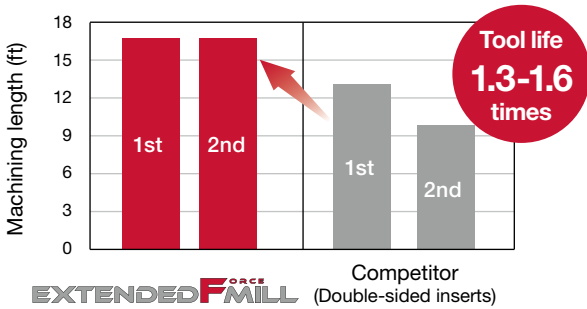
ExtendedForceMill double-sided inserts were as efficient as competitor's single-sided positive inserts with no compromise on cutting parameters.


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)

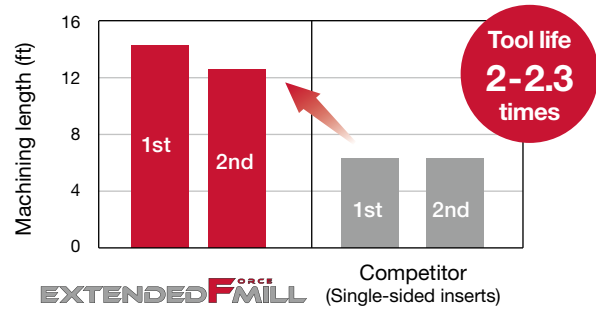
ExtendedForceMill vs competitor's double-sided inserts




	Cutter	: LPSX10U2.00B0.75L3.0R04 (DC = 2", ZEPF = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	1
	Cutting speed	: Vc = 180 sfm
	Feed per tooth	: fz = 0.006 ipt
	Depth of cut	: ap = 0.944"
	Width of cut	: ae = 0.394"
	Coolant	: Wet
	Machine	: Vertical M/C, CAT50

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



	Cutter	: LPSX10U2.00B0.75L3.0R04 (DC = 2", ZEPF = 4)
	Insert	: AXHU100431PER-MM AH130 (for bottom) SXHU100408EN-MM AH130 (for peripheral)
	Effective # of teeth:	1
	Cutting speed	: Vc = 180 sfm
	Feed per tooth	: fz = 0.006 ipt
	Depth of cut	: ap = 0.669"
	Width of cut	: ae = 0.591"
	Coolant	: Wet
	Machine	: Vertical M/C, CAT50

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

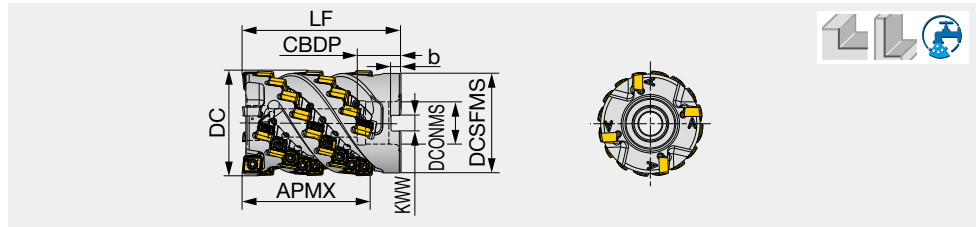
Up-sharp cutting edge helps prevent the cutting point temperatures from increasing during machining, while its thick, strong design eliminates edge chipping. ExtendedForceMill provides long, predictable tool life.

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°



Inch	APMX	DC	ZEPF	CICT	DCSMFS	DCONMS	CBDP	LF	b	KWW	WT(kg)	Air hole	Insert
LPSX10U2.00B0.75L3.0R04	3.011	2.000	4	40	1.771	0.750	0.750	3.500	0.196	0.314	2.01	With	AXHU10..., SXHU10...
LPSX10U2.00B1.00L2.1R04	2.125	2.000	4	28	1.862	1.000	1.023	3.250	0.236	0.374	1.71	With	AXHU10..., SXHU10...
LPSX10U2.00B1.00L3.0R04	3.011	2.000	4	40	1.862	1.000	1.023	4.094	0.236	0.374	2.19	With	AXHU10..., SXHU10...
LPSX10U2.50B1.00L3.0R04	3.011	2.500	4	40	2.354	1.000	1.023	3.750	0.236	0.374	3.31	With	AXHU10..., SXHU10...
LPSX10U2.50B1.00L3.0R05	3.011	2.500	5	50	2.354	1.000	1.023	3.750	0.236	0.374	3.45	With	AXHU10..., SXHU10...
LPSX10U3.00B1.25L3.0R06	3.011	3.000	6	60	2.874	1.250	1.259	4.000	0.314	0.500	5.38	With	AXHU10..., SXHU10...

Metric	APMX	DC	ZEPF	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
LPSX10U2.00B0.75L3.0R04	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	C0.375X3.0
LPSX10U2.00B1.00L2.1R04	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	C0.500X2.5
LPSX10U2.00B1.00L3.0R04	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	C0.500X3.5
LPSX10U2.50B1.00L3.0R04	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	C0.500X3.5
LPSX10U2.50B1.00L3.0R05	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	C0.500X3.5
LPSX10U3.00B1.25L3.0R06	CSTB-4M	H-TBS	BT15S	SSHM4-4-OH08	SD10-54
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

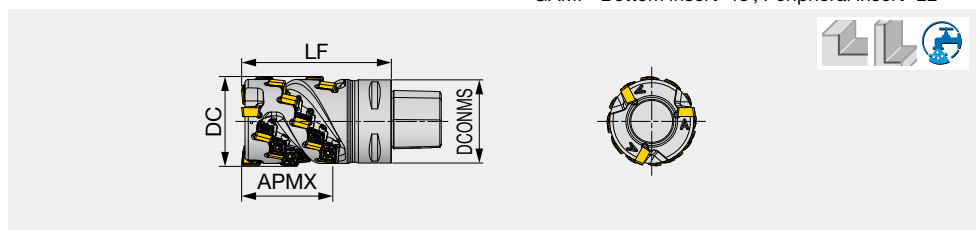
Recommended clamping torque: CSTB-4M = 2.58 lbs-ft, 3.5 N-m

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°



Metric	APMX	DC	ZEPF	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

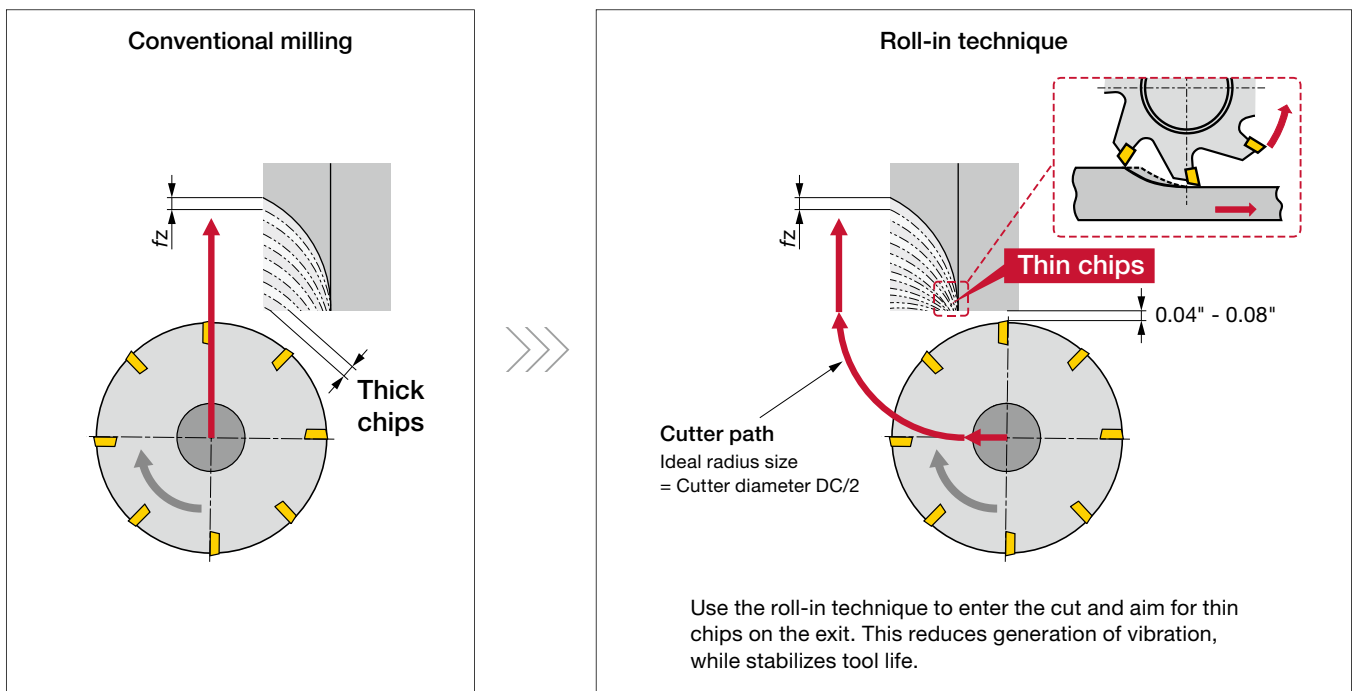
Recommended clamping torque: CSTB-4M = 3.5 N-m

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness	Priority	Grades	Cutting speed Vc (sfm)	Feed per tooth fz (ipt)
K	Gray cast iron No.250B, No.300B, etc.	150 - 250 HB	First choice	AH8015	330 - 984	0.004 - 0.010
	Ductile cast iron 60-40-18, 80-55-06, etc.	150 - 250 HB	First choice	AH8015	330 - 656	0.004 - 0.010
S	Titanium alloys Ti-6Al-4V, etc.	-	First choice	AH130	98 - 196	0.0024 - 0.0079
	Superalloys Inconel 718, etc.	-	First choice	AH130	66 - 164	0.0020 - 0.004

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

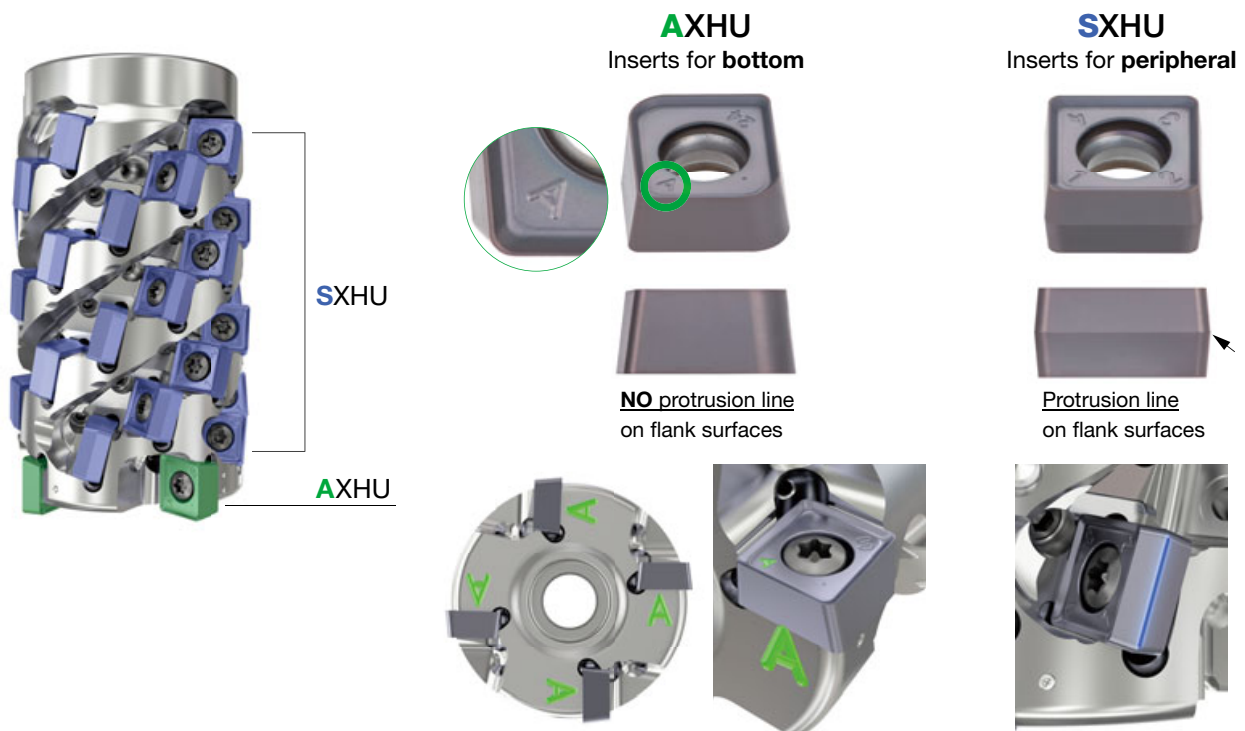
Please make sure the correct inserts are mounted in their respective pockets as shown below. Incorrect installation may result in tool damage and possible human injury.



Scan the QR code to watch the tutorial video

Insert Positioning

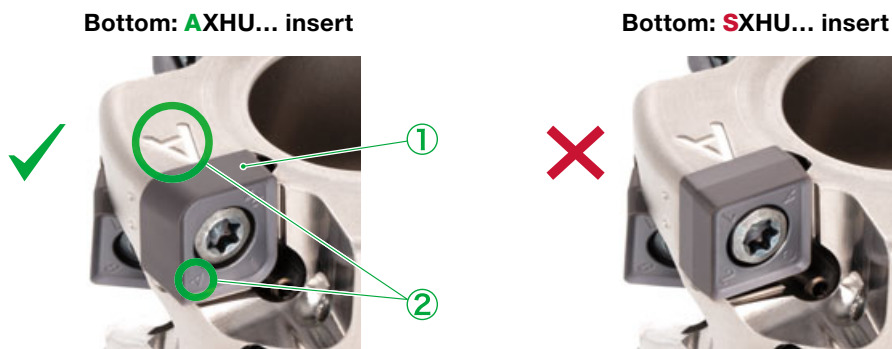
Mount the AXHU inserts on the bottom pockets marked with the matching “A” sign on the cutter body. On the remaining peripheral pockets, install the SXHU inserts.



Check points

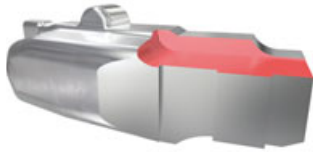

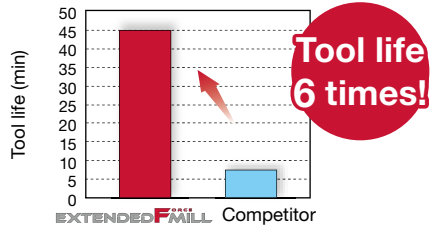
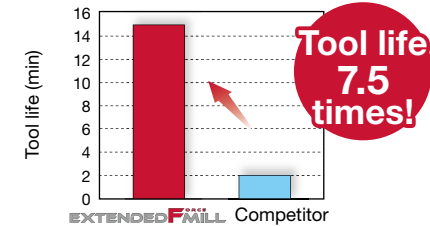

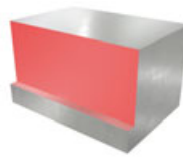
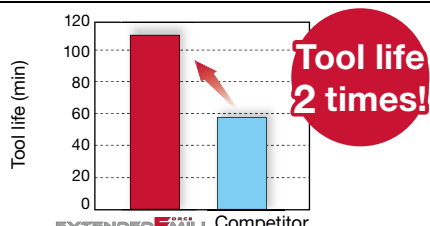
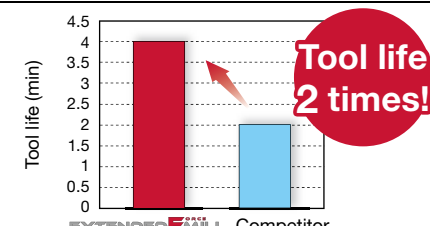
Ensure the following two points for the correct installation of the bottom inserts:

- 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^{FORCE}FMILL

PRACTICAL EXAMPLES

Workpiece type		Parts for aerospace	Parts for aerospace
Cutter		LPSX10U2.00B1.00L2.0R04 (DC = 2", ZEFP = 4)	LPSX10U2.50B1.00L3.0R05 (DC = 2.5", ZEFP = 5))
Insert (for bottom)		AXHU100408PER-MM	AXHU100408PER-MM
Insert (for peripheral)		SXHU100408EN-MM	SXHU100408EN-MM
Grade		AH130	AH130
		Ti-6Al-4V	Ti-6Al-4V
Workpiece material		 S	 S
Cutting conditions	Cutting speed: Vc (sfm)	150	200
	Feed per tooth: fz (ipt)	0.004	0.004
	Feed speed: Vf (ipm)	4.5	4.8
	Depth of cut : ap (in)	2	0.55
	Width of cut : ae (in)	Up to 1.5	0.17
	Machining	Shoulder milling	Shoulder milling
	Coolant	Internal	Internal
Machine		Vertical M/C, CAT50	Vertical M/C, CAT50
Results		 <p>Tool life 6 times!</p> <p>Thanks to robust cutting edge, ExtendedForceMill offered longer tool life without chipping.</p>	 <p>Tool life 7.5 times!</p> <p>Thanks to AH130 grade, ExtendedForceMill 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		LPSX10U2.00B1.00L2.0R04 (DC = 2", ZEFP = 4)	LPSX10U2.00B1.00L2.0R04 (DC = 2", ZEFP = 4)
Insert (for bottom)		AXHU100408PER-MM	AXHU100408PER-MM
Insert (for peripheral)		SXHU100408EN-MM	SXHU100408EN-MM
Grade		AH130	AH130
		Ti-6Al-4V	Ti-6Al-4V
Workpiece material		 S	 S
Cutting conditions	Cutting speed: Vc (sfm)	154	180
	Feed per tooth: fz (ipt)	0.0022	0.006
	Feed speed: Vf (ipm)	2.8	8.26
	Depth of cut : ap (in)	1.77	0.984
	Width of cut : ae (in)	0.24	0.196
	Machining	Shoulder milling	Shoulder milling
	Coolant	Internal	Internal
Machine		Vertical M/C, CAT50	Vertical M/C, CAT50
Results		 <p>Tool life 2 times!</p> <p>Thanks to robust cutting edge, ExtendedForceMill offered longer tool life without chipping.</p>	 <p>Tool life 2 times!</p> <p>Thanks to sharp edge preparation and obtused cutting edge design, ExtendedForceMill 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.

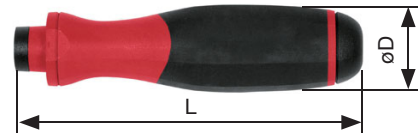
Versatility

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



Handle

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

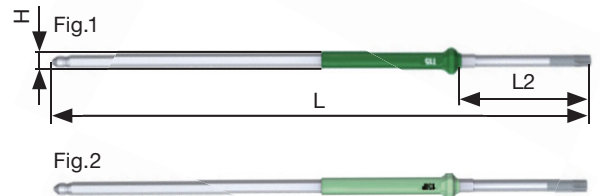


Designation	Stock	Torque (N-m)	Accuracy (%)	øD	L
TW-D-0.6NM	●	0.6	10	34	130
TW-D-0.9NM	●	0.9	10	34	130
TW-D-1.1NM	●	1.1	10	34	130
TW-D-1.4NM	●	1.4	10	34	130
TW-D-2.5NM	●	2.5	10	34	130
TW-D-3.0NM	●	3.0	10	34	130
TW-D-3.5NM	●	3.5	10	34	130

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

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